National Space Institute - DTU Orbit (18/06/2018)

National Space Institute
Technical University of Denmark
Short name: DTU Space

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Organisation profile

Education
DTU Space offers a number of exciting study lines and courses within space research and space technology. With an education from DTU, you can become one of the people who set the agenda for future space research and contribute to monitoring and understanding climate change and the Earth's environment.

Research
Research at DTU Space is characterised by a strong interaction between basic research and technology development, and the Institute's projects often involve international co-operation.
Organisational unit: Department

Publications:

25 years of elevation changes of the Greenland Ice Sheet from ERS, Envisat, and CryoSat-2 radar altimetry

General information
State: Published
Organisations: National Space Institute, Geodynamics, Russian State Hydrometeorological University, ESRIN - ESA Centre for Earth Observation
Authors: Sørensen, L. S. (Intern), Simonsen, S. B. (Intern), Forsberg, R. (Intern), Khvorostovsky, K. (Ekstern), Meister, R. (Intern), Engdahl, M. E. (Ekstern)
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Web of Science (2017): Indexed yes
Since 2014, NASA’s K2 mission has observed large portions of the ecliptic plane in search of transiting planets and has detected hundreds of planet candidates. With observations planned until at least early 2018, K2 will continue to identify more planet candidates. We present here 275 planet candidates observed during Campaigns 0–10 of the K2 mission that are orbiting stars brighter than 13 mag (in Kepler band) and for which we have obtained high-resolution spectra (R = 44,000). These candidates are analyzed using the vespa package in order to calculate their false-positive probabilities (FPP). We find that 149 candidates are validated with an FPP lower than 0.1%, 39 of which were previously only candidates and 56 of which were previously undetected. The processes of data reduction, candidate identification, and statistical validation are described, and the demographics of the candidates and newly validated planets are explored. We show tentative evidence of a gap in the planet radius distribution of our candidate sample. Comparing our sample to the
Kepler candidate sample investigated by Fulton et al., we conclude that more planets are required to quantitatively confirm the gap with K2 candidates or validated planets. This work, in addition to increasing the population of validated K2 planets by nearly 50% and providing new targets for follow-up observations, will also serve as a framework for validating candidates from upcoming K2 campaigns and the Transiting Exoplanet Survey Satellite, expected to launch in 2018.

**General information**

- **State:** Published
- **Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Harvard-Smithsonian Center for Astrophysics, Princeton University, University of California, Berkeley, California Institute of Technology, Massachusetts Institute of Technology, University of California, Santa Cruz, Southern Connecticut State University, NASA Ames Research Center, University of Tokyo, NASA Goddard Space Flight Center
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  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 5.26
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): CiteScore 4.8
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): CiteScore 4.57
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): CiteScore 4.85
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 2
  - Scopus rating (2012): CiteScore 5.51
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  - Web of Science (2012): Indexed yes
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  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2010): Indexed yes
  - BFI (2009): BFI-level 2
  - Web of Science (2009): Indexed yes
  - BFI (2008): BFI-level 2
  - Web of Science (2008): Indexed yes
  - Web of Science (2007): Indexed yes
A 3D particle Monte Carlo approach to studying nucleation

The nucleation of sulphuric acid molecules plays a key role in the formation of aerosols. We here present a three-dimensional particle Monte Carlo model to study the growth of sulphuric acid clusters as well as its dependence on the ambient temperature and the initial particle density. We initiate a swarm of sulphuric acid–water clusters with a size of 0.329 nm with densities between $10^7$ and $10^8$ cm$^{-3}$ at temperatures between 200 and 300 K and a relative humidity of 50%. After every time step, we update the position of particles as a function of size-dependent diffusion coefficients. If two particles encounter, we merge them and add their volumes and masses. Inversely, we check after every time step whether a polymer evaporates liberating a molecule. We present the spatial distribution as well as the size distribution calculated from individual clusters. We also calculate the nucleation rate of clusters with a radius of 0.85 nm as a function of time, initial particle density and temperature. The nucleation rates obtained from the presented model agree well with experimentally obtained values and those of a numerical model which serves as a benchmark of our code. In contrast to previous nucleation models, we here present for the first time a code capable of tracing individual particles and thus of capturing the physics related to the discrete nature of particles.
A curious case of the accretion-powered X-ray pulsar GX 1+4

We present detailed spectral and timing studies using a NuSTAR observation of GX 1+4 in 2015 October during an intermediate-intensity state. The measured spin period of 176.778 s is found to be one of the highest values since its discovery. In contrast to a broad sinusoidal-like pulse profile, a peculiar sharp peak is observed in profiles below ~25 keV. The profiles at higher energies are found to be significantly phase shifted compared to the soft X-ray profiles. Broad-band energy spectra of GX 1+4, obtained from NuSTAR and Swift observations, are described with various continuum models. Among these, a two-component model consisting of a bremsstrahlung and a blackbody component is found to best fit the phase-averaged and phase-resolved spectra. Physical models are also used to investigate the emission mechanism in the pulsar, which allows us to estimate the magnetic field strength to be in (5–10) × 10¹² G range. Phase-resolved spectroscopy of NuSTAR observation shows a strong blackbody emission component in a narrow pulse phase range. This component is interpreted as the origin of the peculiar peak in the pulse profiles below ≤25 keV. The size of emitting region is calculated to be ∼400 m. The bremsstrahlung component is found to dominate in hard X-rays and explains the nature of...
simple profiles at high energies.

**General information**

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Physical Research Laboratory
Authors: Jaisawal, G. K. (Intern), Naik, S. (Ekstern), Gupta, S. (Ekstern), Chenevez, J. (intern), Epili, P. (Ekstern)
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Scopus rating (2017): SJR 2.346 SNIP 0.904
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.09 SJR 2.388 SNIP 1.134
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.701 SNIP 1.165 CiteScore 4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.23 SNIP 1.322 CiteScore 4.79
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.155 SNIP 1.23 CiteScore 5.1
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.283 SNIP 1.392 CiteScore 4.89
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.964 SNIP 1.35 CiteScore 4.63
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.18 SNIP 1.339
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.662 SNIP 1.512
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.6 SNIP 1.287
Scopus rating (2007): SJR 3.399 SNIP 1.287
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 4.769 SNIP 1.326
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 4.434 SNIP 1.229
Scopus rating (2004): SJR 4.385 SNIP 1.384
Web of Science (2004): Indexed yes
A deep X-ray view of the bare AGN Ark120. IV. XMM-Newton and NuSTAR spectra dominated by two temperature (warm, hot) Comptonization processes.

Context. The physical characteristics of the material closest to supermassive black holes (SMBHs) are primarily studied through X-ray observations. However, the origins of the main X-ray components such as the soft X-ray excess, the FeKα line complex, and the hard X-ray excess are still hotly debated. This is particularly problematic for active galactic nuclei (AGN) showing a significant intrinsic absorption, either warm or neutral, which can severely distort the observed continuum. Therefore, AGN with no (or very weak) intrinsic absorption along the line of sight, so-called “bare AGN”, are the best targets to directly probe matter very close to the SMBH.

Aims. We perform an X-ray spectral analysis of the brightest and cleanest bare AGN known so far, Ark120, in order to determine the process(es) at work in the vicinity of the SMBH.

Methods. We present spectral analyses of data from an extensive campaign observing Ark120 in X-rays with XMM-Newton (4 × 120 ks, 2014 March 18–24), and NuSTAR (65.5 ks, 2014 March 22).

Results. During this very deep X-ray campaign, the source was caught in a high-flux state similar to the earlier 2003 XMM-Newton observation, and about twice as bright as the lower-flux observation in 2013. The spectral analysis confirms the “softer when brighter” behavior of Ark120. The four XMM-Newton/pn spectra are characterized by the presence of a prominent soft X-ray excess and a significant FeKα complex. The continuum is very similar above about 3 keV, while significant variability is present for the soft X-ray excess. We find that relativistic reflection from a constant-density, flat accretion disk cannot simultaneously produce the soft excess, broad FeKα complex, and hard X-ray excess. Instead, Comptonization reproduces the broadband (0.3–79 keV) continuum well, together with a contribution from a mildly relativistic disk reflection spectrum.

Conclusions. During this 2014 observational campaign, the soft X-ray spectrum of Ark 120 below ~0.5 keV was found to be dominated by Comptonization of seed photons from the disk by a warm (kTe ~ 0.5 keV), optically-thick corona (τ ~ 9). Above this energy, the X-ray spectrum becomes dominated by Comptonization from electrons in a hot optically thin corona, while the broad FeKα line and the mild Compton hump result from reflection off the disk at several tens of gravitational radii.
A **NICER** Look at the Aql X-1 Hard State

We report on a spectral-timing analysis of the neutron star low-mass X-ray binary (LMXB) Aql X-1 with the Neutron Star Interior Composition Explorer (**NICER**) on the International Space Station (**ISS**). Aql X-1 was observed with NICER during a dim outburst in 2017 July, collecting approximately 50 ks of good exposure. The spectral and timing properties of the source correspond to that of a (hard) extreme island state in the atoll classification. We find that the fractional amplitude of the low-frequency (<0.3 Hz) band-limited noise shows a dramatic turnover as a function of energy: it peaks at 0.5 keV with nearly 25% rms, drops to 12% rms at 2 keV, and rises to 15% rms at 10 keV. Through the analysis of covariance spectra, we demonstrate that band-limited noise exists in both the soft thermal emission and the power-law emission. Additionally, we measure hard time lags, indicating the thermal emission at 0.5 keV leads the power-law emission at 10 keV on a timescale of ~100 ms at 0.3 Hz to ~10 ms at 3 Hz. Our results demonstrate that the thermal emission in the hard state is intrinsically variable, and is driving the modulation of the higher energy power-law. Interpreting the thermal spectrum as disk emission, we find that our results are consistent with the disk propagation model proposed for accretion onto black holes.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, NASA Goddard Space Flight Center, Wayne State University, Massachusetts Institute of Technology, University of Amsterdam, Universite de Toulouse, SRON Netherlands Institute for Space Research, University of Maryland, University of Illinois at Urbana-Champaign, University of Michigan


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- Scopus rating (2016): CiteScore 4.45
- Web of Science (2016): Indexed yes
- Scopus rating (2015): CiteScore 4.33
- Web of Science (2015): Indexed yes
- Scopus rating (2014): CiteScore 4.34
- Web of Science (2014): Indexed yes
- Scopus rating (2013): CiteScore 4.18
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- Scopus rating (2012): CiteScore 3.93
- ISI indexed (2012): ISI indexed yes
- Scopus rating (2011): CiteScore 5.85
ALES+: Adapting a homogenous ocean retracker for satellite altimetry to sea ice leads, coastal and inland waters

Water level from sea ice-covered oceans is particularly challenging to retrieve with satellite radar altimeters due to the different shapes assumed by the returned signal compared with the standard open ocean waveforms. Valid measurements are scarce in large areas of the Arctic and Antarctic Oceans, because sea level can only be estimated in the openings in the sea ice (leads and polynyas). Similar signal-related problems affect also measurements in coastal and inland waters.

This study presents a fitting (also called retracking) strategy (ALES+) based on a subwaveform retracker that is able to adapt the fitting of the signal depending on the sea state and on the slope of its trailing edge. The algorithm modifies the existing Adaptive Leading Edge Subwaveform retracker originally designed for coastal waters, and is applied to Envisat and ERS-2 missions.

The validation in a test area of the Arctic Ocean demonstrates that the presented strategy is more precise than the dedicated ocean and sea ice retrackers available in the mission products. It decreases the retracking open ocean noise by over 1cm with respect to the standard ocean retracker and is more precise by over 1cm with respect to the standard sea ice retracker used for fitting specular echoes. Compared to an existing open ocean altimetry dataset, the presented strategy increases the number of sea level retrievals in the sea ice-covered area and the correlation with a local tide gauge. Further tests against in-situ data show that also the quality of coastal retrievals increases compared to the standard ocean product in the last 6km within the coast.

ALES+ improves the sea level determination at high latitudes and is adapted to fit reflections from any water surface. If used in the open ocean and in the coastal zone, it improves the current official products based on ocean retrackers. First results in the inland waters show that the correlation between water heights from ALES+ and from in-situ measurement is always over 0.95.

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Organisations: National Space Institute, Geodesy, Technische Universität München, National Oceanography Centre Liverpool, ESRIN - ESA Centre for Earth Observation
Authors: Passaro, M. (Ekstern), Kildegaard Rose, S. (Intern), Andersen, O. B. (Intern), Boergens, E. (Ekstern), Calafat, F. M. (Ekstern), Dettmering, D. (Ekstern), Benveniste, J. (Ekstern)
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Scopus rating (2017): SNIP 2.5 SJR 3.121
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.92 SJR 3.035 SNIP 2.956
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.697 SNIP 3.044 CiteScore 7.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.881 SNIP 3.477 CiteScore 7.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.148 SNIP 2.982 CiteScore 5.6
A New Model of Jupiter's Magnetic Field from Juno's First Nine Orbits

A spherical harmonic model of the magnetic field of Jupiter is obtained from vector magnetic field observations acquired by the Juno spacecraft during its first nine polar orbits about the planet. Observations acquired during eight of these orbits provide the first truly global coverage of Jupiter's magnetic field with a coarse longitudinal separation of ~45° between perijoves. The magnetic field is represented with a degree 20 spherical harmonic model for the planetary ("internal") field, combined with a simple model of the magnetodisc for the field ("external") due to distributed magnetospheric currents. Partial solution of the underdetermined inverse problem using generalized inverse techniques yields a model ("Juno Reference Model through Perijove 9") of the planetary magnetic field with spherical harmonic coefficients well determined through degree and order 10, providing the first detailed view of a planetary dynamo beyond Earth.

General information
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Organisations: National Space Institute, Measurement and Instrumentation Systems, NASA Goddard Space Flight Center, Harvard University, Southwest Research Institute, NASA Jet Propulsion Laboratory
Authors: Connerney, J. E. P. (Ekstern), Kotsiaros, S. (Ekstern), Oliversen, R. J. (Ekstern), Espley, J. R. (Ekstern), Jørgensen, J. L. (Intern), Joergensen, P. S. (Intern), Merayo, J. M. (Intern), Herceg, M. (Intern), Bloxham, J. (Ekstern),
Moore, K. M. (Ekstern), Bolton, S. J. (Ekstern), Levin, S. M. (Ekstern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.35 SJR 2.819 SNIP 1.495
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.24 SNIP 1.728 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.573 SNIP 1.325
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.361 SNIP 1.248
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.262 SNIP 1.299
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.239 SNIP 1.257
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.261 SNIP 1.348
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.906 SNIP 1.285
Sea level is a very sensitive index of climate change since it integrates the impacts of ocean warming and ice mass loss from glaciers and the ice sheets. Sea level has been listed as an essential climate variable (ECV) by the Global Climate Observing System (GCOS). During the past 25 years, the sea level ECV has been measured from space by different altimetry missions that have provided global and regional observations of sea level variations. As part of the Climate Change Initiative (CCI) program of the European Space Agency (ESA) (established in 2010), the Sea Level project (SL_cci) aimed to provide an accurate and homogeneous long-term satellite-based sea level record. At the end of the first phase of the project (2010-2013), an initial version (v1.1) of the sea level ECV was made available to users (Ablain et al., 2015). During the second phase of the project (2014-2017), improved altimeter standards were selected to produce new sea level products (called SL_cci v2.0) based on nine altimeter missions for the period 1993-2015 (https://doi.org/10.5270/esa-sea_level_cci-1993_2015-v_2.0-201612; Legeais and the ESA SL_cci team, 2016c). Corresponding orbit solutions, geophysical corrections and altimeter standards used in this v2.0 dataset are described in detail in Quartly et al. (2017). The present paper focuses on the description of the SL_cci v2.0 dataset and associated uncertainty and discusses how it has been validated. Various approaches have been used for the quality assessment such as internal validation, comparisons with sea level records from other groups and with in situ measurements, sea level budget closure analyses and comparisons with model outputs. Compared with the previous version of the sea level ECV, we show that use of improved geophysical corrections, careful bias reduction between missions and inclusion of new altimeter missions lead to improved sea level products with reduced uncertainties on different spatial and temporal scales. However, there is still room for improvement since the uncertainties remain larger than the GCOS requirements (GCOS, 2011). Perspectives on subsequent evolution are also discussed.
An Ultra-short Period Rocky Super-Earth with a Secondary Eclipse and a Neptune-like Companion around K2-141

Ultra-short period (USP) planets are a class of low-mass planets with periods shorter than one day. Their origin is still unknown, with photo-evaporation of mini-Neptunes and in situ formation being the most credited hypotheses. Formation scenarios differ radically in the predicted composition of USP planets, and it is therefore extremely important to increase the still limited sample of USP planets with precise and accurate mass and density measurements. We report here the characterization of a USP planet with a period of 0.28 days around K2-141 (EPIC 246393474), and the validation of an outer planet with a period of 7.7 days in a grazing transit configuration. We derived the radii of the planets from the K2 light curve and used high-precision radial velocities gathered with the HARPS-N spectrograph for mass measurements. For K2-141b, we thus inferred a radius of 1.51 ± 0.05 R⊕ and a mass of 5.08 ± 0.41 M⊕, consistent with a rocky composition and lack of a thick atmosphere. K2-141c is likely a Neptune-like planet, although due to the grazing transits and the non-detection in the RV data set, we were not able to put a strong constraint on its density. We also report the detection of secondary eclipses and phase curve variations for K2-141b. The phase variation can be modeled either by a planet with a geometric albedo of 0.30 ± 0.06 in the Kepler bandpass, or by thermal emission from the surface of the planet at ~3000 K. Only follow-up observations at longer wavelengths will allow us to distinguish between these two scenarios.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of St Andrews, University of Warwick, University of Cambridge, National Institute for Astrophysics, Harvard-Smithsonian Center for Astrophysics, University of Geneva, California Institute of Technology, Massachusetts Institute of Technology, University of California at Berkeley, National Optical Astronomy Observatory, University of Porto, University of California, Santa Cruz, Queen's University Belfast, University of Edinburgh, NASA Ames Research Center
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Arctic Sea Ice Characterization Using Spaceborne Fully Polarimetric L-, C-, and X-Band SAR With Validation by Airborne Measurements

In recent years, spaceborne synthetic aperture radar (SAR) polarimetry has become a valuable tool for sea ice analysis. Here, we employ an automatic sea ice classification algorithm on two sets of spatially and temporally near coincident fully polarimetric acquisitions from the ALOS-2, Radarsat-2, and TerraSAR-X/TanDEM-X satellites. Overlapping coincident sea ice freeboard measurements from airborne laser scanner data are used to validate the classification results. The automated sea ice classification algorithm consists of two steps. In the first step, we perform a polarimetric feature
extraction procedure. Next, the resulting feature vectors are ingested into a trained neural network classifier to arrive at a pixelwise supervised classification. Coherency matrix-based features that require an eigendecomposition are found to be either of low relevance or redundant to other covariance matrix-based features, which makes coherency matrix-based features dispensable for the purpose of sea ice classification. Among the most useful features for classification are matrix invariant-based features (geometric intensity, scattering diversity, and surface scattering fraction). Classification results show that 100% of the open water is separated from the surrounding sea ice and that the sea ice classes have at least 96.9% accuracy. This analysis reveals analogous results for both X-band and C-band frequencies and slightly different for the L-band. The subsequent classification produces similarly promising results for all four acquisitions. In particular, the overlapping image portions exhibit a reasonable congruence of detected sea ice when compared with high-resolution airborne measurements.

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Organisations: National Space Institute, Geodynamics, German Aerospace Center, UiT The Arctic University of Norway, Norwegian Meteorological Institute
Authors: Singha, S. (Ekstern), Johansson, M. (Ekstern), Hughes, N. (Ekstern), Hvidegaard, S. M. (Intern), Skourup, H. (Intern)
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   Scopus rating (2016): CiteScore 5.45 SJR 2.616 SNIP 3.184
   Web of Science (2016): Indexed yes
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   Scopus rating (2015): SJR 2.486 SNIP 3.107 CiteScore 4.7
   Web of Science (2015): Indexed yes
   BFI (2014): BFI-level 2
   Scopus rating (2014): SJR 2.445 SNIP 3.459 CiteScore 4.71
   Web of Science (2014): Indexed yes
   BFI (2013): BFI-level 2
   Scopus rating (2013): SJR 2.283 SNIP 3.227 CiteScore 4.22
   ISI indexed (2013): ISI indexed yes
   Web of Science (2013): Indexed yes
   BFI (2012): BFI-level 2
   Scopus rating (2012): SJR 2.337 SNIP 3.833 CiteScore 4.26
   ISI indexed (2012): ISI indexed yes
   Web of Science (2012): Indexed yes
   BFI (2011): BFI-level 2
   Scopus rating (2011): SJR 2.249 SNIP 2.988 CiteScore 3.85
   ISI indexed (2011): ISI indexed yes
   Web of Science (2011): Indexed yes
   BFI (2010): BFI-level 2
   Scopus rating (2010): SJR 2.14 SNIP 2.932
   Web of Science (2010): Indexed yes
   BFI (2009): BFI-level 2
   Scopus rating (2009): SJR 2.85 SNIP 2.964
   Web of Science (2009): Indexed yes
   BFI (2008): BFI-level 1
Arctide2017, a high-resolution regional tidal model in the Arctic Ocean

The Arctic Ocean is a challenging region for tidal modelling. The accuracy of the global tidal models decreases by several centimeters in the Polar Regions, which has a large impact on the quality of the satellite altimeter sea surface heights and the altimetry-derived products.

NOVELTIS, DTU Space and LEGOS have developed Arctide2017, a regional, high-resolution tidal atlas in the Arctic Ocean, in the framework of an extension of the CryoSat Plus for Ocean (CP4O) ESA STSE (Support to Science Element) project. In particular, this atlas benefits from the assimilation of the most complete satellite altimetry dataset ever used in this region, including Envisat data up to 82°N and CryoSat-2 data between 82°N and 88°N. The combination of these satellite altimetry missions gives the best possible coverage of altimetry-derived tidal constituents. The available tide gauge data were also used for data assimilation and validation.

This paper presents the implementation methodology and the performance of this new regional tidal model in the Arctic Ocean, compared to the existing global and regional tidal models.

General information
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Organisations: National Space Institute, Geodesy, Noveltis, Laboratoire d’Études en Géophysique et Océanographie Spatiales, Satellite Oceanographic Consultants, ESRIN - ESA Centre for Earth Observation
Authors: Cancet, M. (Ekstern), Andersen, O. B. (Intern), Lyard, F. (Ekstern), Cotton, D. (Ekstern), Benveniste, J. (Ekstern)
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.067 SJR 0.569
Web of Science (2017): Indexed yes
Basal Settings Control Fast Ice Flow in the Recovery/Slessor/Bailey Region, East Antarctica

The region of Recovery Glacier, Slessor Glacier, and Bailey Ice Stream, East Antarctica, has remained poorly explored, despite representing the largest potential contributor to future global sea level rise on a centennial to millennial time scale. Here we use new airborne radar data to improve knowledge about the bed topography and investigate controls of fast ice flow. Recovery Glacier is underlain by an 800 km long trough. Its fast flow is controlled by subglacial water in its upstream and topography in its downstream region. Fast flow of Slessor Glacier is controlled by the presence of subglacial water on a rough crystalline bed. Past ice flow of adjacent Recovery and Slessor Glaciers was likely connected via the newly discovered Recovery-Slessor Gate. Changes in direction and speed of past fast flow likely occurred for upstream parts of Recovery Glacier and between Slessor Glacier and Bailey Ice Stream. Similar changes could also reoccur here in the future.
Changes in Greenland's peripheral glaciers linked to the North Atlantic Oscillation

Glaciers and ice caps peripheral to the main Greenland Ice Sheet contribute markedly to sea-level rise. Their changes and variability, however, have been difficult to quantify on multi-decadal timescales due to an absence of long-term data. Here, using historical aerial surveys, expedition photographs, spy satellite imagery and new remote-sensing products, we map glacier length fluctuations of approximately 350 peripheral glaciers and ice caps in East and West Greenland since 1890. Peripheral glaciers are found to have recently undergone a widespread and significant retreat at rates of 12.2 m per year and 16.6 m per year in East and West Greenland, respectively; these changes are exceeded in severity only by the early twentieth century post-Little-Ice-Age retreat. Regional changes in ice volume, as reflected by glacier length, are further shown to be related to changes in precipitation associated with the North Atlantic Oscillation (NAO), with a distinct east–west asymmetry; positive phases of the NAO increase accumulation, and thereby glacier growth, in the eastern periphery, whereas opposite effects are observed in the western periphery. Thus, with projected trends towards positive NAO in the future, eastern peripheral glaciers may remain relatively stable, while western peripheral glaciers will continue to diminish.
Comparison of Freeboard Retrieval and Ice Thickness Calculation From ALS, ASIRAS, and CryoSat-2 in the Norwegian Arctic to Field Measurements Made During the N-ICE2015 Expedition

We present freeboard measurements from airborne laser scanner (ALS), the Airborne Synthetic Aperture and Interferometric Radar Altimeter System (ASIRAS), and CryoSat-2 SIRAL radar altimeter; ice thickness measurements from both helicopter-borne and ground-based electromagnetic-sounding; and point measurements of ice properties. This case study was carried out in April 2015 during the N-ICE2015 expedition in the area of the Arctic Ocean north of Svalbard. The region is represented by deep snow up to 1.12 m and a widespread presence of negative freeboards. The main scattering surfaces from both CryoSat-2 and ASIRAS are shown to be closer to the snow freeboard obtained by ALS than to the ice freeboard measured in situ. This case study documents the complexity of freeboard retrievals from radar altimetry. We show that even under cold (below −15°C) conditions the radar freeboard can be close to the snow freeboard on a regional scale of tens of kilometers. We derived a modal sea-ice thickness for the study region from CryoSat-2 of 3.9 m compared to measured total thickness 1.7 m, resulting in an overestimation of sea-ice thickness on the order of a factor 2. Our results also highlight the importance of year-to-year regional scale information about the depth and density of the snowpack, as this influences the sea-ice freeboard, the radar penetration, and is a key component of the hydrostatic balance equations used to convert radar freeboard to sea-ice thickness.

General information
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Organisations: National Space Institute, Geodynamics, Alfred Wegener Institute, Norwegian Polar Institute, University of Bremen, U.S. Army Cold Regions Research and Engineering Laboratory, Colorado State University
Authors: King, J. (Ekstern), Skourup, H. (Intern), Hvidegaard, S. M. (Intern), Rösel, A. (Ekstern), Gerland, S. (Ekstern), Spreen, G. (Ekstern), Polashenski, C. (Ekstern), Helm, V. (Ekstern), Liston, G. E. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.056 SNIP 1.753
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.85 SNIP 1.738
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.826 SNIP 1.529
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.835 SNIP 1.471
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.034 SNIP 1.627
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.855 SNIP 1.417
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.984 SNIP 1.643
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.948 SNIP 1.847
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.784 SNIP 1.877
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 3.86 SNIP 1.692
Web of Science (2001): Indexed yes
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This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.
Confirmation of the detection of B modes in the Planck polarization maps

One of the main problems of extracting the cosmic microwave background (CMB) from submm/mm observations is correcting for the galactic components, mainly synchrotron, free–free, and thermal dust emission, with the required accuracy. Through a series of papers, it has been demonstrated that this task can be fulfilled by means of simple neural networks with high confidence. The main purpose of this paper is to demonstrate that the CMB BB power spectrum detected in the Planck 2015 polarization maps is present in the improved Planck 2017 maps with higher signal-to-noise ratio. Two features have been detected in the EB power spectrum in the new dataset, both with S/N ~ 4. The origin of these features is most likely leakage from E to B with a level of about 1%. This leakage does not significantly contribute to the detected BB power spectrum. The TB power spectrum is consistent with a zero signal. Altogether, the BB power spectrum is not consistent with the “canonical” tensor-to-scalar models combined with gravitational lensing spectra. These results will provide additional strong arguments for support to the proposed polarization satellite projects to follow up on the Planck mission.

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Authors: Nørgaard-Nielsen, H. U. (Intern)
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ISSN (Print): 0004-6337
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.402 SJR 0.712
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.87 SJR 0.53 SNIP 0.468
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.636 SNIP 0.465 CiteScore 0.91
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.781 SNIP 0.549 CiteScore 1.07
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.77 SNIP 0.505 CiteScore 1.12
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.738 SNIP 0.543 CiteScore 1.01
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.574 SNIP 0.484 CiteScore 0.83
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.587 SNIP 0.441
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.731 SNIP 0.404
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.583 SNIP 0.407
Scopus rating (2007): SJR 0.596 SNIP 0.33
Contribution of deformation to sea-ice mass balance: a case study from an N-ICE2015 storm

The fastest and most efficient process of gaining sea ice volume is through the mechanical redistribution of mass as a consequence of deformation events. During the ice growth season divergent motion produces leads where new ice grows thermodynamically, while convergent motion fractures the ice and either piles the resultant ice blocks into ridges or rafts one floe under the other. Here we present an exceptionally detailed airborne dataset from a 9km² area of first and second year ice in the Transpolar Drift north of Svalbard that allowed us to estimate the redistribution of mass from an observed deformation event. To achieve this level of detail we analyzed changes in sea ice freeboard acquired from two airborne laser scanner surveys just before and right after a deformation event brought on by a passing low pressure system. A linear regression model based on divergence during this storm can explain 64% of freeboard variability. Over the survey region we estimated that about 1.3% of level sea ice volume was pressed together into deformed ice and the new ice formed in leads in a week after the deformation event would increase the sea ice volume by 0.5%. As the region is impacted by about 15 storms each winter a simple linear extrapolation would result in about 7% volume increase and 20% deformed ice fraction at the end of the season.
Convolutional Neural Networks - Generalizability and Interpretations

Sufficient data is key when training Machine Learning algorithms in order to obtain models that generalize for operational use. Sometimes sufficient data is infeasible to obtain and this prevents the use of Machine Learning in many applications. The goal of this thesis is to gain insights and learn from data despite being limited in amount or context representation. Within Machine Learning this thesis focuses on Convolutional Neural Networks for Computer Vision. The research aims to answer how to explore a model's generalizability to the whole population of data samples and how to interpret the model's
function. The thesis presents three overall approaches to gaining insights on generalizability and interpretation. First, one can change the main objective of a problem to study expected insufficiencies and based on this make better a choice of model. For this first approach the thesis presents both a study on translational invariance as well as an example of changing the objective of a problem from classification to segmentation to robustly extract lower level information. The second approach is the use of simulated data which can help by inferring knowledge in our model if real data is scarce. The results show clear advantages both when using rendered Synthetic Aperture Radar images, but also when predictions from physical models are used as target variables which are matched with real data to form a large dataset. The third approach to cope with data insufficiencies is to visualize and understand the internal representations of a model. This approach is explored and concrete examples of learnings that can be obtained are shown. There is no doubt that large quantities of well representing data is the best foundation for training Machine Learning models. On the other hand, there are many tools and techniques available to interpret and understand properties of our models. With these at hand we can still learn about our models and use this knowledge to e.g. collect better datasets or improve on the modeling.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing  
**Authors:** Malmgren-Hansen, D. (Intern), Nielsen, A. A. (Intern), Engholm, R. (Ekstern), Skriver, H. (Intern)  
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**Main Research Area:** Technical/natural sciences  
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**Publication:** Research › Ph.D. thesis – Annual report year: 2018

**Detection of Reflection Features in the Neutron Star Low-mass X-Ray Binary Serpens X-1 with NICER**

We present Neutron Star Interior Composition Explorer (NICER) observations of the neutron star (NS) low-mass X-ray binary Serpens X-1 during the early mission phase in 2017. With the high spectral sensitivity and low-energy X-ray passband of NICER, we are able to detect the Fe L line complex in addition to the signature broad, asymmetric Fe K line. We confirm the presence of these lines by comparing the NICER data to archival observations with XMM-Newton /Reflection Grating Spectrometer (RGS) and NuSTAR.

**General information**

**State:** Published  
**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, University of Michigan, NASA Goddard Space Flight Center, Wayne State University, Massachusetts Institute of Technology, Kyoto University, University of Cambridge, Universite de Toulouse, SRON Netherlands Institute for Space Research, University of Maryland, NASA Marshall Space Flight Center  
**Authors:** Ludlam, R. M. (Ekstern), Miller, J. M. (Ekstern), Arzoumanian, Z. (Ekstern), Bult, P. M. (Ekstern), Cackett, E. M. (Ekstern), Chakrabarty, D. (Ekstern), Enoto, T. (Ekstern), Fabian, A. C. (Ekstern), Gendreau, K. C. (Ekstern), Guillot, S. (Ekstern), Homan, J. (Ekstern), Jaisawal, G. K. (Intern), Keek, L. (Ekstern), La Marr, B. (Ekstern), Malacaria, C. (Ekstern), Markwardt, C. B. (Ekstern), Steiner, J. F. (Ekstern), Strohmayer, T. E. (Ekstern)  
**Number of pages:** 6  
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**Publication information**

**Journal:** Astrophysical Journal Letters  
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**Issue number:** 1  
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**Ratings:**
Early 21st century spatially detailed elevation changes of Jammu and Kashmir glaciers (Karakoram–Himalaya)

Although a number of studies indicate the regional heterogeneity of the glacier elevation and mass changes in high-mountain Asia in the early 21st century, little is known about these changes with high spatial detail for some of the regions. In this study we present respective glacier elevation and mass change estimates in the Indian state of Jammu and Kashmir (JK) for the period 2000–2012. Our estimates are based on the interferometric analysis of SRTM DEM and the bistatic TanDEM-X data. On an average the JK East (Karakoram) glaciers showed legs negative elevation changes (~ 0.19 ± 0.22 myr$^{-1}$) compared to the JK West (Himalaya) glaciers (~ 0.50 ± 0.28 myr$^{-1}$). This agrees very well with previous studies that show a transition from larger changes in the western Himalaya to a steady-state situation in the Karakoram. We observe distinct elevation change patterns on a glacier scale that is most likely linked to debris insulation and the enhanced ice melting due to supraglacial lakes, ponds and ice cliffs. We also found 16 surge-type glaciers in the JK East which were not documented before. In total, 25 glaciers surged and 4 others appeared to be in a quiescent phase in the observation period. Our results also reveal that the glacier-averaged elevation change rates of surge-type and non-surge-type glaciers in the JK East region are not significantly different.

General information
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Organisations: National Space Institute, Geodesy, Friedrich-Alexander-Universität Erlangen-Nürnberg
Authors: Vijay, S. (Intern), Braun, M. (Ekstern)
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Web of Science (2018): Indexed yes
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Scopus rating (2016): CiteScore 4.16
Web of Science (2016): Indexed yes
Earth's Magnetic Field: Understanding Geomagnetic Sources from the Earth's Interior and its Environment

This volume provides a comprehensive view on the different sources of the geomagnetic field both in the Earth’s interior and from the field’s interaction with the terrestrial atmosphere and the solar wind. It combines expertise from various relevant areas of geomagnetic and near Earth space research with the aim to better characterise the state and dynamics of Earth’s magnetic field. Advances in the exploitation of geomagnetic observations hold a huge potential not only for an improved quantitative description of the field source but also for a better understanding of the underlying processes and physics. Key is the separation of the field sources in the observations, especially, but not solely, during times of quiet geomagnetic conditions, when the most subtle geomagnetic effects can be identified and become significant. The collected articles are based on the current constellation of ground and space observations, and on state-of-the-art empirical models and physics-based simulations. Thus, it provides an in-depth overview over recent achievements, current limitations and challenges, and future opportunities in the field of geomagnetism and space sciences.

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EPIC 219217635: A Doubly Eclipsing Quadruple System Containing an Evolved Binary

We have discovered a doubly eclipsing, bound, quadruple star system in the field of K2 Campaign 7. EPIC 219217635 is a stellar image with $K_p = 12.7$ that contains an eclipsing binary (‘EB’) with $P_A = 3.59470$ d and a second EB with $P_B = 0.61825$ d. We have obtained followup radial-velocity (‘RV’) spectroscopy observations, adaptive optics imaging, as well as ground-based photometric observations. From our analysis of all the observations, we derive good estimates for a number of the system parameters. We conclude that (1) both binaries are bound in a quadruple star system; (2) a linear trend to the RV curve of binary A is found over a 2-year interval, corresponding to an acceleration, $Y = 0.0024 \pm 0.0007$ cm s$^{-2}$; (3) small irregular variations are seen in the eclipse-timing variations (‘ETVs’) detected over the same interval; (4) the orbital separation of the quadruple system is probably in the range of 8-25 AU; and (5) the orbital planes of the two binaries must be inclined with respect to each other by at least 25°. In addition, we find that binary B is evolved, and the cooler and currently less massive star has transferred much of its envelope to the currently more massive star. We have also demonstrated that the system is sufficiently bright that the eclipses can be followed using small ground-based telescopes, and that this system may be profitably studied over the next decade when the outer orbit of the quadruple is expected to manifest itself in the ETV and/or RV curves.
Evaluation of multi-mode CryoSat-2 altimetry data over the Po River against in situ data and a hydrodynamic model

Coverage of in situ observations to monitor surface waters is insufficient on the global scale, and decreasing across the globe. Satellite altimetry has become an increasingly important monitoring technology for continental surface waters. The ESA CryoSat-2 altimetry mission, launched in 2010, has two novel features. (i) The radar altimeter instrument on board of CryoSat-2 is operated in three modes; two of them reduce the altimeter footprint by using Delay-Doppler processing. (ii) CryoSat-2 is placed on a distinct orbit with a repeat cycle of 369 days, leading to a drifting ground track pattern. The drifting ground track pattern challenges many common methods of processing satellite altimetry data over rivers. This study evaluates the observation error of CryoSat-2 water level observations over the Po River, Italy, against in situ observations. The average RMSE between CryoSat-2 and in situ observations was found to be 0.38 meters. CryoSat-2 was also shown to be useful for channel roughness calibration in a hydrodynamic model of the Po River. The small across-track distance of CryoSat-2 means that observations are distributed almost continuously along the river. This allowed resolving channel roughness with higher spatial resolution than possible with in situ or virtual station altimetry data. Despite the Po River being extensively monitored, CryoSat-2 still provides added value thanks to its unique spatio-temporal sampling pattern.

General information
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Organisations: Department of Environmental Engineering, National Space Institute, Geodesy, Air, Land & Water Resources, National Research Council of Italy, DHI Denmark
Authors: Schneider, R. (Intern), Tarpanelli, A. (Ekstern), Nielsen, K. (Intern), Madsen, H. (Ekstern), Bauer-Gottwein, P. (Intern)
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.561 SJR 1.551
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.53 SJR 2.202 SNIP 2.036
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.24 SNIP 2.062 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.951 SNIP 1.951 CiteScore 3.66
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.432 SNIP 1.748 CiteScore 3.03
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.567 SNIP 1.743 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.614 SNIP 1.714 CiteScore 2.84
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.712 SNIP 1.466
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.866 SNIP 1.639
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.566 SNIP 1.579
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.503 SNIP 1.497
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.296 SNIP 1.538
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.632 SNIP 1.86
Scopus rating (2004): SJR 1.358 SNIP 1.575
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.314 SNIP 1.536
Scopus rating (2002): SJR 1.117 SNIP 1.421
Web of Science (2002): Indexed yes
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Experimental study of $\text{H}_2\text{SO}_4$ aerosol nucleation at high ionization levels

One hundred and ten direct measurements of aerosol nucleation rate at high ionization levels were performed in an 8m$^3$ reaction chamber. Neutral and ion-induced particle formation from sulfuric acid ($\text{H}_2\text{SO}_4$) was studied as a function of ionization and $\text{H}_2\text{SO}_4$ concentration. Other species that could have participated in the nucleation, such as NH$_3$ or organic compounds, were not measured but assumed constant, and the concentration was estimated based on the parameterization by Gordon et al. (2017). Our parameter space is thus $[\text{H}_2\text{SO}_4] = 4 \times 10^6 - 3 \times 10^7 \text{cm}^{-3}$, $[\text{NH}_3 + \text{org}] = 2.2\text{ppb}$, $T = 295\text{K}$, $\text{RH} = 38\%$, and ion concentrations of 1700–19000cm$^{-3}$. The ion concentrations, which correspond to levels caused by a nearby supernova, were achieved with gamma ray sources. Nucleation rates were directly measured with a particle size magnifier (PSM Airmodus A10) at a size close to critical cluster size (mobility diameter of $\sim 1.4$nm) and formation rates at a mobility diameter of $\sim 4$nm were measured with a CPC (TSI model 3775). The measurements show that nucleation increases by around an order of magnitude when the ionization increases from background to supernova levels under fixed gas conditions. The results expand the parameterization presented in Dunne et al. (2016) and Gordon et al. (2017) (for $[\text{NH}_3 + \text{org}] = 2.2\text{ppb}$ and $T = 295\text{K}$) to lower sulfuric acid concentrations and higher ion concentrations. The results make it possible to expand the parameterization presented in Dunne et al. (2016) and Gordon et al. (2017) to higher ionization levels.

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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.72 SNIP 3.356 SJR 1.776
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.298 SNIP 1.526 CiteScore 5.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.607 SNIP 1.691 CiteScore 5.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.796 SNIP 1.824 CiteScore 5.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.944 SNIP 1.568 CiteScore 4.91
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.279 SNIP 1.48 CiteScore 5.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
GNSS Transpolar Earth Reflectometry explorinG System (G-TERN): Mission Concept

The global navigation satellite system (GNSS) Transpolar Earth Reflectometry explorinG system (G-TERN) was proposed in response to ESA’s Earth Explorer 9 revised call by a team of 33 multi-disciplinary scientists. The primary objective of the mission is to quantify at high spatio-temporal resolution crucial characteristics, processes and interactions between sea ice, and other Earth system components in order to advance the understanding and prediction of climate change and its impacts on the environment and society. The objective is articulated through three key questions. 1) In a rapidly changing Arctic regime and under the resilient Antarctic sea ice trend, how will highly dynamic forcings and couplings between the various components of the ocean, atmosphere, and cryosphere modify or influence the processes governing the characteristics of the sea ice cover (ice production, growth, deformation, and melt)? 2) What are the impacts of extreme events and feedback mechanisms on sea ice evolution? 3) What are the effects of the cryosphere behaviors, either rapidly changing or resiliently stable, on the global oceanic and atmospheric circulation and mid-latitude extreme events? To contribute answering these questions, G-TERN will measure key parameters of the sea ice, the oceans, and the atmosphere with frequent and dense coverage over polar areas, becoming a “dynamic mapper” of the ice conditions, the ice production, and the loss in multiple time and space scales, and surrounding environment. Over polar areas, the G-TERN will measure sea ice surface elevation (<10 cm precision), roughness, and polarimetry aspects at 30-km resolution and 3-days full coverage. G-TERN will implement the interferometric GNSS reflectometry concept, from a single satellite in near-polar orbit with capability for 12 simultaneous observations. Unlike currently orbiting GNSS reflectometry missions, the G-TERN uses the full GNSS available bandwidth to improve its ranging measurements. The lifetime would be 2025–2030 or optimally 2025–2035, covering key stages of the transition toward a nearly ice-free Arctic Ocean in summer. This paper describes the mission objectives, it reviews its measurement techniques, summarizes the suggested implementation, and finally, it estimates the expected performance.

General information
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Organisations: National Space Institute, Geodesy, IFREMER, Alfred Wegener Institute for Polar and Marine Research, Institute of Space Sciences, German Research Centre for Geosciences, IMST GmbH, Airbus DS Space Systems España , California Institute of Technology, TRYO Group, DEIMOS Engenharia SA, RUAG Space GmbH, Environment and Climate Change Canada, University of Bern, La Sapienza - Università di Roma, Barcelona Expert Center on Remote Sensing, Finnish Meteorological Institute, Collecte Localisation Satellites, University of Graz, OHB System AG, Ohio State University, Harp Technologies Ltd., National Oceanography Centre, European Centre for Medium-Range Weather Forecasts, IEEC - Institute of Space Studies of Catalonia
Authors: Cardellach, E. (Ekstern), Wickert, J. (Ekstern), Baggen, R. (Ekstern), Benito, J. (Ekstern), Camps, A. (Ekstern), Catarino, N. (Ekstern), Chapron, B. (Ekstern), Dielacher, A. (Ekstern), Fabra, F. (Ekstern), Flato, G. (Ekstern), Fragner, H. (Ekstern), Gabarro, C. (Ekstern), Gommenginger, C. (Ekstern), Haas, C. (Ekstern), Healy, S. (Ekstern), Hernandez-Pajares, M. (Ekstern), Høeg, P. (Intern), Jaggi, A. (Ekstern), Kainulainen, J. (Ekstern), Khan, S. A. (Intern), Lemke, N. M.
High-Energy Emissions induced by air density fluctuations of discharges

Bursts of X- and γ-rays are observed from lightning and laboratory sparks. They are bremsstrahlung from energetic electrons interacting with neutral air molecules, but it is still unclear how the electrons achieve the required energies. It has been proposed that the enhanced electric field of streamers, found in the corona of leader tips, may account for the acceleration, however, their efficiency is questioned because of the relatively low production rate found in simulations. Here we emphasize that streamers usually are simulated with the assumption of homogeneous gas, which may not be the case on the small temporal and spatial scales of discharges. Since the streamer properties strongly depend on the reduced electric field $E/n$, where $n$ is the neutral number density, fluctuations may potentially have a significant effect. To explore what might be expected if the assumption of homogeneity is relaxed, we conducted simple numerical experiments based on simulations of streamers in a neutral gas with a radial gradient in the neutral density, assumed to be created, for instance, by a previous spark. We also studied the effects of background electron density from previous discharges. We find that X- and γ-radiation is enhanced when the on-axis air density is reduced by more than $\Delta 1/425\%$. Pre-ionization tends to reduce the streamer field and thereby the production rate of high-energy electrons, however, the reduction is modest. The simulations suggest that fluctuations in the neutral densities, on the temporal and spacial scales of streamers, may be important for electron acceleration and bremsstrahlung radiation.
Informing a hydrological model of the Ogooué with multi-mission remote sensing data

Remote sensing provides a unique opportunity to inform and constrain a hydrological model and to increase its value as a decision-support tool. In this study, we applied a multi-mission approach to force, calibrate and validate a hydrological model of the ungauged Ogooué river basin in Africa with publicly available and free remote sensing observations. We used a rainfall–runoff model based on the Budyko framework coupled with a Muskingum routing approach. We parametrized the model using the Shuttle Radar Topography Mission digital elevation model (SRTM DEM) and forced it using precipitation from two satellite-based rainfall estimates, FEWS-RFE (Famine Early Warning System rainfall estimate) and the Tropical Rainfall Measuring Mission (TRMM) 3B42 v.7, and temperature from ECMWF ERA-Interim. We combined three different datasets to calibrate the model using an aggregated objective function with contributions from (1) historical in situ discharge observations from the period 1953–1984 at six locations in the basin, (2) radar altimetry measurements of river stages by Envisat and Jason-2 at 12 locations in the basin and (3) GRACE (Gravity Recovery and Climate Experiment) total water storage change (TWSC). Additionally, we extracted CryoSat-2 observations throughout the basin using a Sentinel-1 SAR (synthetic aperture radar) imagery water mask and used the observations for validation of the model. The use of new satellite missions, including Sentinel-1 and CryoSat-2, increased the spatial characterization of river stage. Throughout the basin, we achieved good agreement between observed and simulated discharge and the river stage, with an RMSD between simulated and observed water amplitudes at virtual stations of 0.74m for the TRMM-forced model and 0.87m for the FEWS-RFE-forced model. The hydrological model also captures overall total water storage change patterns, although the amplitude of storage change is generally underestimated. By combining hydrological modeling with multi-mission remote sensing from 10 different satellite missions, we obtain new information on an otherwise unstudied basin. The proposed model is the best current baseline characterization of hydrological conditions in the Ogooué in light of the available observations.
NICER Detection of Strong Photospheric Expansion during a Thermonuclear X-Ray Burst from 4U 1820–30

The Neutron Star Interior Composition Explorer (NICER) on the International Space Station (ISS) observed strong photospheric expansion of the neutron star in 4U 1820–30 during a Type I X-ray burst. A thermonuclear helium flash in the star’s envelope powered a burst that reached the Eddington limit. Radiation pressure pushed the photosphere out to ~200 km, while the blackbody temperature dropped to 0.45 keV. Previous observations of similar bursts were performed with instruments that are sensitive only above 3 keV, and the burst signal was weak at low temperatures. NICER’s 0.2–12 keV passband enables the first complete detailed observation of strong expansion bursts. The strong expansion lasted only 0.6 s, and was followed by moderate expansion with a 20 km apparent radius, before the photosphere finally settled back down at 3 s after the burst onset. In addition to thermal emission from the neutron star, the NICER spectra reveal a second component that is well fit by optically thick Comptonization. During the strong expansion, this component is six times brighter than prior to the burst, and it accounts for 71% of the flux. In the moderate expansion phase, the Comptonization flux drops, while the thermal component brightens, and the total flux remains constant at the Eddington limit. We speculate that the thermal emission is reprocessed in the accretion environment to form the Comptonization component, and that changes in the covering fraction of the star explain the evolution of the relative contributions to the total flux.
Accretion disks around neutron stars regularly undergo sudden strong irradiation by Type-I X-ray bursts powered by unstable thermonuclear burning on the stellar surface. We investigate the impact on the disk during one of the first X-ray burst observations with the Neutron Star Interior Composition Explorer (NICER) on the International Space Station. The burst is seen from Aql X-1 during the hard spectral state. In addition to thermal emission from the neutron star, the burst spectrum exhibits an excess of soft X-ray photons below 1 keV, where NICER’s sensitivity peaks. We interpret the excess as a combination of reprocessing by the strongly photoionized disk and enhancement of the pre-burst persistent flux, possibly due to Poynting–Robertson drag or coronal reprocessing. This is the first such detection for a short sub-Eddington burst. As these bursts are observed frequently, NICER will be able to study how X-ray bursts affect the disk and corona for a range of accreting neutron star systems and disk states.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Maryland, NASA Goddard Space Flight Center, SRON Netherlands Institute for Space Research, Massachusetts Institute of Technology, Université de Toulouse, Istanbul University, Wayne State University, Massachusetts Institute of Technology, University of Cambridge, Université de Toulouse, Istanbul University, University of Illinois at Urbana-Champaign, Naval Research Laboratory, University of Michigan

In situ study of electric field controlled ion transport in the Fe/BaTiO3 interface

Electric field controlled ion transport and interface formation of iron thin films on a BaTiO3 substrate have been investigated by in situ nuclear resonance scattering and x-ray reflectometry techniques. At early stage of deposition, an iron-II oxide interface layer was observed. The hyperfine parameters of the interface layer were found insensitive to the evaporated layer thickness. When an electric field was applied during growth, a 10 Å increase of the nonmagnetic/magnetic thickness threshold and an extended magnetic transition region was measured compared to the case where no field was applied. The interface layer was found stable under this threshold when further evaporation occurred, contrary to the magnetic layer where the magnitude and orientation of the hyperfine magnetic field vary continuously. The obtained results of the growth mechanism and of the electric field effect of the Fe/BTO system will allow the design of novel applications by creating custom oxide/metallic nanopatterns using laterally inhomogeneous electric fields during sample preparation.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Hungarian Academy of Sciences, Delft University of Technology, European Synchrotron Radiation Facility
INTEGRAL results on the electromagnetic counterparts of gravitational waves

Thanks to its high orbit and a set of complementary detectors providing continuous coverage of the whole sky, the INTEGRAL satellite has unique capabilities for the identification and study of the electromagnetic radiation associated to gravitational waves signals and, more generally, for multi-messenger astrophysics. Here we briefly review the results obtained during the first two observing runs of the advanced LIGO/Virgo interferometers.

Interplanetary magnetic field $B_x$ component influence on horizontal and field-aligned currents in the ionosphere

Statistical analyses have shown that the sunward component of the interplanetary magnetic field, $B_x$ (GSM), moderately but significantly affects the auroral intensity. These observations have been interpreted as signatures of a similar IMF $B_x$ control on Birkeland currents, yet to be observed directly. Such a control, attributed to differences in magnetic tension on newly opened magnetic field lines, would lead to stronger region 1 (R1) Birkeland currents for $B_x$ negative (positive) conditions in the northern (southern) hemisphere than when $B_x$ is positive (negative). In this paper we perform a detailed
investigation of three different sets of magnetic field measurements, from the CHAMP and Swarm low-Earth-Orbit satellites, from the AMPERE products derived from the Iridium satellite constellation, and from the SuperMAG ground magnetometer network, each analyzed using different techniques, to test these predictions. The results show that a change in sign of $B_x$ changes the Birkeland currents by no more than $\approx 10\%$. The current patterns show little support for an inter-hemispheric asymmetry of the kind proposed to explain auroral observations. Instead we propose an alternative interpretation, which is consistent with most of the auroral observations and with the current observations in the present paper, except for those based on AMPERE. The solar wind-magnetosphere coupling is more efficient when the dipole tilt angle and $B_x$ have the same sign than when they are different. We suggest the higher coupling is because the dayside reconnection region is closer to the subsolar point when the dipole tilt angle and $B_x$ have the same sign.

**General information**

State: Published
Organisations: National Space Institute, Geomagnetism, University of Bergen
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Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
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Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
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BFI (2012): BFI-level 2
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.056 SNIP 1.753
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.85 SNIP 1.738
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.826 SNIP 1.529
Web of Science (2008): Indexed yes
Jupiter Analogs Orbit Stars with an Average Metallicity Close to That of the Sun

Jupiter played an important role in determining the structure and configuration of the Solar System. Whereas hot-Jupiter type exoplanets preferentially form around metal-rich stars, the conditions required for the formation of planets with masses, orbits, and eccentricities comparable to Jupiter (Jupiter analogs) are unknown. Using spectroscopic metallicities, we show that stars hosting Jupiter analogs have an average metallicity close to solar, in contrast to their hot-Jupiter and eccentric cool-Jupiter counterparts, which orbit stars with super-solar metallicities. Furthermore, the eccentricities of Jupiter analogs increase with host-star metallicity, suggesting that planet-planet scatterings producing highly eccentric cool Jupiters could be more common in metal-rich environments. To investigate a possible explanation for these metallicity trends, we compare the observations to numerical simulations, which indicate that metal-rich stars typically form multiple Jupiters, leading to planet-planet interactions and, hence, a prevalence of either eccentric cool Jupiters or hot Jupiters with circularized orbits. Although the samples are small and exhibit variations in their metallicities, suggesting that numerous processes other than metallicity affect the formation of planetary systems, the data in hand suggests that Jupiter analogs and terrestrial-sized planets form around stars with average metallicities close to solar, whereas high-metallicity systems preferentially host eccentric cool Jupiter or hot Jupiters, indicating that higher metallicity systems may not be favorable for the formation of planetary systems akin to the Solar System.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Lund University, Harvard-Smithsonian Center for Astrophysics, University of Copenhagen, Columbia University
Authors: Buchhave, L. A. (Intern), Bitsch, B. (Ekstern), Johansen, A. (Ekstern), Latham, D. W. (Ekstern), Bizzarro, M. (Ekstern), Bieryla, A. (Ekstern), Kipping, D. M. (Ekstern)
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
Monitoring of surface water resources in East Africa using CryoSat-2 radar altimetry and Sentinel-1 SAR imagery

General Information
State: Published
Organisations: Department of Environmental Engineering, Air, Land & Water Resources, National Space Institute, Geodesy, DHI GRAS
Authors: Kittel, C. M. M. (Intern), Jiang, L. (Intern), Tøttrup, C. (Ekstern), Nielsen, K. (Intern), Bauer-Gottwein, P. (Intern)
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Monitoring Riverscapes with Unmanned Airborne Vehicles

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Organisations: Department of Environmental Engineering, Air, Land & Water Resources, Environmental Fate & Effect of Chemicals, National Space Institute, Geodesy, Astrophysics and Atmospheric Physics, Orbicon, Drone Systems ApS, DHI, Region Hovedstaden, Region Syddanmark, Vejle County, Technical University of Denmark, Photrack AG
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Multi-Beam Focal Plane Arrays with Digital Beamforming for High Precision Space-Borne Ocean Remote Sensing

The present-day ocean remote sensing instruments that operate at low microwave frequencies are limited in spatial resolution and do not allow for monitoring of the coastal waters. This is due to the difficulties of employing a large reflector antenna on a satellite platform, and generating high-quality pencil beams at multiple frequencies. Recent advances in digital beamforming focal-plane-arrays (FPAs) have been exploited in the current work to overcome the above problems. A holistic design procedure for such novel multi-beam radiometers has been developed, where (i) the antenna system specifications are derived directly from the requirements to oceanographic surveys for future satellite missions; and (ii) the numbers of FPA elements/receivers are determined through a dedicated optimum beamforming procedure minimizing the distance to coast. This approach has been applied to synthesize FPAs for two alternative radiometer systems: a conical scanner with an off-set parabolic reflector, and stationary wide-scan torus reflector system; each operating at C, X and Ku bands. Numerical results predict excellent beam performance for both systems with as low as 0.14 % total received power over the land.

General information
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Organisations: National Space Institute, Microwaves and Remote Sensing, Chalmers University of Technology, TICRA, European Space Agency
NICER Discovers the Ultracompact Orbit of the Accreting Millisecond Pulsar IGR J17062–6143

We present results of recent Neutron Star Interior Composition Explorer (NICER) observations of the accreting millisecond X-ray pulsar (AMXP) IGR J17062–6143 that show that it resides in a circular, ultracompact binary with a 38-minute orbital period. NICER observed the source for ≈26 ks over a 5.3-day span in 2017 August, and again for 14 and 11 ks in 2017 October and November, respectively. A power spectral analysis of the August exposure confirms the previous detection of pulsations at 163.656 Hz in Rossi X-ray Timing Explorer (RXTE) data, and reveals phase modulation due to orbital motion of the neutron star. A coherent search for the orbital solution using the Z2 method finds a best-fitting circular orbit with a period of 2278.21 s (37.97 minutes), a projected semimajor axis of 0.00390 lt-s, and a barycentric pulsar frequency of 163.6561105 Hz. This is currently the shortest known orbital period for an AMXP. The mass function is $9.12 \times 10^{-8} M_\odot$, presently the smallest known for a stellar binary. The minimum donor mass ranges from ≈0.005 to 0.007 $M_\odot$ for a neutron star mass from 1.2 to 2 $M_\odot$. Assuming mass transfer is driven by gravitational radiation, we find donor mass and binary inclination bounds of 0.0175–0.0155 $M_\odot$ and 19°.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, NASA Goddard Space Flight Center, Massachusetts Institute of Technology, Naval Research Laboratory, Columbia University, Kyto University, CNRS, Haverford College, SRON Netherlands Institute for Space Research, University of Maryland, National Radio Astronomy Observatory
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Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 4.45
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 4.33
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 4.34
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 4.18
ISI indexed (2013): ISI indexed yes
Numerical insights into the early stages of nanoscale electrodeposition: nanocluster surface diffusion and aggregative growth

Fundamental understanding of the early stages of electrodeposition at the nanoscale is key to address the challenges in a wide range of applications. Despite having been studied for decades, a comprehensive understanding of the whole process is still out of reach. In this work, we introduce a novel modelling approach that couples a finite element method (FEM) with a random walk algorithm, to study the early stages of nanocluster formation, aggregation and growth, during electrochemical deposition. This approach takes into account not only electrochemical kinetics and transport of active species, but also the surface diffusion and aggregation of adatoms and small nanoclusters. The simulation results reveal that the relative surface mobility of the nanoclusters compared to that of the adatoms plays a crucial role in the early growth stages. The number of clusters, their size and their size dispersion are influenced more significantly by nanocluster mobility than by the applied overpotential itself. Increasing the overpotential results in shorter induction times and leads to aggregation prevalence at shorter times. A higher mobility results in longer induction times, a delayed transition from nucleation to aggregation prevalence, and as a consequence, a larger surface coverage of smaller clusters with a smaller size dispersion. As a consequence, it is shown that a classical first-order nucleation kinetics equation cannot describe the evolution of the number of clusters with time, N(t), in potentiostatic electrodeposition. Instead, a more accurate representation of N(t) is provided. We show that an evaluation of N(t), which neglects the effect of nanocluster mobility and aggregation, can induce errors of several orders of magnitude in the determination of nucleation rate constants. These findings are extremely important towards evaluating the elementary electrodeposition processes, considering not only adatoms, but also nanoclusters as building blocks.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Vrije Universiteit Brussel
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.77 SNIP 1.542 CiteScore 7.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.646 SNIP 1.649 CiteScore 7.64
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.558 SNIP 1.467 CiteScore 6.89
Occultations from an Active Accretion Disk in a 72-day Detached Post-Algol System Detected by K2

Disks in binary systems can cause exotic eclipsing events. MWC 882 (BD −22 4376, EPIC 225300403) is such a disk-eclipsing system identified from observations during Campaign 11 of the K2 mission. We propose that MWC 882 is a post-Algol system with a B7 donor star of mass in a 72-day orbit around an A0 accreting star of mass . The disk around the accreting star occults the donor star once every orbit, inducing 19-day long, 7% deep eclipses identified by K2 and subsequently found in pre-discovery All-Sky Automated Survey and All Sky Automated Survey for Supernovae observations. We coordinated a campaign of photometric and spectroscopic observations for MWC 882 to measure the dynamical masses of the components and to monitor the system during eclipse. We found the photometric eclipse to be grey to ≈1%. We found that the primary star exhibits spectroscopic signatures of active accretion, and we observed gas absorption features from the disk during eclipse. We suggest that MWC 882 initially consisted of a ≈3.6 M⊙ donor star transferring mass via Roche lobe overflow to a ≈2.1 M⊙ accretor in a ≈7-day initial orbit. Through angular momentum conservation, the donor star is pushed outward during mass transfer to its current orbit of 72 days. The observed state of the system corresponds with the donor star having left the red giant branch ∼0.3 Myr ago, terminating active mass transfer. The present disk is expected to be short-lived (10^2 yr) without an active feeding mechanism, presenting a challenge to this model.

General information
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Optimal estimation of sea surface temperature from AMSR-E

The Optimal Estimation (OE) technique is developed within the European Space Agency Climate Change Initiative (ESA-CCI) to retrieve subskin Sea Surface Temperature (SST) from AQUA's Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E). A comprehensive matchup database with drifting buoy observations is used to develop and test the OE setup. It is shown that it is essential to update the first guess atmospheric and oceanic state variables and to perform several iterations to reach an optimal retrieval. The optimal number of iterations is typically three to four in the current setup. In addition, updating the forward model, using a multivariate regression model is shown to improve the capability of the forward model to reproduce the observations. The average sensitivity of the OE retrieval is 0.5 and shows a latitudinal dependency with smaller sensitivity for cold waters and larger sensitivity for warmer waters. The OE SSTs are evaluated against drifting buoy measurements during 2010. The results show an average difference of 0.02 K with a standard deviation of 0.47 K when considering the 64% matchups, where the simulated and observed brightness temperatures are most consistent. The corresponding mean uncertainty is estimated to 0.48 K including the in situ and sampling uncertainties. An independent validation against Argo observations from 2009 to 2011 shows an average difference of 0.01 K, a standard deviation of 0.50 K and a mean uncertainty of 0.47 K, when considering the best 62% of retrievals. The satellite versus in situ discrepancies are highest in the dynamic oceanic regions due to the large satellite footprint size and the associated sampling effects. Uncertainty estimates are available for all retrievals and have been
validated to be accurate. They can thus be used to obtain very good retrieval results. In general, the results from the OE retrieval are very encouraging and demonstrate that passive microwave observations provide a valuable alternative to infrared satellite observations for retrieving SST.

**General information**
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Organisations: National Space Institute, Microwaves and Remote Sensing, Danish Meteorological Institute, Earth & Space Research, ESTEC, Brockmann Consult GmbH
Authors: Nielsen-Englyst, P. (Ekstern), Høyer, J. L. (Ekstern), Pedersen, L. T. (Intern), Gentemann, C. L. (Ekstern), Alerskans, E. (Ekstern), Block, T. (Ekstern), Donlon, C. (Ekstern)
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- Scopus rating (2016): CiteScore 3.56 SJR 1.309 SNIP 1.718
- Web of Science (2016): Indexed yes
- Scopus rating (2015): SJR 1.349 SNIP 1.682 CiteScore 3.76
- Web of Science (2015): Indexed yes
- Scopus rating (2014): SJR 1.275 SNIP 1.856 CiteScore 3.23
- Web of Science (2014): Indexed yes
- Scopus rating (2013): SJR 1.127 SNIP 1.973 CiteScore 3.01
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- Scopus rating (2012): SJR 0.99 SNIP 1.801 CiteScore 2.36
- ISI indexed (2012): ISI indexed no
- Scopus rating (2011): SJR 0.533 SNIP 1.327 CiteScore 1.3
- ISI indexed (2011): ISI indexed no
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**Planck intermediate results - XV. A study of anomalous microwave emission in Galactic clouds (Corrigendum)**
There is a typographical error in the unit of the 250 column of Table 3 of Planck Collaboration XVI (2014), resulting in all 250 values listed being a factor of 10 smaller than they should be. Corresponding author: C. Dickinson, e-mail: clive.dickinson@manchester.ac.uk The values have been multiplied by 104 and not 105 as listed in the previously published version. All the values relating to τ250 in the main body of text and figures remain correct.

**General information**
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Scopus rating (2014): SJR 2.883 SNIP 1.247 CiteScore 2.82
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BFI (2013): BFI-level 2
Abstract The relationship between the magnetospheric field-aligned currents (FAC) measured by the Swarm satellites and the magnetic activity PC index (which is a proxy of the solar wind energy incoming into the magnetosphere) is examined. It is shown that current intensities measured in the R1 and R2 FAC layers at the poleward and equatorward boundaries of the auroral oval are well correlated, the R2 currents being evidently secondary in relation to R1 currents and correlation in the dawn and dusk oval sectors being better than in the noon and night sectors. There is evident relationship between the PC index and the intensity of field-aligned currents in the R1 dawn and dusk layers: increase of FAC intensity in the course of
substorm development is accompanied by increasing the PC index values. Correlation between PC and FAC intensities in the R2 dawn and dusk layers is also observed, but it is much weaker. No correlation is observed between PC and field-aligned currents in the midnight as well as in the noon sectors ahead of the substorm expansion phase. The results are indicative of the R1 field-aligned currents as a driver of the polar cap magnetic activity (PC index) and currents in the R2 layer.

**General information**

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Organisations: National Space Institute, Geomagnetism, Arctic and Antarctic Research Institute
Authors: Troshichev, О. (Ekstern), Sormakov, D. (Ekstern), Behlke, R. (Intern)
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Web of Science (2005): Indexed yes
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Scopus rating (2003): SJR 0.956 SNIP 1.254
Web of Science (2003): Indexed yes
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Revisiting the Phase Curves of WASP-43b: Confronting Re-analyzed Spitzer Data with Cloudy Atmospheres

Recently acquired Hubble and Spitzer phase curves of the short-period hot Jupiter WASP-43b make it an ideal target for confronting theory with data. On the observational front, we re-analyze the 3.6 and 4.5 μm Spitzer phase curves and demonstrate that our improved analysis better removes residual red noise due to intra-pixel sensitivity, which leads to greater fluxes emanating from the nightside of WASP-43b, thus reducing the tension between theory and data. On the theoretical front, we construct cloud-free and cloudy atmospheres of WASP-43b using our Global Circulation Model (GCM), THOR, which solves the non-hydrostatic Euler equations (compared to GCMs that typically solve the hydrostatic primitive equations). The cloud-free atmosphere produces a reasonable fit to the dayside emission spectrum. The multi-phase emission spectra constrain the cloud deck to be confined to the nightside and have a finite cloud-top pressure. The multi-wavelength phase curves are naturally consistent with our cloudy atmospheres, except for the 4.5 μm phase curve, which requires the presence of enhanced carbon dioxide in the atmosphere of WASP-43b. Multi-phase emission spectra at higher spectral resolution, as may be obtained using the James Webb Space Telescope, and a reflected-light phase curve at visible wavelengths would further constrain the properties of clouds in WASP-43b.
Searching for Short GRBs in Soft Gamma Rays with INTEGRAL/PICsIT

With gravitational wave (GW) detections by the LIGO/Virgo collaboration over the past several years, there is heightened interest in gamma-ray bursts (GRBs), especially "short" GRBs (T < 2s). The high-energy PICsIT detector (~0.2 – 10 MeV) on-board the INTErnational Gamma-Ray Astrophysics Laboratory (INTEGRAL) is able to observe sources out to approximately 70° off-axis, making it essentially a soft gamma-ray, all-sky monitor for impulsive events, such as SGRBs. Because SGRBs typically have hard spectra with peak energies of a few hundred keV, PICsIT with its ~ 3000 cm² collecting area is able to provide spectral information about these sources at soft gamma-ray energies. We have begun a study of PICsIT data for faint SGRB similar to the one associated with the binary neutron star (BNS) merger GW170817, and also are preparing for future GW triggers by developing a real-time burst analysis for PICsIT. Searching the PICsIT data for significant excesses during ~30 min-long pointings containing times of SGRBs, we have been able to differentiate between SGRBs and spurious events. Also, this work allows us to assess what fraction of reported SGRBs have been detected by PICsIT, which can be used to provide an estimate of the number of GW BNS events seen by PICsIT during the next LIGO/Virgo observing run starting in Fall 2018.
Seasonal ice dynamics of the Northeast Greenland Ice Stream
Previous studies about the seasonal ice dynamics of the marine-terminating glaciers of Greenland and their dynamic mass losses are limited by the temporal resolution of the existing data. Sentinel-1 radar mission opens the possibility for continuous monitoring of glaciers with very high spatial and temporal details. This study focus on the Northeast Greenland Ice Stream (NEGIS), which consists of three main outlets, 79 North glacier (79N), Zachariae Isstrøm (ZI) and Storstrømmen Glacier (SG). While both 79 North and Storstrømmen have floating tongues, Zachariae Isstrøm is mostly grounded. In this study, we present the seasonal ice dynamics of these three outlets of NEGIS as well as their implications on bedrock displacements during 2015-2017. We derive surface velocities using SAR offset tracking applied over Sentinel-1 SAR data. We use radar backscatter from Sentinel SAR data to mark the onset of surface melt and the extent of the melt season. Moreover, we include the changes in ice front from Sentinel SAR data, surface elevation changes from CryoSat-2 data and GPS derived bedrock displacements in our analysis. We find that among these outlets, ZI is the fastest varying between 5.6 m/day and 7.0 m/day during 2015-2017. 79 N fluctuates between 3.6 m/day and 4.2 day, while the velocity of SG is less than 1 m/day throughout our observation period. All three of them speed up with the onset of surface melt and attain maximum velocity in the middle of the melt season. Afterwards they slowdown and attain minimum velocity at the end of the melt season followed by either moderate winter speedup (ZI) or stable flow (79 N, SG). This indicates the surface melt induced changes in the subglacial hydrology governs the seasonal flow dynamics of these outlets. We also notice dynamic thinning from CryoSat-2 data and corresponding elastic displacements (detected by GPS) of the bedrock due to ice mass unloading of the crust.
Simulating ice thickness and velocity evolution of Upernavik Isstrom 1849-2012 by forcing prescribed terminus positions in ISSM

Tidewater glacier velocity and mass balance are known to be highly responsive to terminus position change. Yet it remains challenging for ice flow models to reproduce observed ice margin changes. Here, using the Ice Sheet System Model (ISSM; Larour et al., 2012), we simulate the ice velocity and thickness changes of Upernavik Isstrom (north-western Greenland) by prescribing a collection of 27 observed terminus positions spanning 164 years (1849-2012). The simulation shows increased ice velocity during the 1930s, the late 1970s and between 1995 and 2012 when terminus retreat was observed along with negative surface mass balance anomalies. Three distinct mass balance states are evident in the reconstruction: (1849-1932) with near zero mass balance, (1932-1992) with ice mass loss dominated by ice dynamical flow, and (1998-2012), when increased retreat and negative surface mass balance anomalies led to mass loss that was twice that of any earlier period. Over the multi-decadal simulation, mass loss was dominated by thinning and acceleration responsible for 70% of the total mass loss induced by prescribed change in terminus position. The remaining 30% of the total ice mass loss resulted directly from prescribed terminus retreat and decreasing surface mass balance. Although the method cannot explain the cause of glacier retreat, it enables the reconstruction of ice flow and geometry during 1849-2012. Given annual or seasonal observed terminus front positions, this method could be a useful tool for evaluating simulations investigating the effect of calving laws.
Solar wind and seasonal influence on ionospheric currents from Swarm and CHAMP measurements

We present a new climatological model of the ionospheric current system, determined from magnetic measurements taken by the CHAMP and Swarm satellites. The model describes the horizontal currents in the ionosphere, below the satellites, and the field-aligned (Birkeland) currents that connect the ionosphere with the magnetosphere. The model provides ionospheric current values at any location as continuous functions of solar wind speed, interplanetary magnetic field (IMF), dipole tilt angle, and the F10.7 index of solar flux. Geometric distortions due to variations in the Earth's main magnetic field are taken into account, thus allowing for precise comparisons between the two hemispheres. The model is the first of its kind to describe the full 3D electric currents, and not only the field-aligned or the equivalent horizontal current. We use this capability to demonstrate a key difference between seasons: During winter, the total horizontal current is almost entirely confined to the auroral oval, for all IMF orientations, where it connects upward and downward Birkeland currents. During more sunlit conditions, the horizontal current extends beyond the auroral oval, and is a sum of currents connecting Birkeland currents and currents that circulate in the ionosphere. The westward electrojet is the only large-scale current structure that is persistent across seasons. Comparison with average convection maps suggests that it is comprised largely of Hall currents, which connect to Birkeland currents in the winter but not in summer.

General information
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Organisations: National Space Institute, Geomagnetism, University of Bergen
Authors: Laundal, K. M. (Ekstern), Finlay, C. C. (Intern), Olsen, N. (Intern), Reistad, J. P. (Ekstern)
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Scopus rating (2017): SJR 2.272 SNIP 1.475
Streamer properties and associated x-rays in perturbed air

Streamers are ionization waves in electric discharges. One of the key ingredients of streamer propagation is an ambient gas that serves as a source of free electrons. Here, we explore the dependence of streamer dynamics on different spatial distributions of ambient air molecules. We vary the spatial profile of air parallel and perpendicular to the ambient electric field. We consider local sinusoidal perturbations of 5%–100%, as induced from discharge shock waves. We use acylindrically symmetric particle-in-cell code to simulate the evolution of bidirectional streamers and compare the electron density, electric field, streamer velocity and electron energy of streamers in uniform air and in perturbed air. In all considered cases, the motion is driven along in decreasing air density and damped along increasing air density. Perturbations of at most 5%–10% change the velocity differences by up to approximately 40%. Perturbations perpendicular to the electric field additionally squeeze or branch streamers. Air variations can thus partly explain the difference of velocities and morphologies of streamer discharges. In cases with large perturbations, electrons gain energies of up to 30 keV compared to 100 eV in uniformly distributed air. For such perturbations parallel to the ambient electric field, we see the spontaneous initiation of a negative streamer; for perpendicular perturbations, x-rays with energies of up to 20 keV are emitted within 0.17 ns.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Russian Federal Nuclear Center
Authors: Köhn, C. (Intern), Chanrion, O. (Intern), Babich, L. P. (Ekstern), Neubert, T. (Intern)
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.995 SNIP 1.602 CiteScore 2.05
BFI (2014): BFI-level 1
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Scopus rating (2012): SJR 0.873 SNIP 1.382 CiteScore 1.74
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.134 SNIP 1.787 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.274 SNIP 1.67
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.106 SNIP 1.395
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.402 SNIP 1.998
STROBE-X: X-ray Timing & Spectroscopy on Dynamical Timescales from Microseconds to Years

We describe a probe-class mission concept that provides an unprecedented view of the X-ray sky, performing timing and 0.2-30 keV spectroscopy over timescales from microseconds to years. The Spectroscopic Time-Resolving Observatory for Broadband Energy X-rays (STROBE-X) comprises three primary instruments. The first uses an array of lightweight optics (3-m focal length) that concentrate incident photons onto solid state detectors with CCD-level (85-130 eV) energy resolution, 100 ns time resolution, and low background rates to cover the 0.2-12 keV band. This technology is scaled up from NICER, with enhanced optics to take advantage of the longer focal length of STROBE-X. The second uses large-area collimated silicon drift detectors, developed for ESA's LOFT, to cover the 2-30 keV band. These two instruments each provide an order of magnitude improvement in effective area compared with its predecessor (NICER and RXTE, respectively). Finally, a sensitive sky monitor triggers pointed observations, provides high duty cycle, high time resolution, high spectral resolution monitoring of the X-ray sky with ~20 times the sensitivity of the RXTE ASM, and enables multi-wavelength and multi-messenger studies on a continuous, rather than scanning basis. We include updated instrument designs resulting from the GSFC IDL run in November 2017. For the first time, the broad coverage provides simultaneous study of thermal components, non-thermal components, iron lines, and reflection features from a single platform for accreting black holes at all scales. The enormous collecting area allows detailed studies of the dense matter equation of state using both thermal emission from rotation-powered pulsars and harder emission from X-ray burst oscillations. The combination of the wide-field monitor and the sensitive pointed instruments enables observations of potential electromagnetic counterparts to LIGO/Virgo and neutrino events. Extragalactic science, such as constraining bulk metallicity of medium to high redshift clusters and nearby compact groups and unprecedented timing investigations of active galactic nuclei, is also obtained.

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Temperature trends with reduced impact of ocean air temperature

Temperature data 1900–2010 from meteorological stations across the world have been analyzed and it has been found that all land areas generally have two different valid temperature trends. Coastal stations and hill stations facing ocean winds are normally more warm-trended than the valley stations that are sheltered from dominant oceans winds.

Thus, we found that in any area with variation in the topography, we can divide the stations into the more warm trended ocean air-affected stations, and the more cold-trended ocean air-sheltered stations. We find that the distinction between ocean air-affected and ocean air-sheltered stations can be used to identify the influence of the oceans on land surface. We can then use this knowledge as a tool to better study climate variability on the land surface without the moderating effects of the ocean.

We find a lack of warming in the ocean air sheltered temperature data – with less impact of ocean temperature trends – after 1950. The lack of warming in the ocean air sheltered temperature trends after 1950 should be considered when evaluating the climatic effects of changes in the Earth’s atmospheric trace amounts of greenhouse gasses as well as variations in solar conditions.

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ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.185 SNIP 0.295
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.197 SNIP 0.514
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.149 SNIP 0.314
Scopus rating (2007): SJR 0.336 SNIP 0.563
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Scopus rating (2006): SJR 0.435 SNIP 0.83
The Dependence of the Peak Velocity of High-Speed Solar Wind Streams as Measured in the Ecliptic by ACE and the STEREO satellites on the Area and Co-Latitude of their Solar Source Coronal Holes

We study the properties of 115 coronal holes in the time-range from 2010/08 to 2017/03, the peak velocities of the corresponding high-speed streams as measured in the ecliptic at 1AU, and the corresponding changes of the Kp index as marker of their geo-effectiveness. We find that the peak velocities of high-speed streams depend strongly on both the areas and the co-latitudes of their solar source coronal holes with regard to the heliospheric latitude of the satellites. Therefore, the co-latitude of their source coronal hole is an important parameter for the prediction of the high-speed stream properties near the Earth. We derive the largest solar wind peak velocities normalized to the coronal hole areas for coronal holes located near the solar equator, and that they linearly decrease with increasing latitudes of the coronal holes. For coronal holes located at latitudes $\gtrsim 60^\circ$, they turn statistically to zero, indicating that the associated high-speed streams have a high chance to miss the Earth. Similar, the Kp index per coronal hole area is highest for the coronal holes located near the solar equator and strongly decreases with increasing latitudes of the coronal holes. We interpret these results as an effect of the three-dimensional propagation of high-speed streams in the heliosphere, i.e., high-speed streams arising from coronal holes near the solar equator propagate in direction towards and directly hit the Earth, whereas solar wind streams arising from coronal holes at higher solar latitudes only graze or even miss the Earth.

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Authors: Hofmeister, S. J. (Ekstern), Veronig, A. (Ekstern), Temmer, M. (Ekstern), Vennerstrøm, S. (Intern), Heber, B. (Ekstern), Vršnak, B. (Ekstern)
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The Influence of Stellar Spin on Ignition of Thermonuclear Runaways

Runaway thermonuclear burning of a layer of accumulated fuel on the surface of a compact star provides a brief but intense display of stellar nuclear processes. For neutron stars accreting from a binary companion, these events manifest as thermonuclear (type-I) X-ray bursts, and recur on typical timescales of hours to days. We measured the burst rate as a function of accretion rate, from seven neutron stars with known spin rates, using a burst sample accumulated over several decades. At the highest accretion rates, the burst rate is lower for faster spinning stars. The observations imply that fast (>400 Hz) rotation encourages stabilization of nuclear burning, suggesting a dynamical dependence of nuclear ignition on the spin rate. This dependence is unexpected, because faster rotation entails less shear between the surrounding accretion disk and the star. Large-scale circulation in the fuel layer, leading to enhanced mixing of the burst ashes into the fuel layer, may explain this behavior; further numerical simulations are required to confirm this.

General information

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Authors: Galloway, D. K. (Ekstern), In't Zand, J. J. M. (Ekstern), Chenevez, J. (Intern), Keek, L. (Ekstern), Sanchez-Fernandez, C. (Ekstern), Worpel, H. (Ekstern), Lampe, N. (Ekstern), Kuulkers, E. (Ekstern), Watts, A. (Ekstern), Ootes, L. (Ekstern)
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Scopus rating (2012): CiteScore 3.93
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The K2-138 System: A Near-resonant Chain of Five Sub-Neptune Planets Discovered by Citizen Scientists

K2-138 is a moderately bright (V = 12.2, K = 10.3) main-sequence K star observed in Campaign 12 of the NASA K2 mission. It hosts five small (1.6-3.3 R⊕) transiting planets in a compact architecture. The periods of the five planets are 2.35, 3.56, 5.40, 8.26, and 12.76 days, forming an unbroken chain of near 3:2 resonances. Although we do not detect the predicted 2-5 minute transit timing variations (TTVs) with the K2 timing precision, they may be observable by higher-
cadence observations with, for example, Spitzer or CHEOPS. The planets are amenable to mass measurement by
precision radial velocity measurements, and therefore K2-138 could represent a new benchmark system for comparing
radial velocity and TTV masses. K2-138 is the first exoplanet discovery by citizen scientists participating in the Exoplanet
Explorers project on the Zooniverse platform.

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Organisations: National Space Institute, University of Oxford, University of Manchester
Authors: Christiansen, J. L. (Ekstern), Crossfield, I. J. M. (Ekstern), Barentsen, G. (Ekstern), Lintott, C. J. (Ekstern),
Barclay, T. (Ekstern), Simmons, B. D. (Ekstern), Petigura, E. (Ekstern), Schlieder, J. E. (Ekstern), Dressing, C. D.
(Ekstern), Vanderburg, A. (Ekstern), Allen, C. (Ekstern), McMaster, A. (Ekstern), Miller, G. (Ekstern), Veldhuis, M.
(Ekstern), Wolfenbarger, Z. (Ekstern), Cox, B. (Ekstern), Zemiro, J. (Ekstern), Howard, A. W. (Ekstern), Livingston, J.
(Ekstern), Sinukoff, E. (Ekstern), Catron, T. (Ekstern), Grey, A. (Ekstern), Kusch, J. J. E. (Ekstern), Terentev, I. (Ekstern),
Vales, M. (Ekstern), Kristiansen, M. H. (Intern)
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Scopus rating (2016): CiteScore 5.26
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Scopus rating (2015): CiteScore 4.8
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.51
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.46
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
The THESEUS space mission concept: science case, design and expected performances

THESEUS is a space mission concept aimed at exploiting Gamma-Ray Bursts for investigating the early Universe and at providing a substantial advancement of multi-messenger and time-domain astrophysics. These goals will be achieved through a unique combination of instruments allowing GRB and X-ray transient detection over a broad field of view (more than 1sr) with 0.5–1 arcmin localization, an energy band extending from several MeV down to 0.3keV and high sensitivity to transient sources in the soft X-ray domain, as well as on-board prompt (few minutes) follow-up with a 0.7m class IR telescope with both imaging and spectroscopic capabilities. THESEUS will be perfectly suited for addressing the main open issues in cosmology such as, e.g., star formation rate and metallicity evolution of the inter-stellar and intra-galactic medium up to redshift 10, signatures of Pop III stars, sources and physics of re-ionization, and the faint end of the galaxy luminosity function. In addition, it will provide unprecedented capability to monitor the X-ray variable sky, thus detecting, localizing, and identifying the electromagnetic counterparts to sources of gravitational radiation, which may be routinely detected in the late ‘20s/early ‘30s by next generation facilities like aLIGO/ aVirgo, eLISA, KAGRA, and Einstein Telescope. THESEUS will also provide powerful synergies with the next generation of multi-wavelength observatories (e.g., LSST, ELT, SKA, CTA, ATHENA).
The Total Electron Content From InSAR and GNSS: A Midlatitude Study

The total electron content (TEC) measured from the interferometric synthetic aperture radar (InSAR) and from a dense network of global navigation satellite system (GNSS) receivers are used to assess the capability of InSAR to retrieve ionospheric information, when the tropospheric contribution to the interferometric phase is reasonably negligible. With this aim, we select three night-time case studies over Italy and investigate the correlation between TEC from advanced land observing satellite-phased array type L-band synthetic aperture radar (ALOS-PALSAR) and from the Rete Integrata Nazionale GPS (RING) network, the latter considered as the reference true ionospheric TEC. To retrieve the TEC variability from ALOS-PALSAR, we first investigate the correlation between the integral of the azimuth shifts and the interferometric phase in the absence of ground motions (e.g., earthquakes) and/or heavy rain events. If correlation exists (as in two out of three case studies under investigation), we can assume the tropospheric contribution to the interferometric phase as negligible and the TEC variability from L-band InSAR can be retrieved. For these two case studies, the comparison between the TEC from the InSAR images and from the RING network is quite encouraging as the correlation coefficient is $R \approx 0.67$ in the first case and $R \approx 0.83$ in the second case. This result highlights the potential to combine InSAR and GNSS experimental measurements to investigate small-scale spatial variability of TEC, in particular over regions scarcely covered by ground-based GNSS receivers.
Topographic Steering of Enhanced Ice Flow at the Bottleneck Between East and West Antarctica

Hypothesized drawdown of the East Antarctic Ice Sheet through the “bottleneck” zone between East and West Antarctica would have significant impacts for a large proportion of the Antarctic Ice Sheet. Earth observation satellite orbits and a sparseness of radio echo sounding data have restricted investigations of basal boundary controls on ice flow in this region until now. New airborne radio echo sounding surveys reveal complex topography of high relief beneath the southernmost Weddell/Ross ice divide, with three subglacial troughs connecting interior Antarctica to the Foundation and Patuxent Ice Streams and Siple Coast ice streams. These troughs route enhanced ice flow through the interior of Antarctica but limit potential drawdown of the East Antarctic Ice Sheet through the bottleneck zone. In a thinning or retreating scenario, these topographically controlled corridors of enhanced flow could however drive ice divide migration and increase mass discharge from interior West Antarctica to the Southern Ocean.

General information
State: Accepted/In press
Organisations: National Space Institute, Geodynamics, Northumbria University, Newcastle University, British Antarctic Survey, Norwegian Polar Institute, ESTEC
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Main Research Area: Technical/natural sciences

Publication information
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ISSN (Print): 0094-8276
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.429 SRJ 2.657
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.35 SRJ 2.819 SNIP 1.495
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.24 SNIP 1.728 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.573 SNIP 1.325
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.361 SNIP 1.248
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.262 SNIP 1.299
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.239 SNIP 1.257
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.261 SNIP 1.348
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.906 SNIP 1.285
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.087 SNIP 1.4
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.403 SNIP 1.292
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.337 SNIP 1.313
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.353 SNIP 1.163

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Source: FindIt
Source-ID: 2434266648
UBAT of UFFO/Lomonosov: The X-Ray Space Telescope to Observe Early Photons from Gamma-Ray Bursts

The Ultra-Fast Flash Observatory (UFFO) Burst Alert and Trigger Telescope (UBAT) has been designed and built for the localization of transient X-ray sources such as Gamma Ray Bursts (GRBs). As one of main instruments in the UFFO payload onboard the Lomonosov satellite (hereafter UFFO/Lomonosov), the UBAT’s roles are to monitor the X-ray sky, to rapidly locate and track transient sources, and to trigger the slewing of a UV/optical telescope, namely Slewing Mirror Telescope (SMT). The SMT, a pioneering application of rapid slewing mirror technology has a line of sight parallel to the UBAT, allowing us to measure the early UV/optical GRB counterpart and study the extremely early moments of GRB evolution. To detect X-rays, the UBAT utilizes a 191.1 cm² scintillation detector composed of Yttrium Oxyorthosilicate (YSO) crystals, Multi-Anode Photomultiplier Tubes (MAPMTs), and associated electronics. To estimate a direction vector of a GRB source in its field of view, it employs the well-known coded aperture mask technique. All functions are written for implementation on a field programmable gate array to enable fast triggering and to run the device’s imaging algorithms. The UFFO/Lomonosov satellite was launched on April 28, 2016, and is now collecting GRB observation data. In this study, we describe the UBAT’s design, fabrication, integration, and performance as a GRB X-ray trigger and localization telescope, both on the ground and in space.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics
Authors: Jeong, S. (Ekstern), Panasyuk, M. I. (Ekstern), Regiero, V. (Ekstern), Connell, P. (Ekstern), Kim, M. B. (Ekstern), Lee, J. (Ekstern), Rodrigo, J. M. (Ekstern), Ripa, J. (Ekstern), Eyles, C. (Ekstern), Lim, H. (Ekstern), Gaikov, G. (Ekstern), Jeong, H. (Ekstern), Leonov, V. (Ekstern), Chen, P. (Ekstern), Castro-Tirado, A. J. (Ekstern), Nam, J. W. (Ekstern), Svertilov, S. (Ekstern), Yashin, I. (Ekstern), Garipov, G. (Ekstern), Huang, M. A. (Ekstern), Huang, J. (Ekstern), Kim, J. E. (Ekstern), Liu, T. (Ekstern), Petrov, V. (Ekstern), Bogomolov, V. (Ekstern), Budtz-Jørgensen, C. (Intern), Park, I. H. (Ekstern), Brandt, S. (Intern)
Number of pages: 25
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
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Volume: 214
Issue number: 16
ISSN (Print): 0038-6308
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 2.518 SJR 3.262
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 6.45 SJR 2.891 SNIP 2.57
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.933 SNIP 2.797 CiteScore 5.97
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.265 SNIP 2.703 CiteScore 5.94
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.474 SNIP 2.342 CiteScore 4.88
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.189 SNIP 2.022 CiteScore 3.8
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.238 SNIP 1.825 CiteScore 4.23
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.223 SNIP 1.724
Web of Science (2010): Indexed yes
The payload of the UFFO (Ultra-Fast Flash Observatory)-pathfinder now onboard the Lomonosov spacecraft (hereafter UFFO/Lomonosov) is a dedicated instrument for the observation of GRBs. Its primary aim is to capture the rise phase of the optical light curve, one of the least known aspects of GRBs. Fast response measurements of the optical emission of GRB will be made by a Slewing Mirror Telescope (SMT), a key instrument of the payload, which will open a new frontier in transient studies by probing the early optical rise of GRBs with a response time in seconds for the first time. The SMT employs a rapidly slewing mirror to redirect the optical axis of the telescope to a GRB position prior determined by the UFFO Burst Alert Telescope (UBAT), the other onboard instrument, for the observation and imaging of X-rays.

UFFO/Lomonosov was launched successfully from Vostochny, Russia on April 28, 2016, and will begin GRB observations after completion of functional checks of the Lomonosov spacecraft. The concept of early GRB photon measurements with UFFO was reported in 2012. In this article, we will report in detail the first mission, UFFO/Lomonosov, for the rapid response to GRB observations.
Uncertainty Reduction of Arctic Sea Ice Freeboard from CryoSat-2 Interferometric Mode

Abstract A study by Armitage and Davidson (2014) has shown that the extra information from the CryoSat-2 (CS2) SARIn mode increases the number of valid sea surface height estimates which are usually discarded in the SAR mode due to snagging of the radar signal. As the number of valid detected leads increases, the uncertainty of the freeboard heights decreases. In this study, the freeboard heights estimated by processing CS2 SARIn level 1b waveforms are validated using the information from airborne laser and radar altimetry as well as snow radar measurements acquired during the CryoVEx 2012 and Operation IceBridge 2012 campaigns, respectively. The possible reduction in the random freeboard uncertainty is investigated comparing two scenarios, i.e. a SAR-like and a SARIn acquisition. A very good agreement is found between average airborne and satellite radar freeboards although, at the CS2 footprint scale, they do not show along-track spatial correlation. It is observed that using the extra phase information, CS2 is able to detect leads up to 2300 m off-nadir. A reduction in the total random freeboard uncertainty of ~ 40% is observed by taking advantage of the CS2 interferometric capabilities, which enable to include ~ 35% of the waveforms discarded in the SAR-like scenario.

General information
State: Accepted/In press
Organisations: National Space Institute, Geodynamics, ESRIN - ESA Centre for Earth Observation
Authors: Di Bella, A. (Intern), Skourup, H. (Intern), Bouffard, J. (Ekstern), Parrinello, T. (Ekstern)
Number of pages: 31
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Advances in Space Research
ISSN (Print): 0273-1177
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.067 SJR 0.569
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.63 SJR 0.575 SNIP 1.196
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.584 SNIP 1.322 CiteScore 1.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.709 SNIP 1.271 CiteScore 1.61
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.657 SNIP 1.268 CiteScore 1.56
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.575 SNIP 1.047 CiteScore 1.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.575 SNIP 0.924 CiteScore 1.23
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.626 SNIP 0.854
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.653 SNIP 0.914
Web of Science (2009): Indexed yes
Understanding the spectral and timing behaviour of a newly discovered transient X-ray pulsar Swift J0243.6+6124

We present the results obtained from timing and spectral studies of the newly discovered accreting X-ray binary pulsar Swift J0243.6+6124 using Nuclear Spectroscopy Telescope Array observation in 2017 October at a flux level of ~280 mCrab. Pulsations at 9.854 23(5) s were detected in the X-ray light curves of the pulsar. Pulse profiles of the pulsar were found to be strongly energy dependent. A broad profile at lower energies was found to evolve into a double-peaked profile in ≥ 30 keV. The 3-79 keV continuum spectrum of the pulsar was well described with a negative and positive exponential cutoff or high-energy cutoff power-law models modified with a hot blackbody at ~3 keV. An iron emission line was also detected at 6.4 keV in the source spectrum. We did not find any signature of cyclotron absorption line in our study. Results obtained from phase-resolved and time-resolved spectroscopy are discussed in the paper.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Physical Research Laboratory
Authors: Jaisawal, G. K. (Intern), Naik, S. (Ekstern), Chenevez, J. (Intern)
Pages: 4432-4437
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Monthly Notices of the Royal Astronomical Society
Volume: 474
Issue number: 4
ISSN (Print): 0035-8711
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 2.346 SNIP 0.904
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.09 SJR 2.388 SNIP 1.134
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.701 SNIP 1.165 CiteScore 4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.23 SNIP 1.322 CiteScore 4.79
Unmanned aerial vehicle observations of water surface elevation and bathymetry in the cenotes and lagoons of the Yucatan Peninsula, Mexico

Observations of water surface elevation (WSE) and bathymetry of the lagoons and cenotes of the Yucatán Peninsula (YP) in southeast Mexico are of hydrogeological interest. Observations of WSE (orthometric water height above mean sea level, amsl) are required to inform hydrological models, to estimate hydraulic gradients and groundwater flow directions. Measurements of bathymetry and water depth (elevation of the water surface above the bed of the water body) improve current knowledge on how lagoons and cenotes connect through the complicated submerged cave systems and the diffuse flow in the rock matrix. A novel approach is described that uses unmanned aerial vehicles (UAVs) to monitor WSE and bathymetry of the inland water bodies on the YP. UAV-borne WSE observations were retrieved using a radar and a global navigation satellite system on-board a multi-copter platform. Water depth was measured using a tethered floating sonar controlled by the UAV. This sonar provides depth measurements also in deep and turbid water. Bathymetry (wet-bed elevation amsl) can be computed by subtracting water depth from WSE. Accuracy of the WSE measurements is better than 5–7 cm and accuracy of the water depth measurements is estimated to be ~3.8% of the actual water depth. The technology provided accurate measurements of WSE and bathymetry in both wetlands (lagoons) and cenotes. UAV-
borne technology is shown to be a more flexible and lower cost alternative to manned aircrafts. UAVs allow monitoring of remote areas located in the jungle of the YP, which are difficult to access by human operators.
GCN CIRCULAR 21672, LIGO/Virgo G298048: INTEGRAL pointed follow-up observations

INTEGRAL is an observatory with multiple instruments: a gamma-ray spectrometer (20 keV - 8 MeV, SPI), an imager (15 keV - 2 MeV, IBIS), an X-ray monitor (3 - 25 keV, JEM-X), and an optical monitor (V band, OMC). Our group requested and obtained follow-up observations of the LIGO/Virgo candidate NS merger G298048 (GCN 21505, 21506).

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Geneva, CEA Saclay, IRAP, National Institute for Astrophysics, Institute for Space Research, European Space Agency, Max-Planck-Institut für extraterrestrische Physik, University College Dublin, Russian Academy of Sciences
Authors: Savchenko, V. (Ekstern), Ferrigno, C. (Ekstern), Kuulkers, E. (Ekstern), Bozzo, E. (Ekstern), Mereghetti, S. (Ekstern), Courvoisier, T. J. (Ekstern), Chenevez, J. (Intern), Brandt, S. (Intern), Diehl, R. (Ekstern), Hanlon, L. (Ekstern), Laurent, P. (Ekstern), Gotz, D. (Ekstern), Roques, J. (Ekstern), Jourdain, E. (Ekstern), Ubertini, P. (Ekstern), Bazzano, A. (Ekstern), Rodi, J. (Ekstern), Lutovinov, A. (Ekstern), Sunyaev, R. (Ekstern)
Publication date: 8 Dec 2017

Publication information
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Last modified date: 24/08/2017
Main Research Area: Technical/natural sciences
Electronic versions:
GCN_Circular_21672.pdf
Links:
https://gcn.gsfc.nasa.gov/gcn3/21672.gcn3

Relations
Press / Media items:
Science: Neutronstjerners sammenstød er årets videnskabelige gennembrud
Source: PublicationPreSubmission
Source-ID: 138657795
Publication: Research › Internet publication – Annual report year: 2017

GCN CIRCULAR 21507, LIGO/Virgo G298048: INTEGRAL detection of a prompt gamma-ray counterpart

We investigated serendipitous INTEGRAL observations carried out at the time of the LIGO/Virgo burst candidate G298048. The satellite was covering a fraction of the probability of the LIGO-Virgo localization. The best sensitivity depends on the source location. We investigated the SPI-ACS light curves between -30 and +30 s from the trigger time (2017-08-17 12:41:04 UTC, T0) on temporal scales from 0.1 to 100s. In the SPI-ACS data, we detect a short and relatively weak transient with S/N of 3 at T0, with an S/N larger than 3 coincident with the GBM trigger (Connaughton 2017, GCN 21506). Further analysis is ongoing, and will be reported in the coming circulars.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Geneva, CEA Saclay, IRAP, National Institute for Astrophysics, Institute for Space Research, European Space Agency, Max-Planck-Institut für extraterrestrische Physik, University College Dublin, Russian Academy of Sciences
Authors: Savchenko, V. (Ekstern), Mereghetti, S. (Ekstern), Ferrigno, C. (Ekstern), Kuulkers, E. (Ekstern), Bozzo, E. (Ekstern), Courvoisier, T. J. (Ekstern), Brandt, S. (Intern), Diehl, R. (Ekstern), Hanlon, L. (Ekstern), Laurent, P. (Ekstern), Lutovinov, A. (Ekstern), Ubertini, P. (Ekstern)
Publication date: 17 Aug 2017

Publication information
Type: Observation Report Circulars
Source/Publisher: GCN Circulars Archive
Last modified date: 17/08/2017
Main Research Area: Technical/natural sciences
Electronic versions:
GCN_21507.pdf
We investigated serendipitous INTEGRAL observations carried out at the time of the LIGO/Virgo burst candidate G297595. The satellite was pointing at RA=240.554 Dec=-55.181, far from the high-probability area of LIGO localization. For the full LIGO 90% confidence region the best upper limit is set by the anti-coincidence shield of the spectrometer on board of INTEGRAL (SPI/ACS). The localization of G297595 is close to optimal for SPI-ACS observation.

> Oh-my-God-partiklen
Detekteret. Nogle partikler fra det ydre rum har så høj energi, at de egentlig ikke burde være her. De er kosmologiens svar på humlebien, der ikke kan flyve, og fysikerne leder stadig efter en god forklaring

Det varer ved
Time-resolved Polarimetry of the Superluminous SN 2015bn with the Nordic Optical Telescope

We present imaging polarimetry of the superluminous supernova SN 2015bn, obtained over nine epochs between -20 and +46 days with the Nordic Optical Telescope. This was a nearby, slowly evolving Type I superluminous supernova that has been studied extensively and for which two epochs of spectropolarimetry are also available. Based on field stars, we determine the interstellar polarization in the Galaxy to be negligible. The polarization of SN 2015bn shows a statistically significant increase during the last epochs, confirming previous findings. Our well-sampled imaging polarimetry series allows us to determine that this increase (from $\sim$0.54% to $\geq$1.10%) coincides in time with rapid changes that took place in the optical spectrum. We conclude that the supernova underwent a "phase transition" at around +20 days, when the photospheric emission shifted from an outer layer, dominated by natal C and O, to a more aspherical inner core, dominated by freshly nucleosynthesized material. This two-layered model might account for the characteristic appearance and properties of Type I superluminous supernovae.
Klimaforskningen har et troværdighedsproblem
Videnskabelige procedurer, der får takten i den globale opvarming til at ændre sig efter behov, illustrerer med al tydelighed, at der er brug for mere åbenhed i klimaforskningen.

General information
State: Published
Organisations: National Space Institute, Innovation and Research-based consultancy
Authors: Lansner, F. (Ekstern), Pedersen, J. O. P. (Intern)
Number of pages: 4
Publication date: 19 Feb 2017

 Publication information
Newspaper: Boersen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Feature article – Annual report year: 2017

En verden uden ende

General information
State: Published
Varmt og fredeligt
Verdensvejret 2016. En historisk kraftig El Niño fik varmen op fra oceanet, men vi slap for de storeulykker.

En jetstrøm i Jordens indre
Magnetfelt. 3000 kilometer under Jordens overflade bevæger en tung, varm strøm af metal sig rundt. Strømme i Jordens indre er med til at holde liv i det magnetfelt, som beskytter Jorden mod Solen.
**Stormvejr i rummet**


**General information**

State: Published
Organisations: National Space Institute, Innovation and Research-based consultancy
Authors: Pedersen, J. O. P. (Intern)
Pages: 11
Publication date: 20 Jan 2017

**Publication information**

Pages (from-to): 11
Newspaper: Weekendavisen
Volume: 3
Ratings:
- ISI indexed (2013): ISI indexed no
- ISI indexed (2012): ISI indexed no
- ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2017

**GCN CIRCULAR 20366, LIGO/Virgo G268556: INTEGRAL search of temporally coincident prompt hard X-ray emission**

We investigated serendipitous INTEGRAL observations carried out at the time of the LIGO/Virgo G268556. The satellite was pointing at RA = 00:04:02 Dec = +67:14:38, away from the high-probability region, derived from the LIGOBayestar pipeline.

**General information**

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Geneva, CEA Saclay, IRAP, National Institute for Astrophysics, Institute for Space Research, European Space Agency, Max-Planck-Institut für extraterrestrische Physik, University College Dublin, Russian Academy of Sciences
Authors: Savchenko, V. (Ekstern), Ferrigno, C. (Ekstern), Mereghetti, S. (Ekstern), Kuulkers, E. (Ekstern), Bazzano, A. (Ekstern), Bozzo, E. (Ekstern), Courvoisier, T. J. (Ekstern), Brandt, S. (Intern), Diehl, R. (Ekstern), Hanlon, L. (Ekstern), Laurent, P. (Ekstern), Lutovinov, A. (Ekstern), Roques, J. (Ekstern), Sunyaev, R. (Ekstern), Ubertini, P. (Ekstern)
Publication date: 4 Jan 2017

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Electronic versions:
- GCN_20366.pdf

**1872**

Der er almindelige og sjældne og næsten usandsynlige stormfloder. Vandstandene i den vestlige Østersø nåede nærmest vanvittige højder under stormfloden den 12.-13. november 1872 og forårsagede oversvømmelser langs mange danske kyster. Selvom det er længe siden, og der gennem tiden er skrevet meget om netop denne stormflod, har den stadig stor betydning. For hvad vil en tilsvarende stormflod have af konsekvenser i dag, og hvor stor er sandsynligheden for, at den indtræffer? Hvis stormflodens sandsynlighed ganges med dens konsekvenser, kan vi tale om en oversvømmelsesrisiko; en risiko, der kan opgøres økonomisk ud fra de skader, den forvolder tillige med fx tab af menneskeliv, som vi ikke i Danmark har tradition for at værdisætte. Når vi som kystsamfund, lokalt eller nationalt, vælger at beskytte os mod fremtidige stormfloder til et vist niveau, træffer vi også et valg om "at løbe en risiko". Vi oplevede det under Egon, under Bodil, 1.-2. November 2006 og ved andre lejligheder, at huse og heleboligkvarterer blev oversvømmet. Det vil ske igen. Mens vandstandene under de nævnte hændelser tilsyneladende var ekstreme i flere af de berørte områder, viser historien også,
at skaderne selvfølgelig langt hen ad vejen forårsages af, at vi har valgt at bo og leve i lavtliggende kystområder. I forhold til enkeltejendomme er det måske de almindelige og halvsjældne stormfloder, der skal ydes beskyttelse imod, mens der i forhold til større byområder og infrastruktur som motorveje, jernbaner og metrolinjer bør gøres helt andre overvejelser om konsekvenserne af de næsten usandsynligestormfloder. Og hvor usandsynlig eller sjælden var 1872 stormfloden egentlig? Me dudgangspunkt i 1872 stormfloden diskuteres, hvordan vi – ikke mindst set i lyset af klimaændringer og havvågne, kan øge videngrundlaget for at for de næste næstenusandsynlige hændelser og håndtere denne udfordring.
A comparison of the ground magnetic responses during the 2013 and 2015 St. Patrick's Day geomagnetic storms

The magnetosphere-ionosphere system response to extreme solar wind driving conditions depends on both the driving conditions and ionospheric conductivity. Since extreme driving conditions are rare, there are few opportunities to control for one parameter or another. The 17 March 2013 and 17 March 2015 geomagnetic storms driven by coronal mass ejections (CME) provide one such opportunity. The two events occur during the same solar illumination conditions; in particular, both occur near equinox on the same day of the year leading to similar ionospheric conductivity profiles. Moreover, both CMEs arrive at the same time of day leading to similar observing conditions (i.e., ground stations at similar magnetic local time in both events). We examine the ground magnetic response to each CME at a range of latitudes and in both the Northern and Southern Hemispheres, remote sensing several current systems. There are dramatic differences between the intensity, onset time and occurrence, duration, and spatial structure of the current systems in each case. For example, differing solar wind driving conditions lead to interhemispheric asymmetries in the high-latitude ground magnetic response during the 2015 storm; these asymmetries are not present in the 2013 storm.

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Organisations: National Space Institute, Geomagnetism, Virginia Tech
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A continuous hyperspatial monitoring system of evapotranspiration and gross primary productivity from Unmanned Aerial Systems

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Advancing Sentinel-1 use in Coastal Climate Impact Assessments and Adaptation – A Case Study from the Danish North Sea

Low-lying coastal communities face increasing challenges from rise in sea level, more extreme storm surge levels and floods. In addition, changing groundwater levels and precipitation patterns may further exacerbate the water-related impacts of climate change on society. Approximately 40,000 km² of Europe’s North Sea region is already flood prone. Storm surges pose a real and substantial risk to this area, especially the densely populated areas. Climate and sea level research seek to provide robust regional projections of change and to address uncertainties and errors inherent in climate models. It is a challenge for coastal communities to transform this information in order to provide for local impact assessments and to implement adaptive measures. To this end, information about potential subsidence, its magnitudes and causes is important: subsidence may adversely affect the probability, extent and depths of future floods, and knowledge about subsidence will serve to reduce the total uncertainty about the anticipated climate impacts. If included in an ‘impact integration system’, reliable subsidence mapping may serve to deal with possible future outcomes in local management and planning.

The paper presents subsidence mapping using Sentinel-1 (S-1) data over a case study area on the Danish North Sea coast, and it addresses challenges to validate and reference results to the national datum levelling network. For this, repeated precision levelling (2006-2015) and ERS2 (1995-2001) data are used. In addition, the Sentinel-1 time series for selected scatter points are compared to groundwater level data from 10 wells and sea level data from two tide gauges to analyse their effect in the S-1 data. Likewise, the variations in the ocean water level (from tidal excursion and positive/negative surges etc.) and in the groundwater table (from ocean level and gradient, wave run-up, precipitation etc.) may in an initial evaluation suggest time-dependent and water-related mechanisms for the inferred subsidence encountered. These variations may thus serve to detail our understanding of S-1 results, and they may be indicative of system responses to subsidence under climate change scenarios. Results are put into perspective in relation to additional S-1 studies carried out by the authors as well as to literature to outline perspectives of further work to relate and apply S-1 data to improve local coastal climate impact assessments and adaptation.

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Advancing Sentinel-1 use in Coastal Climate Impact Assessments and Adaptation – A Case Study from the Danish North Sea

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A long look at MCG-5-23-16 with NuSTAR. I. relativistic reflection and coronal properties

MCG-5-23-16 was targeted in early 2015 with a half mega-second observing campaign using NuSTAR. Here we present the spectral analysis of these data sets along with an earlier observation and study the relativistic reflection and the primary coronal source. The data show strong reflection features in the form of both narrow and broad iron lines plus a Compton reflection hump. A cutoff energy is significantly detected in all exposures. The shape of the reflection spectrum does not change in the two years spanned by the observations, suggesting a stable geometry. A strong positive correlation is found between the cutoff energy and both the hard X-ray flux and spectral index. The measurements imply that the coronal plasma is not at the runaway electron-positron pair limit, and instead contains mostly electrons. The observed variability in the coronal properties is driven by a variable optical depth. A constant heating-to-cooling ratio is measured, implying that there is a feedback mechanism in which a significant fraction of the photons cooling the corona are due to reprocessed hard X-rays.
A Monte Carlo simulation of scattering reduction in spectral x-ray computed tomography

In X-ray computed tomography (CT), scattered radiation plays an important role in the accurate reconstruction of the inspected object, leading to a loss of contrast between the different materials in the reconstruction volume and cupping artifacts in the images. We present a Monte Carlo simulation tool for spectral X-ray CT to predict the scattered radiation generated by complex samples. An experimental setup is presented to isolate the energy distribution of scattered radiation. Spectral CT is a novel technique implementing photon-counting detectors able to discriminate the energy of incoming photons, enabling spectral analysis of X-ray images. This technique is useful to extract efficiently more information on energy dependent quantities (e.g. mass attenuations coefficients) and study matter interactions (e.g. X-ray scattering, photoelectric absorption, etc...). Having a good knowledge of the spectral distribution of the scattered X-rays is fundamental to establish methods attempting to correct for it. The simulations are validated by real measurements using a CdTe spectral resolving detector (Multix ME-100). We observed the effect of the scattered radiation on the image reconstruction, becoming relevant in the energy range where the Compton events are dominant (i.e. above 50keV).

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Analyses of electron runaway in front of the negative streamer channel

X- and γ-ray emissions, observed in correlation with negative leaders of lightning and long sparks of high-voltage laboratory experiments, are conventionally connected with the bremsstrahlung of high-energy runaway electrons (REs). Here we extend a focusing mechanism, analyzed in our previous paper, which allows the electric field to reach magnitudes, required for a generation of significant RE fluxes and associated bremsstrahlung, when the ionization wave propagates in a narrow, ionized channel created by a previous streamer. Under such conditions we compute the production rate of REs per unit streamer length as a function of the streamer velocity and predict that, once a streamer is formed with the electric field capable of producing REs ahead of the streamer front, the ionization induced by the REs is capable of creating an ionized channel that allows for self-sustained propagation of the RE-emitting ionization wave independent of the initial electron concentration. Thus, the streamer coronas of the leaders are probable sources of REs producing the observed high-energy radiation. To prove these predictions, new simulations are planned, which would show explicitly that the pre-ionization in front of the channel via REs will lead to the ionization wave propagation self-consistent with REs generation.

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An Assessment of State-of-the-Art Mean Sea Surface and Geoid Models of the Arctic Ocean: Implications for Sea Ice Freeboard Retrieval

State-of-the-art Arctic Ocean mean sea surface (MSS) models and global geoid models (GGMs) are used to support sea ice freeboard estimation from satellite altimeters, as well as in oceanographic studies such as mapping sea level anomalies and mean dynamic ocean topography. However, errors in a given model in the high frequency domain, primarily due to unresolved gravity features, can result in errors in the estimated along-track freeboard. These errors are exacerbated in areas with a sparse lead distribution in consolidated ice pack conditions. Additionally, model errors can impact ocean geostrophic currents, derived from satellite altimeter data, while remaining biases in these models may impact longer-term, multi-sensor oceanographic time-series of sea level change in the Arctic. This study focuses on an assessment of five state-of-the-art Arctic MSS models (UCL13/04, DTU15/13/10) and a commonly used GGM (EGM2008). We describe errors due to unresolved gravity features, inter-satellite biases, and remaining satellite orbit errors, and their impact on the derivation of sea ice freeboard. The latest MSS models, incorporating CryoSat-2 sea surface height measurements, show improved definition of gravity features, such as the Gakkel Ridge. The standard deviation between models ranges 0.03-0.25 m. The impact of remaining MSS/GGM errors on freeboard retrieval can reach several decimeters in parts of the Arctic. While the maximum observed freeboard difference found in the central
Arctic was 0.59 m (UCL13 MSS minus EGM2008 GGM), the standard deviation in freeboard differences is 0.03-0.06 m.

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NGC 1448 is one of the nearest luminous galaxies (L_{8-1000μm} >10^9 L_☉) to ours (z = 0.00390), and yet the active galactic nucleus (AGN) it hosts was only recently discovered, in 2009. In this paper, we present an analysis of the nuclear source across three wavebands: mid-infrared (MIR) continuum, optical, and X-rays. We observed the source with the Nuclear Spectroscopic Telescope Array (NuSTAR), and combined these data with archival Chandra data to perform broadband X-ray spectral fitting (≈0.5-40 keV) of the AGN for the first time. Our X-ray spectral analysis reveals that the AGN is buried under a Compton-thick (CT) column of obscuring gas along our line of sight, with a column density of N_{H}(los) ≥ 2.5 × 10^{24} cm^{-2}. The best-fitting torus models measured an intrinsic 2-10 keV luminosity of L_{2-10 keV} = (3.5-7.6) ×10^{40} erg s^{-1}, making NGC 1448 one of the lowest luminosity CTAGNs known. In addition to the NuSTAR observation, we also performed optical spectroscopy for the nucleus in this edge-on galaxy using the European Southern Observatory New Technology Telescope. We re-classify the optical nuclear spectrum as a Seyfert on the basis of the Baldwin-Phillips-Terlevich diagnostic diagrams, thus identifying the AGN at optical wavelengths for the first time. We also present high spatial resolution MIR observations of NGC 1448 with Gemini/T-ReCS, in which a compact nucleus is clearly detected. The absorption-corrected 2-10 keV luminosity measured from our X-ray spectral analysis agrees with that predicted from the optical [O iii]λ5007 Å emission line and the MIR 12 μm continuum, further supporting the CT nature of the AGN.
A new phase in the production of quality-controlled sea level data
Sea level is an essential climate variable (ECV) that has a direct effect on many people through inundations of coastal
areas, and it is also a clear indicator of climate changes due to external forcing factors and internal climate variability.
Regional patterns of sea level change inform us on ocean circulation variations in response to natural climate modes such
as El Ninõ and the Pacific Decadal Oscillation, and anthropogenic forcing. Comparing numerical climate models to a
consistent set of observations enables us to assess the performance of these models and help us to understand and
predict these phenomena, and thereby alleviate some of the environmental conditions associated with them. All such
studies rely on the existence of long-term consistent high-accuracy datasets of sea level. The Climate Change Initiative
(CCI) of the European Space Agency was established in 2010 to provide improved time series of some ECVs, including
sea level, with the purpose of providing such data openly to all to enable the widest possible utilisation of such data. Now
in its second phase, the Sea Level CCI project (SL-cci) merges data from nine different altimeter missions in a clear,
consistent and well-documented manner, selecting the most appropriate satellite orbits and geophysical corrections in
order to further reduce the error budget. This paper summarises the corrections required, the provenance of corrections
and the evaluation of options that have been adopted for the recently released v2.0 dataset (https://doi.org/10.5270/esasea-level-cci-1993-2015-v-2.0-201612). This information enables scientists and other users to clearly understand which
corrections have been applied and their effects on the sea level dataset. The overall result of these changes is that the
rate of rise of global mean sea level (GMSL) still equates to ∼3.2mmyr-1 during 1992-2015, but there is now greater
confidence in this result as the errors associated with several of the corrections have been reduced. Compared with v1.1
of the SL-cci dataset, the new rate of Sea level is an essential climate variable (ECV) that has a direct effect on many
people through inundations of coastal areas, and it is also a clear indicator of climate changes due to external forcing
factors and internal climate variability. Regional patterns of sea level change inform us on ocean circulation variations in
response to natural climate modes such as El Ninõ and the Pacific Decadal Oscillation, and anthropogenic forcing.
Comparing numerical climate models to a consistent set of observations enables us to assess the performance of these
models and help us to understand and predict these phenomena, and thereby alleviate some of the environmental
conditions associated with them. All such studies rely on the existence of long-term consistent high-accuracy datasets of
sea level. The Climate Change Initiative (CCI) of the European Space Agency was established in 2010 to provide
improved time series of some ECVs, including sea level, with the purpose of providing such data openly to all to enable
the widest possible utilisation of such data. Now in its second phase, the Sea Level CCI project (SL-cci) merges data from
nine different altimeter missions in a clear, consistent and well-documented manner, selecting the most appropriate
satellite orbits and geophysical corrections in order to further reduce the error budget. This paper summarises the
corrections required, the provenance of corrections and the evaluation of options that have been adopted for the recently
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scientists and other users to clearly understand which corrections have been applied and their effects on the sea level
dataset. The overall result of these changes is that the rate of rise of global mean sea level (GMSL) still equates to
∼3.2mmyr-1 during 1992-2015, but there is now greater confidence in this result as the errors associated with several of
the corrections have been reduced. Compared with v1.1 of the SL-cci dataset, the new rate of Sea level is an essential
climate variable (ECV) that has a direct effect on many people through inundations of coastal areas, and it is also a clear
indicator of climate changes due to external forcing factors and internal climate variability. Regional patterns of sea level
change inform us on ocean circulation variations in response to natural climate modes such as El Ninõ and the Pacific
Decadal Oscillation, and anthropogenic forcing. Comparing numerical climate models to a consistent set of observations
enables us to assess the performance of these models and help us to understand and predict these phenomena, and
thereby alleviate some of the environmental conditions associated with them. All such studies rely on the existence of
long-term consistent high-accuracy datasets of sea level. The Climate Change Initiative (CCI) of the European Space
Agency was established in 2010 to provide improved time series of some ECVs, including sea level, with the purpose of
providing such data openly to all to enable the widest possible utilisation of such data. Now in its second phase, the Sea
Level CCI project (SL-cci) merges data from nine different altimeter missions in a clear, consistent and well-documented
manner, selecting the most appropriate satellite orbits and geophysical corrections in order to further reduce the error
budget. This paper summarises the corrections required, the provenance of corrections and the evaluation of options that
have been adopted for the recently released v2.0 dataset (https://doi.org/10.5270/esa-sea-level-cci-1993-2015-v-2.0201612). This information enables scientists and other users to clearly understand which corrections have been applied
and their effects on the sea level dataset. The overall result of these changes is that the rate of rise of global mean sea
level (GMSL) still equates to ∼3.2mmyr-1 during 1992-2015, but there is now greater confidence in this result as the errors
associated with several of the corrections have been reduced. Compared with v1.1 of the SL-cci dataset, the new rate of
change is 0.2mmyr-1 less during 1993 to 2001 and 0.2mmyr-1 higher during 2002 to 2014. Application of new correction
models brought a reduction of altimeter crossover variances for most corrections.
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M. (Ekstern), Rudenko, S. (Ekstern), Carrère, L. (Ekstern), Nilo Garciá, P. (Ekstern), Cipollini, P. (Ekstern), Andersen, O.
B. (Intern), Poisson, J. C. (Ekstern), Mbajon Njiche, S. (Ekstern), Cazenave, A. (Ekstern), Benveniste, J. (Ekstern)
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Annual variations in GPS-measured vertical displacements near Upernavik Isstrøm (Greenland) and contributions from surface mass loading: Annual GPS Verticals in Greenland

In response to present-day ice mass loss on and near the Greenland Ice Sheet, steady crustal uplifts have been observed from the network of Global Positioning System (GPS) stations mounted on bedrock. In addition to the secular uplift trends, the GPS time series also show prominent annual variability. Here we examine the annual changes of the vertical displacements measured at two GPS stations (SRMP and UPVK) near Upernavik Isstrøm in western Greenland. We model elastic loading displacements due to various surface mass loading including three non-ice components: atmospheric pressure, ocean bottom pressure, continental water storage, and one ice component, i.e., surface mass balance (SMB). We find that the contribution from atmospheric pressure changes can explain 46% and 78% of the annual amplitude observed in the GPS verticals at SRMP and UPVK, respectively. We also show that removing the predicted loading displacements due to SMB adversely increases the annual variance of the GPS residuals. However, using the GPS data alone, we cannot identify the exact cause(s) of this discrepancy because the annual loading displacements are sensitive to the SMB changes from over 85% of the ice sheet area. Alternatively, by differencing vertical displacements between the two stations, we find a good agreement between the modeled differential SMB loading displacements and the GPS residuals after removing non-ice components. Our study highlights the necessity of correcting for non-ice loading contributions in the GPS measurements of crustal deformation to infer ice mass changes in Greenland at annual periods.
Application of CryoSat-2 altimetry data for river analysis and modelling

Availability of in situ river monitoring data, especially of data shared across boundaries, is decreasing, despite growing challenges for water resource management across the entire globe. This is especially valid for the case study of this work, the Brahmaputra Basin in South Asia. Commonly, satellite altimeters are used in various ways to provide information about such river basins. Most missions provide virtual station time series of water levels at locations where their repeat orbits cross rivers. CryoSat-2 is equipped with a new type of altimeter, providing estimates of the actual ground location seen in the reflected signal. It also uses a drifting orbit, challenging conventional ways of processing altimetry data to river water levels and their incorporation in hydrologic–hydrodynamic models. However, CryoSat-2 altimetry data provides an unprecedentedly high spatial resolution. This paper suggests a procedure to (i) filter CryoSat-2 observations over rivers to extract water-level profiles along the river, and (ii) use this information in combination with a hydrologic–hydrodynamic model to fit the simulated water levels with an accuracy that cannot be reached using information from globally available digital elevation models (DEMs) such as from the Shuttle Radar Topography Mission (SRTM) only. The filtering was done based on dynamic river masks extracted from Landsat imagery, providing spatial and temporal resolutions high enough to map the braided river channels and their dynamic morphology. This allowed extraction of river water levels over previously unmonitored narrow stretches of the river. In the Assam Valley section of the Brahmaputra River, CryoSat-2 data and Envisat virtual station data were combined to calibrate cross sections in a 1-D hydrodynamic model of the river. The hydrologic–hydrodynamic model setup and calibration are almost exclusively based on openly available remote sensing data and other global data sources, ensuring transferability of the developed methods. They provide an opportunity to achieve forecasts of both discharge and water levels in a poorly gauged river system.

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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.22 SJR 2.361 SNIP 1.656
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.209 SNIP 1.494 CiteScore 3.74
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.141 SNIP 1.628 CiteScore 3.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.872 SNIP 1.521 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Application of Low-Cost UASs and Digital Photogrammetry for High-Resolution Snow Depth Mapping in the Arctic

The repeat acquisition of high-resolution snow depth measurements has important research and civil applications in the Arctic. Currently the surveying methods for capturing the high spatial and temporal variability of the snowpack are expensive, in particular for small areal extents. An alternative methodology based on Unmanned Aerial Systems (UASs) and digital photogrammetry was tested over varying surveying conditions in the Arctic employing two diverse and low-cost UAS-camera combinations (500 and 1700 USD, respectively). Six areas, two in Svalbard and four in Greenland, were mapped covering from 1386 to 38,410 m². The sites presented diverse snow surface types, underlying topography and light conditions in order to test the method under potentially limiting conditions. The resulting snow depth maps achieved spatial resolutions between 0.06 and 0.09 m. The average difference between UAS-estimated and measured snow depth, checked with conventional snow probing, ranged from 0.015 to 0.16 m. The impact of image pre-processing was explored, improving point cloud density and accuracy for different image qualities and snow/light conditions. Our UAS photogrammetry results are expected to be scalable to larger areal extents. While further validation is needed, with the inclusion of extra validation points, the study showcases the potential of this cost-effective methodology for high-resolution monitoring of snow dynamics in the Arctic and beyond.

General information

State: Published
Organisations: Department of Civil Engineering, ARTEK, Section for Arctic Engineering and Sustainable Solutions, National Space Institute, Geodynamics, Technical University of Denmark, University of Tasmania
Authors: Cimoli, E. (Ekstern), Marcer, M. (Ekstern), Vandecrux, B. R. M. (Intern), Bøggild, C. E. (Intern), Williams, G. (Ekstern), Simonsen, S. B. (Intern)
Number of pages: 29
Publication date: 2017
Main Research Area: Technical/natural sciences
Building upon decades of experience with deformation monitoring from repeated precision leveling and GNSS measurements as well as more recent time series analyses of ERS, Envisat, and Sentinel-1 imagery, we are now working towards a nationwide mapping using Sentinel-1 Interferometric Wide Swath (IWS) mode data. The mission’s high spatio-temporal resolution yields multiple new potentials, one of which is the focus of this work: the establishment of an operational service for a nationwide monitoring of vertical land deformations in Denmark.

We present deformation rates over selected test sites, obtained by applying Persistent Scatterer Interferometry to nearly two years of Sentinel-1 IWS data. They clearly demonstrate the potential in using such observations to identify areas undergoing rapid changes, so-called hotspots. Close collaborations with end-users show that the high-resolution
information is relevant for, e.g., climate change adaptation and for optimizing renovation works of subsurface pipelines. Other relevant end-users represent road authorities, insurance companies, local authorities, etc. A nationwide mapping therefore is associated with great potentials for optimizing processes in both the public and private sectors. This will inevitably lead to significant economic savings.

The test study makes up part of the foundation for establishing a nationwide service. As such, the results over the test sites will be presented to a broad range of end-users to identify their needs for the full-scale, technical solution. Furthermore, we investigate how to optimally exploit our network of in-situ measurements as well as a national uplift model to generate absolute deformation rates with a mm-accuracy. Combined with the close involvement of end-users, we focus on developing a service tailored to specific needs, which increases the probability of its implementation in both the public and private sectors.

Presenting the results obtained on the road to setting up a nationwide deformation monitoring will clearly demonstrate the potentials arising with the continuous stream of Sentinel-1 IWS data.

**General information**
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Organisations: National Space Institute, Geodesy, Danish Ministry of Energy, Utilities and Climate
Authors: Fredenslund Levinsen, J. (Ekstern), Sørensen, C. S. (Intern), Broge, N. H. (Ekstern)
Number of pages: 1
Publication date: 2017
Event: Abstract from Fringe 2017 Workshop, Helsinki, Finland.
Main Research Area: Technical/natural sciences

Arctic Ocean outflow and glacier-ocean interactions modify water over the Wandel Sea shelf (northeastern Greenland)
The first-ever conductivity-temperature-depth (CTD) observations on the Wandel Sea shelf in northeastern Greenland were collected in April-May 2015. They were complemented by CTDs taken along the continental slope during the Norwegian FRAM 2014-2015 drift. The CTD profiles are used to reveal the origin of water masses and interactions with ambient water from the continental slope and the tidewater glacier outlet. The subsurface water is associated with the Pacific water outflow from the Arctic Ocean. The underlying halocline separates the Pacific water from a deeper layer of polar water that has interacted with the warm Atlantic water outflow through the Fram Strait, recorded below 140 m. Over the outer shelf, the halocline shows numerous cold density-compensated intrusions indicating lateral interaction with an ambient polar water mass across the continental slope. At the front of the tidewater glacier outlet, colder and turbid water intrusions were observed at the base of the halocline. On the temperature-salinity plots these stations indicate a mixing line that is different from the ambient water and seems to be conditioned by the ocean-glacier interaction. Our observations of Pacific water are set within the context of upstream observations in the Beaufort Sea and downstream observations from the Northeast Water Polynya, and clearly show the modification of Pacific water during its advection across the Arctic Ocean. Moreover, ambient water over the Wandel Sea slope shows different thermohaline structures indicating the different origin and pathways of the on-shore and off-shore branches of the Arctic Ocean outflow through the western Fram Strait.

**General information**
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, University of Manitoba, Finnish Meteorological Institute, University of Bergen
Authors: Dmitrenko, I. A. (Ekstern), Kirillov, S. A. (Ekstern), Rudels, B. (Ekstern), Babb, D. G. (Ekstern), Pedersen, L. T. (Intern), Rysgaard, S. (Ekstern), Kristoffersen, Y. (Ekstern), Barber, D. G. (Ekstern)
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Scopus rating (2017): SNIP 1.05 SJR 1.554
Web of Science (2017): Indexed Yes
Arctic Sea Level During the Satellite Altimetry Era
Results of the sea-level budget in the high latitudes (up to 80°N) and the Arctic Ocean during the satellite altimetry era. We investigate the closure of the sea-level budget since 2002 using two altimetry sea-level datasets based on the Envisat waveform retracking: temperature and salinity data from the ORAP5 reanalysis, and Gravity Recovery And Climate Experiment (GRACE) space gravimetry data to estimate the steric and mass components. Regional sea-level trends seen in the altimetry map, in particular over the Beaufort Gyre and along the eastern coast of Greenland, are of halosteric origin. However, in terms of regional average over the region ranging from 66°N to 80°N, the steric component contributes little to the observed sea-level trend, suggesting a dominant mass contribution in the Arctic region. This is confirmed by GRACE-based ocean mass time series that agree well with the altimetry-based sea-level time series. Direct estimate of the mass component is not possible prior to GRACE. Thus, we estimated the mass contribution from the difference between the altimetry-based sea level and the steric component. We also investigate the coastal sea level with tide gauge records. Twenty coupled climate models from the CMIP5 project are also used. The models lead us to the same conclusions concerning the halosteric origin of the trend patterns.

General information
State: Published
Organisations: National Space Institute, Geodesy, Nansen Environmental and Remote Sensing Center, Laboratoire d'Études en Géophysique et Océanographie Spatiales, CLS Satellite Oceanography Division
Authors: Carret, A. (Ekstern), Johannessen, J. A. (Ekstern), Andersen, O. B. (Intern), Ablain, M. (Ekstern), Prandi, P. (Ekstern), Velazquez-Blazquez, A. (Ekstern), Cazenave, A. (Ekstern)
Pages: 251-275
Publication date: 2017
Assessment of Unusual Gigantic Jets observed during the Monsoon season: First observations from Indian Subcontinent

Gigantic Jets are electric discharges from thunderstorm cloud tops to the bottom of ionosphere at similar to 90 km altitude and electrically connect the troposphere and lower ionosphere. Since their first report in 2002, sporadic observations have
been reported from ground and space based observations. Here we report first observations of Gigantic Jets in Indian subcontinent over the Indo-Gangetic plains during the monsoon season. Two storms each produced two jets with characteristics not documented so far. Jets propagated similar to 37 km up remarkably in similar to 5 ms with velocity of similar to 7.4 x 10(6) ms(-1) and disappeared within similar to 40-80 ms, which is faster compared to jets reported earlier. The electromagnetic signatures show that they are of negative polarity, transporting net negative charge of similar to 17-23 C to the lower ionosphere. One jet had an unusual form observed for the first time, which emerged from the leading edge of a slowly drifting complex convective cloud close to the highest regions at similar to 17 km altitude. A horizontal displacement of similar to 10 km developed at similar to 50 km altitude before connecting to the lower ionosphere. Modeling of these Gigantic jets suggests that Gigantic Jets may bend when initiated at the edge of clouds with misaligned vertical charge distribution.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Indian Institute of Geomagnetism, Duke University, AGH University of Science and Technology, Georgia Institute of Technology, Indian Institute of Tropical Meteorology â?? IITM, University of the South Pacific
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.63 SJR 1.692 SNIP 1.354
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.034 SNIP 1.597 CiteScore 5.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.163 SNIP 1.554 CiteScore 4.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.998 SNIP 1.57 CiteScore 4.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.531 SNIP 0.962 CiteScore 2.44
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Associating ground magnetometer observations with current or voltage generators

A circuit analogy for magnetosphere-ionosphere current systems has two extremes for drivers of ionospheric currents: ionospheric electric fields/voltages constant while current/conductivity vary—the "voltage generator"—and current constant while electric field/conductivity vary—the "current generator." Statistical studies of ground magnetometer observations associated with dayside Transient High Latitude Current Systems (THLCS) driven by similar mechanisms find contradictory results using this paradigm: some studies associate THLCS with voltage generators, others with current generators. We argue that most of this contradiction arises from two assumptions used to interpret ground magnetometer observations: (1) measurements made at fixed position relative to the THLCS field-aligned current and (2) negligible auroral precipitation contributions to ionospheric conductivity. We use observations and simulations to illustrate how these two assumptions substantially alter expectations for magnetic perturbations associated with either a current or a voltage generator. Our results demonstrate that before interpreting ground magnetometer observations of THLCS in the context of current/voltage generators, the location of a ground magnetometer station relative to the THLCS field-aligned current and the location of any auroral zone conductivity enhancements need to be taken into account.

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Organisations: National Space Institute, Geomagnetism, Virginia Polytechnic Institute and State University, Beihang University, New Jersey Institute of Technology, Institute for Space Research, University of Michigan
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BFI (2017): BFI-level 2
Scopus rating (2017): SJR 2.272 SNIP 1.475
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
Greenland's bed topography is a primary control on ice flow, grounding line migration, calving dynamics, and subglacial drainage. Moreover, fjord bathymetry regulates the penetration of warm Atlantic water (AW) that rapidly melts and undercutts Greenland's marine-terminating glaciers. Here we present a new compilation of Greenland bed topography that assimilates seafloor bathymetry and ice thickness data through a mass conservation approach. A new 150 m horizontal resolution bed topography/bathymetric map of Greenland is constructed with seamless transitions at the ice/ocean interface, yielding major improvements over previous data sets, particularly in the marine-terminating sectors of northwest and southeast Greenland. Our map reveals that the total sea level potential of the Greenland ice sheet is $7.42 \pm 0.05$ m, which is 7 cm greater than previous estimates. Furthermore, it explains recent calving front response of numerous outlet glaciers and reveals new pathways by which AW can access glaciers with marine-based basins, thereby highlighting sectors of Greenland that are most vulnerable to future oceanic forcing.
State: Published
Organisations: National Space Institute, Geodesy, University of Bristol, Aberystwyth University, University of Cambridge, Karolinska University Hospital, Utrecht University, University of Durham, University of Exeter, Imperial College London, Greenland Institute of Natural Resources, University of California, Irvine, Alfred Wegener Institute for Polar and Marine Research, University of Texas at Austin, California Institute of Technology, Natural Environment Research Council, The Ohio State University, University of New Hampshire, Durham, Aarhus University, Woods Hole Oceanographic Institution
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.429 SJR 2.657
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.35 SJR 2.819 SNIP 1.495
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.24 SNIP 1.728 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.573 SNIP 1.325
Web of Science (2008): Indexed yes
Building and breaking a Large Igneous Province: An example from the High Arctic

The genesis of the Amerasia Basin in the Arctic Ocean has been difficult to discern due to overprint of the Cretaceous High-Arctic Large Igneous Province (HALIP). Based on detailed analysis of bathymetry data, new Arctic magnetic and gravity compilations, and recently published radiometric and seismic data, we present a revised plate kinematic model of the northernmost Amerasia Basin. We show that the smaller Makarov Basin is formed by rifting and seafloor spreading during the latest Cretaceous (to middle Paleocene). The opening progressively migrated into the Alpha Ridge structure, which was the focus of Early-to-Middle Cretaceous HALIP formation, causing breakup of the proto-Alpha Ridge into the present-day Alpha Ridge and Alpha Ridge West Plateau. We propose that breakup of the Makarov Basin was triggered by extension between the North America and Eurasian plates and possibly North Pacific plate rollback.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, University of Oslo, Naval Research Laboratory
Authors: Døssing Andreasen, A. (Intern), Gaina, C. (Ekstern), Brozena, J. M. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.35 SJR 2.819 SNIP 1.495
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 3.24 SNIP 1.728 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.573 SNIP 1.325
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.361 SNIP 1.248
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.262 SNIP 1.299
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.239 SNIP 1.257
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.261 SNIP 1.348
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.906 SNIP 1.285
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.087 SNIP 1.4
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.403 SNIP 1.292
Web of Science (2001): Indexed yes
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Web of Science (2000): Indexed yes
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Challenges Handling Magnetospheric and Ionospheric Signals in Internal Geomagnetic Field Modelling

Measurements of the Earth's magnetic field collected by low-Earth-orbit satellites such as Swarm and CHAMP, as well as at ground observatories, are dominated by sources in the Earth's interior. However these measurements also contain significant contributions from more rapidly-varying current systems in the ionosphere and magnetosphere. In order to fully exploit magnetic data to probe the physical properties and dynamics of the Earth's interior, field models with suitable treatments of external sources, and their associated induced signals, are essential. Here we review the methods presently used to construct models of the internal field, focusing on techniques to handle magnetospheric and ionospheric signals. Shortcomings of these techniques often limit the quality, as well as spatial and temporal resolution, of internal field models. We document difficulties in using track-by-track analysis to characterize magnetospheric field fluctuations, differences in internal field models that result from alternative treatments of the quiet-time ionospheric field, and challenges associated with rapidly changing, but spatially correlated, magnetic signatures of polar cap current systems. Possible strategies for improving internal field models are discussed, many of which are described in more detail elsewhere in this volume.
Change detection in a series of Sentinel-1 SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a time series of seven multilook, dual polarization Sentinel-1 SAR data in the covariance matrix representation (with diagonal elements only) is carried out. The omnibus test statistic and its factorization detect if and when change occurs.


General information
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Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern), Canty, M. J. (Ekstern)
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Change detection in multi-temporal dual polarization Sentinel-1 data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a time series of 19 multilook, dual polarization Sentinel-1 SAR data in the covariance matrix representation (with diagonal elements only) is carried out. The omnibus test statistic and its factorization detect if and when change occurs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH
Authors: Nielsen, A. A. (Intern), Canty, M. J. (Ekstern), Skriver, H. (Intern), Conradsen, K. (Intern)
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Pages: 3901-3908
Publication date: 2017
Characteristics of Low-latitude Coronal Holes near the Maximum of Solar Cycle 24

We investigate the statistics of 288 low-latitude coronal holes extracted from SDO/AIA-193 filtergrams over the time range of 2011 January 01–2013 December 31. We analyze the distribution of characteristic coronal hole properties, such as the areas, mean AIA-193 intensities, and mean magnetic field densities, the local distribution of the SDO/AIA-193 intensity and the magnetic field within the coronal holes, and the distribution of magnetic flux tubes in coronal holes. We find that the mean magnetic field density of all coronal holes under study is 3.0 ± 1.6 G, and the percentaged unbalanced magnetic flux is 49 ± 16%. The mean magnetic field density, the mean unsigned magnetic field density, and the percentaged unbalanced magnetic flux of coronal holes depend strongly pairwise on each other, with correlation coefficients $c c > 0.92$. Furthermore, we find that the unbalanced magnetic flux of the coronal holes is predominantly concentrated in magnetic flux tubes: 38% (81%) of the unbalanced magnetic flux of coronal holes arises from only 1% (10%) of the coronal hole area, clustered in magnetic flux tubes with field strengths >50 G (10 G). The average magnetic field density and the unbalanced magnetic flux derived from the magnetic flux tubes correlate with the mean magnetic field density and the unbalanced magnetic flux of the overall coronal hole ($c c > 0.93$). These findings give evidence that the overall magnetic characteristics of coronal holes are governed by the characteristics of the magnetic flux tubes.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Graz, HVAR Observatory, Universität Kiel
Authors: Hofmeister, S. J. (Ekstern), Veronig, A. (Ekstern), Reiss, M. A. (Ekstern), Temmer, M. (Ekstern), Vennerstrøm, S. (Intern), Vršnak, B. (Ekstern), Heber, B. (Ekstern)
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Scopus rating (2016): CiteScore 5.26
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.8
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.57
Web of Science (2014): Indexed yes
Characterization and compensation of thermo-elastic instability of SWARM optical bench on Micro Advanced Stellar Compass attitude observations

Launched into orbit on November 22, 2013, the Swarm constellation of three satellites precisely measures magnetic signal of the Earth. To ensure the high accuracy of magnetic observation by vector magnetometer (VFM), its inertial attitude is precisely determined by µASC (micro Advanced Stellar Compass). Each of the three Swarm satellites is equipped with three µASC Camera Head Units (CHU) mounted on a common optical bench (OB), which has a purpose of transference of the attitude from the star trackers to the magnetometer measurements. Although substantial pre-launch analyses were made to maximize thermal and mechanical stability of the OB, significant signal with thermal signature is discovered when comparing relative attitude between the three CHU's (Inter Boresight Angle, IBA). These misalignments between CHU's, and consequently geomagnetic reference frame, are found to be correlated with the period of angle between Swarm orbital plane and the Sun (ca. 267 days), which suggests sensitivity of optical bench system on temperature variation. In this paper, we investigate the propagation of thermal effects into the µASC attitude observations and demonstrate how thermally induced attitude variation can be predicted and corrected in the Swarm data processing. The results after applying thermal corrections show decrease in IBA RMS from 6.41 to 2.58 arc-seconds. The model significantly improves attitude determination which, after correction, meets the requirements of Swarm satellite mission. This study demonstrates the importance of the OB pre-launch analysis to ensure minimum thermal gradient on satellite optical system and therefore maximum attitude accuracy.

General information
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Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Herceg, M. (Intern), Jørgensen, P. S. (Intern), Jørgensen, J. L. (Intern)
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- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.08 SJR 1.009 SNIP 1.974
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.004 SNIP 1.676 CiteScore 1.49
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- Scopus rating (2013): SJR 0.638 SNIP 1.411 CiteScore 1.24
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- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
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- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.403 SNIP 1.149
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.311 SNIP 0.878
- BFI (2008): BFI-level 1
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- Scopus rating (2007): SJR 0.272 SNIP 0.786
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- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.252 SNIP 0.651
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 0.274 SNIP 0.765
- Scopus rating (2003): SJR 0.278 SNIP 0.727
- Scopus rating (2002): SJR 0.319 SNIP 0.806
- Scopus rating (2001): SJR 0.23 SNIP 0.467
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Climate Impacts and Adaptation; Towards Local Solutions to Global Challenges

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Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. S. (Intern), Knudsen, P. (Intern), Andersen, O. B. (Intern)
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Coastal communities and climate change – addressing needs for capacity building and collaboration

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Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. S. (Intern), Knudsen, P. (Intern)
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Coastal flood protection management under uncertainty – the Danish case
Local stakeholders responsible for coastal management. In Denmark, the responsibility of defining, planning and implementing coastal flood protection lies with the local stakeholders, such as landowners and municipalities. Similarly, it is a municipal responsibility to define building foundation and flood protection levels in urban planning and long term development. These planning and protection levels are most often defined from the hazard instead of a risk perspective. The Danish Coastal Authority (DCA) guides local stakeholders on general coastal flood protection and implements the EU Flood Directive on flood risk reduction in appointed areas of significant flood risk. DCA is obligated to communicate the concept of risk and, in a thorough and easily comprehensible way, the hazards and uncertainties relating to this today and in the future.

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Organisations: National Space Institute, Geodesy, Danish Coastal Authority
Authors: Jumppanen Andersen, K. (Ekster), Sørensen, C. S. (Intern), Piontkowitz, T. (Ekster)
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Coastal flood protection management under uncertainty – the Danish case

General information
Coastal Sea Level from CryoSat-2 SARIn Altimetry in Norway

Conventional (pulse-limited) altimeters determine the sea surface height with an accuracy of a few centimeters over the open ocean. Sea surface heights and tide-gauge sea level serve as each other’s buddy check. However, in coastal areas, altimetry suffers from numerous effects, which degrade its quality. The Norwegian coast adds further challenges due to its complex coastline with many islands, mountains, and deep, narrow fjords.

The European Space Agency CryoSat-2 satellite carries a synthetic aperture interferometric radar altimeter, which is able to observe sea level closer to the coast than conventional altimeters. In this study, we explore the potential of CryoSat-2 to provide valid observations in the Norwegian coastal zone. We do this by comparing time series of CryoSat-2 sea level anomalies with time series of in situ sea level at 22 tide gauges, where the CryoSat-2 sea level anomalies are averaged in a 45-km area around each tide gauge. For all tide gauges, CryoSat-2 shows standard deviations of differences and correlations of 16 cm and 61%, respectively. We further identify the ocean tide and inverted barometer geophysical corrections as the most crucial, and note that a large amount of observations at land-confined tide gauges are not assigned an ocean tide value. With the availability of local air pressure observations and ocean tide predictions, we substitute the standard inverted barometric and ocean tide corrections with local corrections. This gives an improvement of 24% (to 12.2 cm) and 12% (to 68%) in terms of standard deviations of differences and correlations, respectively. Finally, we perform the same in situ analysis using data from three conventional altimetry missions, Envisat, SARAL/AltKa, and Jason-2. For all tide gauges, the conventional altimetry missions show an average agreement of 11 cm and 60% in terms of standard deviations of differences and correlations, respectively. There is a tendency that results improve with decreasing distance to the tide gauge and a smaller footprint, underlining the potential of SAR altimetry in coastal zones.

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Organisations: National Space Institute, Geodesy, Norwegian University of Life Sciences
Authors: Idžanović, M. (Ekstern), Ophaug, V. (Ekstern), Andersen, O. B. (Intern)
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Comparison cosmic ray irradiation simulation and particle beam test on UFFO Burst Alert & Trigger telescope (UBAT) detectors

Ultra-Fast Flash Observatory pathfinder (UFFO-p) was launched onboard Lomonosov on 28th of April, 2016, and now is under various types of calibration for detection of Gamma Ray Bursts (GRBs). Since last September UFFO-p has taken X-ray data in space with UFFO Burst Alert &Trigger telescope (UBAT), those X-rays are mostly diffused backgrounds however, the rate turns out to be higher than expected by a factor of three. We assumed cosmic rays can contribute by
making the count rate higher. We did such a simulation to investigate the effect of cosmic rays. In December 2016, we irradiated fragmented high energy heavy ions at CERN on the UBAT detector. We will report the result of comparison between simulation and beam test.

**General information**

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**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Sungkyunkwan University, Moscow State University, Instituto de Astrofísica de Andalucía, National Taiwan University, Universidad de Valencia

**Authors:** Jeong, H. M. (Ekstern), Jeong, S. (Ekstern), Kim, M. B. (Ekstern), Lee, J. (Ekstern), Park, I. H. (Ekstern), Amelushkin, A. M. (Ekstern), Barinova, V. O. (Ekstern), Bogomolov, A. V. (Ekstern), Bogomolov, V. V. (Ekstern), Brandt, S. (Intern), Budtz-Jørgensen, C. (Intern), Castro-Tirado, A. J. (Ekstern), Chen, P. (Ekstern), Conneli, P. (Ekstern), Dzhioeva, N. L. (Ekstern), Eyles, C. (Ekstern), Garipov, G. (Ekstern), Gorbovskoy, E. S. (Ekstern), Huang, M. H. A. (Ekstern), Ivudin, A. F. (Ekstern), Kaledaev, V. V. (Ekstern), Kasarjan, P. S. (Ekstern), Kim, J. E. (Ekstern), Kornilov, V. G. (Ekstern), Kuznetsova, E. A. (Ekstern), Lim, H. (Ekstern), Lipunov, V. M. (Ekstern), Liu, T. C. (Ekstern), Myagkova, I. N. (Ekstern), Nam, J. W. (Ekstern), Panasyuk, M. I. (Ekstern), Panchenko, M. I. (Ekstern), Petrov, V. L. (Ekstern), Prokhorov, A. V. (Ekstern), Reglero, V. (Ekstern), Ripa, J. (Ekstern), Rodrigo, J. M. (Ekstern), Shustova, A. N. (Ekstern), Svertilov, S. I. (Ekstern), Tuyrina, N. V. (Ekstern), Yashin, I. V. (Ekstern)

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**Continuous estimation of gross primary productivity and evapotranspiration from an Unmanned Aerial System**

**General information**

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**Organisations:** Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy, Atmospheric Environment, Technical University of Denmark, European Commission - Joint Research Center

**Authors:** Wang, S. (Intern), Bandini, F. (Intern), Jakobsen, J. (Intern), Zoro Tejada, P. J. (Ekstern), Liu, X. (Ekstern), Olesen, D. H. (Intern), Ibrom, A. (Intern), Bauer-Gottwein, P. (Intern), Garcia, M. (Intern)

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Copenhagen ITS: Forsøg med wifi-baseret positionering på H.C. Andersens Boulevard


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Coping with Future Coastal Floods in Denmark—Advancing the Use of Global Frameworks

The main aim of Disaster Risk Management and Climate Change Adaptation is to lower the risk for the population and society at large. Risk assessments constitute an important part of flood risk management and their quality is crucial to well-informed decision making. This requires an in-depth understanding of the society and its vulnerabilities. Often attention to the flood risk and vulnerability in developed countries is absent due to the assumption that society can cope with disaster; For Denmark, a mixed methods’ research inquiry reveals that this is not always the case. In a critique of current Danish approaches to deal with Disaster Risk Management and Climate Change Adaptation including coordination and planning, the paper proposes a new pathway for coping with the risks of coastal floods: Global frameworks like the Hyogo and Sendai tailored to suit Danish conditions may serve to mainstream Disaster Risk Management and Climate Change Adaptation and provide for a holistic, sustainable and more consistent national approach. In addition, such an approach will advance coordination and produce more elaborate guidelines and uniform progress report mechanisms to local and national actors when dealing with flood risks and adaptation.
Corrections to "Change Detection in Full and Dual Polarization, Single- and Multi-Frequency SAR Data"

When the covariance matrix formulation is used for multi-look polarimetric synthetic aperture radar (SAR) data, the complex Wishart distribution applies. Based on this distribution a test statistic for equality of two complex variance-covariance matrices and an associated asymptotic probability of obtaining a smaller value of the test statistic are given. In a case study airborne EMISAR C- and L-band SAR images from the spring of 1998 covering agricultural fields and wooded areas near Foulum, Denmark, are used in single- and bi-frequency, bi-temporal change detection with full and dual polarimetry data.
Cosmic ray effect on the X-ray Trigger Telescope of UFFO/Lomonosov using YSO scintillation crystal array in space

UFFO Burst Alert and Trigger telescope (UBAT) is the X-ray trigger telescope of UFFO/Lomonosov to localize X-ray source with coded mask method and X-ray detector. Its X-ray detector is made up of 36 8×8 pixels Yttrium OxyorthoSilicate (Y2SiO5:Ce, YSO) scintillation crystal arrays and 36 64-channel Multi-Anode PhotoMultiplier Tubes (MAPMTs) for space mission. Its effective detection area is 161cm² and energy range is several keV to 150 keV. It was successfully launched in April 28, 2016. In several calibration run, we got several X-ray background data. We already knew X-ray background flux is 2-3 counts/cm²/sec in space. However our X-ray background data shows approximately 7-8 times higher than what we know. There are many candidates to explain high X-ray background count in space. One of candidates is cosmic ray. We will report cosmic ray effect on the X-ray detector using YSO scintillation crystal arrays in space.

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Authors: Kim, M. B. (Ekstern), Jeong, S. (Ekstern), Jeong, H. M. (Ekstern), Leonov, V. (Ekstern), Lee, J. (Ekstern), Park, I. (Ekstern), Amelushkin, A. (Ekstern), Barinova, V. O. (Ekstern), Bogomolov, A. (Ekstern), Bogomolov, V. V. (Ekstern), Brandt, S. (Intern), Budtz-Jørgensen, C. (Intern), Castro-Tirado, A. J. (Ekstern), Chen, P. (Ekstern), Connell, P. (Ekstern), Garipov, G. (Ekstern), Gorbovskoy, E. S. (Ekstern), Dzhioeva, N. L. (Ekstern), Eyles, C. (Ekstern), Huang, M. A. (Ekstern), Iyudin, A. (Ekstern), Kalegaev, V. V. (Ekstern), Kasarjan, P. S. (Ekstern), Kim, J. E. (Ekstern), Kornilov, V. G. (Ekstern), Kuznetsova, E. A. (Ekstern), Lim, H. (Ekstern), Lipunov, V. M. (Ekstern), Liu, T.- (Ekstern), Myagkova, I. N. (Ekstern), Nam, J. W. (Ekstern), Panasyuk, M. I. (Ekstern), Panchenko, M. I. (Ekstern), Petrov, V. L. (Ekstern), Prokhorov, A. V. (Ekstern), Reglero, V. (Ekstern), Ripa, J. (Ekstern), Rodrigo, J. M. (Ekstern), Shustova, A. N. (Ekstern), Svertilov, S. I. (Ekstern), Tyurina, N. V. (Ekstern), Yashin, I. V. (Ekstern)
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CryoSat-2 Altimetry Applications over Rivers and Lakes

Monitoring the variation of rivers and lakes is of great importance. Satellite radar altimetry is a promising technology to do this on a regional to global scale. Satellite radar altimetry data has been used successfully to observe water levels in lakes and (large) rivers, and has also been combined with hydrologic/hydrodynamic models. Except CryoSat-2, all radar altimetry missions have been operated in conventional low resolution mode with a short repeat orbit (35 days or less). CryoSat-2, carrying a Synthetic Aperture Radar (SAR) altimeter, has a 369-day repeat and a drifting ground track pattern and provides new opportunities for hydrologic research. The narrow inter-track distance (7.5 km at the equator) makes it possible to monitor many lakes and rivers and SAR mode provides a finer along-track resolution, higher return power and speckle reduction through multi-looks. However, CryoSat-2 challenges conventional ways of dealing with satellite inland water altimetry data because virtual station time series cannot be directly derived for rivers. We review the CryoSat-2 mission characteristics, data products, and its use and perspectives for inland water applications. We discuss all the important steps in the workflow for hydrologic analysis with CryoSat-2, and conclude with a discussion of promising future research directions.
CryoSat-2 radar altimetry for monitoring freshwater resources of China

Surface water bodies (lakes, reservoirs, and rivers) are key components of the water cycle and are important water resources. Water level and storage vary greatly under the impacts of climate change and human activities. Due to sparse in-situ monitoring networks, a comprehensive national-scale monitoring dataset of surface water bodies in China is not available. Over the last two decades, satellite altimetry has been used successfully for inland water monitoring. Here, we use CryoSat-2 radar altimetry to monitor water level variations of large lakes, reservoirs and rivers across China and demonstrate its potential to complement available in-situ monitoring datasets for the country.

In this study, over 1000 lakes and reservoirs, and 6 large rivers are investigated. The results show that surface water varied greatly over the past 6 years, e.g. in the Tibetan Plateau, the Junggar Basin, the Northeast China Plain, and the central Yangtze River basin. Estimated changes in volume indicate that surface water variation contributes significantly to terrestrial storage variation, especially in the Qaidam Basin and the Tibetan Plateau. CryoSat-2 is capable of measuring regional-scale river level at high spatial resolution and competitive accuracy as demonstrated by comparison with available in-situ gauging data. The results are encouraging with RMSE values ranging from 0.24 to 0.35 m for the Heilongjiang-Amur River, 0.22 to 0.6 m for the Yellow River and 0.22 to 0.5 m for the Songhua River. Comparatively, accuracy is much lower over the Yangtze and Pearl Rivers (RMSE ~ 2.6 m and ~ 3.3 m), probably due to intensive inland waterway navigation. CryoSat-2 shows great potential for monitoring surface water at national scale in China.
Danish risk management plans of the EU floods directive

The paper evaluates the impact and effect of the EU Flood's Directive (2007/60/EC) in Denmark and the flood risk management plans that are the result of the national implementation in the first plan period (2010-2015). Twenty flood risk management plans have been elaborated and published by the 22 Danish municipalities included in 10 risk areas appointed due to a risk of floods from rivers, the sea, or both. For the municipal work, the national government has provided hazard, vulnerability, and risk assessments and maps as well as guidelines to fulfill the legal binding of the Directive. The plans are reviewed and analysed regarding main objectives and structural and non-structural mitigation measures. Conclusions point to the need of introducing better decision support systems, a need to define acceptable risks, and a need to enhance coordination between municipal and cross-sectorial actors as well as an increased effort to involve civil society is necessary. In general, the implementation of the Directive has significantly advanced the national scientific and cross-sectorial working platform for dealing with risks from floods.

L'article présente un bilan de la mise en œuvre de la Directive Inondation (2007/60 / CE) au Danemark. Vingt plans de gestion des risques d'inondation ont été élaborés (2010-2015) par les 22 municipalités danoises concernées, dans dix zones de risque d'inondation par débordement de cours d'eau et/ou submersion marine. Le gouvernement national a fourni les cartes d'aléa, de vulnérabilité et de risque, ainsi que des recommandations générales pour la mise en œuvre de la Directive. Les plans de gestion ont ensuite été mis au point, avec les principales mesures d'atténuation structurelles et non structurelles. Le bilan de cette première application montre la nécessité d'introduire de meilleurs systèmes d'aide à la décision, le besoin de définir des risques acceptables et l'importance d'améliorer la coordination entre les acteurs municipaux et les autres acteurs concernés, dont la société civile. La mise en œuvre de la directive a permis de progresser dans la gestion du risque d'inondation, que ce soit au niveau scientifique que dans l'implication des différents acteurs.

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Delta progradation in Greenland driven by increasing glacial mass loss

Climate changes are pronounced in Arctic regions and increase the vulnerability of the Arctic coastal zone(1). For example, increases in melting of the Greenland Ice Sheet and reductions in sea ice and permafrost distribution are likely to alter coastal morphodynamics. The deltas of Greenland are largely unaffected by human activity, but increased freshwater runoff and sediment fluxes may increase the size of the deltas, whereas increased wave activity in ice-free periods could reduce their size, with the net impact being unclear until now. Here we show that southwestern Greenland deltas were largely stable from the 1940s to 1980s, but prograded (that is, sediment deposition extended the delta into the sea) in a warming Arctic from the 1980s to 2010s. Our results are based on the areal changes of 121 deltas since the 1940s, assessed using newly discovered aerial photographs and remotely sensed imagery. We find that delta progradation was driven by high freshwater runoff from the Greenland Ice Sheet coinciding with periods of open water. Progradation was controlled by the local initial environmental conditions (that is, accumulated air temperatures above 0 degrees C per year, freshwater runoff and sea ice in the 1980s) rather than by local changes in these conditions from the 1980s to 2010s at each delta. This is in contrast to a dominantly eroding trend of Arctic sedimentary coasts along the coastal plains of Alaska(2), Siberia(3) and western Canada(4), and to the spatially variable patterns of erosion and accretion along the large deltas of the main rivers in the Arctic5-7. Our results improve the understanding of Arctic coastal evolution in a changing climate, and reveal the impacts on coastal areas of increasing ice mass loss and the associated freshwater runoff and lengthening of open-water periods.
Design, development, and performance of X-ray mirror coatings for the ATHENA mission

We report the latest results on coating design optimisation and optics performance for the present Ir/B4C baseline coating and alternative designs and materials, including bilayers and linear graded multilayers. We make use of X-ray reflectometry (XRR) to test both coating performance and robustness.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, European Space Agency, Cosine BV, Technical University of Denmark, Physikalisch-Technische Bundesanstalt
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Number of pages: 10
Determining Storm Surge Return Periods: The Use of Evidence of Historic Events

Storm surges are a major concern for many coastal communities, and rising levels of surges is a key concern in relation to climate change. The sea level of a statistical 100-year or 1000-year storm surge event and similar statistical measures are used for spatial planning and emergency preparedness. These statistics are very sensitive to the assessments of past events, and to future sea level change.

The probability of a major storm surge from the Baltic Sea hitting the Copenhagen metropolitan area is officially determined by the Danish Coastal Authority based on tide gauge records. We have a long history for tide gauge measurements, with 120 years of data available for the calculations. However, the oldest of these tide gauge stations was set up after a major storm surge in 1872, and no events of similar severity have occurred since.

Including the evidence of the historic events from the 18th century changes the return period statistics, with a best estimate of a 100 year event changing from 1.5 meters (Sørensen et al. 2013) to 2.6 [2.2 – 2.8] meters (present study) in Køge just south of Copenhagen. Thus, with the tide gauge-based statistics, the storm surge on January 4 2017 was a 100 year event, but with the revised statistics using historic evidence, much larger events can be expected.

Further, we assess the very large impact of sea level rise on the storm surge statistics. As an example, according to the official statistics of southern Copenhagen, the flooding of a present day 100 year event will statistically occur every 10 years with just 27 cm of mean sea level rise.

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Storm surge, Climate, Regional, Historic
Electronic versions:
Determining_storm_surge_return_periods.pdf
Development of ATHENA mirror modules

Silicon Pore Optics (SPO), developed at cosine with the European Space Agency (ESA) and several academic and industrial partners, provides lightweight, yet stiff, high-resolution X-ray optics. This technology enables ATHENA to reach an unprecedentedly large effective area in the 0.2-12 keV band with an angular resolution better than 5". After developing the technology for 50 m and 20 m focal length, this year has witnessed the first 12 m focal length mirror modules being produced. The technology development is also gaining momentum with three different radii under study: Mirror modules for the inner radii ($R_{\text{min}} = 250$ mm), outer radii ($R_{\text{max}} = 1500$ mm) and middle radii ($R_{\text{mid}} = 737$ mm) are being developed in parallel.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics
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Direction-of-Arrival Analysis of Airborne Ice Depth Sounder Data

In this paper, we analyze the direction-of-arrival (DOA) of the ice-sheet data collected over Jakobshavn Glacier with the airborne Multichannel Radar Depth Sounder (MCReDS) during the 2006 field season. We extracted weak ice–bed echoes buried in signals scattered by the rough surface of the fast-flowing Jakobshavn Glacier by analyzing the DOA of signals received with a five-element receive-antenna array. This allowed us to obtain ice thickness information, which is a key parameter when generating bed topography of glaciers. We also estimated ice–bed roughness and bed slope from the combined analysis of the DOA and radar waveforms. The bed slope is about 8° and the roughness in terms of rms slope is about 16°.

General information
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Organisations: National Space Institute, Microwaves and Remote Sensing, University of Kansas
Authors: Nielsen, U. (Intern), Yan, J. (Ekstern), Gogineni, S. (Ekstern), Dall, J. (Intern)
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Scopus rating (2015): SJR 2.486 SNIP 3.107 CiteScore 4.7
Web of Science (2015): Indexed yes
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Scopus rating (2013): SJR 2.283 SNIP 3.227 CiteScore 4.22
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
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BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.14 SNIP 2.932
Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 2.85 SNIP 2.964
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 2.77 SNIP 3.084
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.657 SNIP 3.67
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.137 SNIP 2.821
Web of Science (2006): Indexed yes
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Web of Science (2005): Indexed yes
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Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2 SNIP 3.412
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.075 SNIP 3.302
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.113 SNIP 1.934
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.107 SNIP 1.635
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.368 SNIP 1.8
Original language: English
The Earth's magnetic field results from different sources in the Earth's interior and in near Earth space. Commonly, when investigating solar-terrestrial interactions where the Earth's internal field plays a major role, scientists concentrate on strong (tens to thousands of nanotesla) and rapid (seconds to days) magnetic field variations that are caused by currents in the ionosphere and magnetosphere when solar activity, and correspondingly the electric currents in Earth's environment, are enhanced. However, for studying the internal sources of the geomagnetic field, originating in the core and crust, scientists use observations from so called “geomagnetic quiet” times, when external field variations are expected to be weak. However, even these weak variations impact internal field modelling, and incomplete knowledge of them hinders their separation. Difficulties arise in particular in characterizing the long term behaviour of external sources, e.g., seasonal and solar cycle variations of the magnetospheric ring current, polar convection currents or ionospheric dynamo currents driven by atmospheric tides, since they have amplitudes and spatial scales similar to those of the core field's secular variation or the lithospheric field. Since such external currents are also present during geomagnetic quiet conditions they may result in biased core and crustal field models. An additional complexity arises from magnetic observations taken by satellites because of the movement of the platform, leading to a possible space-time ambiguity.

**General information**
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Organisations: National Space Institute, Geomagnetism, Uppsala University, Helmholtz Centre Potsdam German Research Center for Geosciences (GFZ)
Authors: Stolle, C. (Ekstern), Olsen, N. (Intern), Richmond, A. D. (Ekstern), Opgenoorth, H. J. (Ekstern)
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 6.45 SJR 2.891 SNIP 2.57
BFI (2015): BFI-level 1
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.265 SNIP 2.703 CiteScore 5.94
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.474 SNIP 2.342 CiteScore 4.88
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Electron acceleration during streamer collisions in air

High-voltage laboratory experiments show that discharges in air, generated over a gap of one meter with maximal voltage of 1 MV, may produce X-rays with photon energies up to 1 MeV. It has been suggested that the photons are bremsstrahlung from electrons accelerated by the impulsive, enhanced field during collisions of negative and a positive streamers. To explore this process, we have conducted the first self-consistent particle simulations of streamer encounters. Our simulation model is a 2-D, cylindrically symmetric, particle-in-cell code tracing the electron dynamics and solving the space charge fields, with a Monte Carlo scheme accounting for collisions and ionization. We present the electron density, the electric field, and the velocity distribution as functions of space and time. Assuming a background electric field 1.5 times the breakdown field, we find that the electron density reaches $2 \times 10^{21} \text{ m}^{-3}$, the size of the encounter region is $\sim 3 \times 10^{-12} \text{ m}^3$, and that the field enhances to $\sim 9$ times the breakdown field during $\sim 10^{-11}$ s. We further find that the radial component becomes comparable to the parallel component, which together with angular scattering leads to an almost isotropic distribution of electrons. This is consistent with laboratory observations that X-rays are emitted isotropically. However, the maximum energy of electrons reached in the simulation is $\sim 600$ eV, which is well below the energies required to explain observations. The reason is that the encounter region is small in size and duration. For the photon energies observed, the field must be enhanced in a larger region and/or for a longer time.
Electron number density profiles derived from radio occultation on the CASSIOPE spacecraft

This paper presents electron number density profiles derived from high resolution Global Positioning System (GPS) radio occultation (RO) observations performed using the Enhanced Polar Outflow Probe (e-POP) payload on the high inclination CAScade, Smallsat and IOnospheric Polar Explorer (CASSIOPE) spacecraft. We have developed and applied a novel inverse Abel transform algorithm on high rate RO total electron content (TEC) measurements performed along GPS to CASSIOPE radio links to recover electron density profiles. The high resolution density profiles inferred from the CASSIOPE RO are: (1) in very good agreement with density profiles estimated from ionosonde data, measured over nearby stations to the latitude and longitude of the RO tangent points, (2) in good agreement with density profiles inferred from GPS RO measured by the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC), and (3) in general agreement with density profiles estimated using the International Reference Ionosphere (IRI) climatological model. Using both CASSIOPE and COSMIC RO observations, we identify, for the first time, that there exist differences in the characteristics of the electron number density profiles retrieved over landmasses and oceans. The density profiles over oceans exhibit wide-spread values and scale heights compared to density profiles over landmasses. We provide an explanation for the ocean-landmass discrepancy in terms of the unique wave coupling mechanisms operating over oceans and landmasses.

General information

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Organisations: National Space Institute, Geodesy, NASA Jet Propulsion Laboratory, University of New Brunswick
Authors: Shume, E. B. (Ekstern), Vergados, P. (Ekstern), Komjathy, A. (Ekstern), B. Langley, R. (Ekstern), Durgonics, T. (Intern)
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.65 SJR 0.562 SNIP 1.165
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 1.031 SNIP 1.207 CiteScore 1.59
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.921 SNIP 1.262 CiteScore 1.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.866 SNIP 1.19 CiteScore 1.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.567 SNIP 0.852 CiteScore 1.16
ISI indexed (2012): ISI indexed yes
We present a strongly interacting quadruple system associated with the K2 target EPIC 220204960. The K2 target itself is a $K_p = 12.7$-mag star at $T_{\text{eff}} \approx 6100$ K, which we designate as 'B-N' (blue northerly image). The host of the quadruple system, however, is a $K_p \approx 17$-mag star with a composite M-star spectrum, which we designate as 'R-S' (red southerly image). With a 3.2-arcsec separation and similar radial velocities and photometric distances, 'B-N' is likely physically associated with 'R-S', making this a quintuple system, but that is incidental to our main claim of a strongly interacting quadruple system in 'R-S'. The two binaries in 'R-S' have orbital periods of 13.27 and 14.41 d, respectively, and each has an inclination angle of $\gtrsim 89^\circ$. From our analysis of radial-velocity (RV) measurements, and of the photometric light curve, we conclude that all four stars are very similar with masses close to $0.4 M_\odot$. Both of the binaries exhibit significant eclipse-timing variations where those of the primary and secondary eclipses ‘diverge’ by 0.05 d over the course of the 80-d observations. Via a systematic set of numerical simulations of quadruple systems consisting of two interacting binaries, we conclude that the outer orbital period is very likely to be between 300 and 500 d. If sufficient time is devoted to RV studies of this faint target, the outer orbit should be measurable within a year.
Erratum: A space weather mission concept: Observatories of the solar corona and active regions (oscar) (Journal of Space Weather and Space Climate (2015) 5 (A4) DOI: 10.1051/swsc/2015003)

In this erratum we acknowledge EASCO as one of the inspirational mission concepts that helped the development of our original mission concept OSCAR. It was brought to our attention that our original paper failed to acknowledge the mission concept EASCO, which was originally laid out in Gopalswamy et al. (2011). At the time we developed OSCAR, EASCO was one of the inspirational mission concepts on which we built our new and original concept of twin satellites leading and trailing the Earth with a separation angle of 68°. The omission of EASCO in our original paper was unintentional, and we wanted to acknowledge this important previous work in the present erratum.

Evaluation and comparison of the processing methods of airborne gravimetry concerning the errors effects on downward continuation results: Case studies in Louisiana (USA) and the Tibetan Plateau (China)

Gravity data gaps in mountainous areas are nowadays often filled in with the data from airborne gravity surveys. Because of the errors caused by the airborne gravimeter sensors, and because of rough flight conditions, such errors cannot be completely eliminated. The precision of the gravity disturbances generated by the airborne gravimetry is around 3â€œ5
mgal. A major obstacle in using airborne gravimetry are the errors caused by the downward continuation. In order to improve the results the external high-accuracy gravity information e.g., from the surface data can be used for high frequency correction, while satellite information can be applying for low frequency correction. Surface data may be used to reduce the systematic errors, while regularization methods can reduce the random errors in downward continuation. Airborne gravity surveys are sometimes conducted in mountainous areas and the most extreme area of the world for this type of survey is the Tibetan Plateau. Since there are no high-accuracy surface gravity data available for this area, the above error minimization method involving the external gravity data cannot be used. We propose a semi-parametric downward continuation method in combination with regularization to suppress the systematic error effect and the random error effect in the Tibetan Plateau; i.e., without the use of the external high-accuracy gravity data. We use a Louisiana airborne gravity dataset from the USA National Oceanic and Atmospheric Administration (NOAA) to demonstrate that the new method works effectively. Furthermore, and for the Tibetan Plateau we show that the numerical experiment is also successfully conducted using the synthetic Earth Gravitational Model 2008 (EGM08)-derived gravity data contaminated with the synthetic errors. The estimated systematic errors generated by the method are close to the simulated values. In addition, we study the relationship between the downward continuation altitudes and the error effect. The analysis results show that the proposed semi-parametric method combined with regularization is efficient to address such modelling problems.
This paper assesses the potential of using BDS and GPS signals to position in challenged environments such as indoors. Traditional assisted GNSS approaches that use code phase as measurements (i.e., coarse-time solutions) are shown to be prone to multipath and noise. An enhanced approach that has superior sensitivity and positioning performance—the so-called direct positioning receiver architecture—has been implemented and evaluated using live indoor BDS and/or GPS signals. Real indoor experiments have been conducted in Shanghai and significant improvement has been observed with enhanced approaches: results with BDS constellation show better horizontal positioning performance (biases are less than 10m) than using GPS alone, but are slightly worse in the vertical axis; when using the enhanced approach with BDS and GPS, both horizontal and vertical axes show promising results for the environments considered herein; the coarse-time state converges faster and is more reliable compared to other solutions.
Evaluation of the Global Mean Sea Level Budget between 1993 and 2014

Evaluating global mean sea level (GMSL) in terms of its components—mass and steric—is useful for both quantifying the accuracy of the measurements and understanding the processes that contribute to GMSL rise. In this paper, we review the GMSL budget over two periods—1993 to 2014 and 2005 to 2014—using multiple data sets of both total GMSL and the components (mass and steric). In addition to comparing linear trends, we also compare the level of agreement of the time series. For the longer period (1993–2014), we find closure in terms of the long-term trend but not for year-to-year variations, consistent with other studies. This is due to the lack of sufficient estimates of the amount of natural water mass cycling between the oceans and hydrosphere. For the more recent period (2005–2014), we find closure in both the long-term trend and for month-to-month variations. This is also consistent with previous studies.

General information
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Organisations: National Space Institute, Geodynamics, University of South Florida, International Space Science Institute, MERCATOR-Ocean, Utrecht University, Laboratoire d’Études en Géophysique et Océanographie Spatiales, Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS)
Authors: Chambers, D. P. (Ekstern), Cazenave, A. (Ekstern), Champollion, N. (Ekstern), Dieng, H. (Ekstern), Llovel, W. (Ekstern), Forsberg, R. (Intern), von Schuckmann, K. (Ekstern), Wada, Y. (Ekstern)
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Scopus rating (2016): SJR 2.076 SNIP 1.986 CiteScore 3.7
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.411 SNIP 1.775 CiteScore 3.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.647 SNIP 1.499 CiteScore 3.94
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Scopus rating (2013): SJR 3.573 SNIP 2.117 CiteScore 4.77
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.389 SNIP 1.7 CiteScore 3.3
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.395 SNIP 2.435 CiteScore 4.24
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.481 SNIP 2.51
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.765 SNIP 2.159
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.289 SNIP 1.499
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.916 SNIP 0.801
Scopus rating (2006): SJR 0.871 SNIP 1.322
Scopus rating (2005): SJR 0.652 SNIP 0.924
Scopus rating (2004): SJR 0.995 SNIP 1.292
Scopus rating (2003): SJR 0.531 SNIP 0.701
Scopus rating (2002): SJR 0.435 SNIP 0.373
Scopus rating (2001): SJR 0.675 SNIP 0.669
Web of Science (2001): Indexed yes
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Evidence of significant energy input in the late phase of a solar flare from NuSTAR x-ray observations

We present observations of the occulted active region AR 12222 during the third Nuclear Spectroscopic Telescope ARray (NuSTAR) solar campaign on 2014 December 11, with concurrent Solar Dynamics Observatory (SDO)/AIA and FOXSI-2 sounding rocket observations. The active region produced a medium-size solar flare 1 day before the observations, at ~18 UT on 2014 December 10, with the post-flare loops still visible at the time of NuSTAR observations. The time evolution of the source emission in the SDO/AIA 335 Å channel reveals the characteristics of an extreme-ultraviolet late-phase event, caused by the continuous formation of new post-flare loops that arch higher and higher in the solar corona. The spectral fitting of NuSTAR observations yields an isothermal source, with temperature 3.8–4.6 MK, emission measure (0.3–1.8) × 10^{46} cm^{-3}, and density estimated at (2.5–6.0) × 10^{8} cm^{-3}. The observed AIA fluxes are consistent with the derived NuSTAR temperature range, favoring temperature values in the range of 4.0–4.3 MK. By examining the post-flare loops’ cooling times and energy content, we estimate that at least 12 sets of post-flare loops were formed and subsequently cooled between the onset of the flare and NuSTAR observations, with their total thermal energy content an order of magnitude larger than the energy content at flare peak time. This indicates that the standard approach of using only the flare peak time to derive the total thermal energy content of a flare can lead to a large underestimation of its value.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Applied Sciences and Arts Northwestern Switzerland, University of Glasgow, University of Minnesota, University of California at Berkeley, California Institute of Technology, Air Force Research Laboratory, University of California, Santa Cruz, Columbia University, NASA Goddard Space Flight Center
Authors: Kuhar, M. (Ekstern), Krucker, S. (Ekstern), Hannah, I. G. (Ekstern), Glesener, L. (Ekstern), Saint-Hilaire, P. (Ekstern), Grefenstette, B. W. (Ekstern), Hudson, H. S. (Ekstern), White, S. M. (Ekstern), Smith, D. M. (Ekstern), Marsh, A. J. (Ekstern), Wright, P. J. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Stern, D. (Ekstern), Zhang, W. W. (Ekstern)
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BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.51
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.46
ISI indexed (2011): ISI indexed yes
Experiences With an Optimal Estimation Algorithm for Surface and Atmospheric Parameter Retrieval From Passive Microwave Data in the Arctic

We present experiences in using an integrated retrieval method for atmospheric and surface parameters in the Arctic using passive microwave data from the AMSR-E radiometer. The core of the method is a forward model which can ingest bulk data for seven geophysical parameters to reproduce the brightness temperatures observed by a passive microwave radiometer. The retrieval method inverts the forward model and produces ensembles of the seven parameters, wind speed, integrated water vapor, liquid water path, sea and ice temperature, sea ice concentration and multiyear ice fraction. The method is constrained using numerical weather prediction data in order to retrieve a set of geophysical parameters that best fit the measurements. A sensitivity study demonstrates the method is robust and that the solution it provides is not dependent on initialization conditions. The retrieval parameters have been compared with the Arctic Systems Reanalysis model data as well as columnar water vapor retrieved from satellite microwave sounders and the Remote Sensing Systems AMSR-E ocean retrieval product in order to determine the feasibility of using the same setup over pure surface with 100% and 0% sea ice cover, respectively. Sea ice concentration retrieval shows good skill for pure surface cases. Ice types retrieval is in good agreement with scatterometer backscatter data. Deficiencies have been identified in using the forward model over sea ice for retrieving atmospheric parameters, that are connected to the treatment of surface emissivity and surface temperature. The retrieval agrees well with legacy atmospheric retrieval products in open ocean areas.

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Organisations: National Space Institute, Microwaves and Remote Sensing, University of Bremen
Authors: Scarlat, R. C. (Ekstern), Heygster, G. (Ekstern), Pedersen, L. T. (Intern)
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Exploring the Recovery Lakes region and interior Dronning Maud Land, East Antarctica, with airborne gravity, magnetic and radar measurements

Long-range airborne geophysical measurements were carried out in the ICEGRAV campaigns, covering hitherto unexplored parts of interior East Antarctica and part of the Antarctic Peninsula. The airborne surveys provided a regional coverage of gravity, magnetic and ice-penetrating radar measurements for major Dronning Maud Land ice stream systems, from the grounding lines up to the Recovery Lakes drainage basin, and filled in major data voids in Antarctic data compilations, such as AntGP for gravity data, ADMAP for magnetic data and BEDMAP2 for ice thickness data and the sub-ice topography. We present the first maps of gravity, magnetic and ice thickness data and bedrock topography for the region and show examples of bedrock topography and basal reflectivity patterns. The 2013 Recovery Lakes campaign was carried out with a British Antarctic Survey Twin Otter aircraft operating from the Halley and Belgrano II stations, as well as a remote field camp located at the Recovery subglacial Lake B site. Gravity measurements were the primary driver for the survey, with two airborne gravimeters (Lacoste and Romberg and Chekan-AM) providing measurements at an accuracy level of around 2 mGal r.m.s., supplementing GOCE (Gravity Field and Steady-State Ocean Circulation Explorer) satellite data and confirming an excellent sub-milligal agreement between satellite and airborne data at longer wavelengths.

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Authors: Forsberg, R. (Intern), Olesen, A. V. (Intern), Ferraccioli, F. (Ekstern), Jordan, T. A. (Ekstern), Matsuoka, K. (Ekstern), Zakrajsek, A. (Ekstern), Ghidella, M. (Ekstern), Greenbaum, J. S. (Ekstern)
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Field-Aligned Current Response to Solar Indices

Magnetometer data from three satellite missions have been used to analyze and identify the effects of varying solar radiation on the magnitudes and locations of field-aligned currents in the Earth's upper atmosphere. Data from the CHAMP, Ørsted, and Swarm satellite missions have been bought together to provide a database spanning a 15 year
period. The extensive time frame has been augmented by data from the ACE satellite, as well as a number of indices of solar radiation. This data set has been sorted by a number of solar wind, interplanetary magnetic field, and solar radiation indices to provide measurements for the field-aligned current structures in both hemispheres for arbitrary seasonal tilts. In addition, routines have been developed to extract the total current for different regions of the current structures, including regions 0, 1, and 2. Results from this study have been used to evaluate the effects of variations in four different solar indices on the total current in different regions of the polar cap. While the solar indices do not have major influence on the total current of the polar cap when compared to solar wind and interplanetary magnetic field parameters it does appear that there is a nonlinear response to increasing $F_{10.7}$, $M_{10.7}$, and $S_{10.7}$ solar index. Surprisingly, there appears to be a very linear response as $Y_{10.7}$ solar index increases.
Evolution of cold dry snow and firm plays important roles in glaciology; however, the physical formulation of a densification law is still an active research topic. We forced eight firm-densification models and one seasonal-snow model in six different experiments by imposing step changes in temperature and accumulation-rate boundary conditions; all of the boundary conditions were chosen to simulate firm densification in cold, dry environments. While the intended application of the participating models varies, they are describing the same physical system and should in principle yield the same solutions. The firm models all produce plausible depth-density profiles, but the model outputs in both steady state and transient modes differ for quantities that are of interest in ice core and altimetry research. These differences demonstrate that firm-densification models are incorrectly or incompletely representing physical processes. We quantitatively characterize the differences among the results from the various models. For example, we find depth-integrated porosity is unlikely to be inferred with confidence from a firm model to better than 2 m in steady state at a specific site with known accumulation rate and temperature. Firm Model Intercomparison Experiment can provide a benchmark of results for future models, provide a basis to quantify model uncertainties and guide future directions of firm-densification modeling.
First NuSTAR Limits on Quiet Sun Hard X-Ray Transient Events

We present the first results of a search for transient hard X-ray (HXR) emission in the quiet solar corona with the Nuclear Spectroscopic Telescope Array (NuSTAR) satellite. While NuSTAR was designed as an astrophysics mission, it can observe the Sun above 2 keV with unprecedented sensitivity due to its pioneering use of focusing optics. NuSTAR first observed quiet-Sun regions on 2014 November 1, although out-of-view active regions contributed a notable amount of background in the form of single-bounce (unfocused) X-rays. We conducted a search for quiet-Sun transient brightenings on timescales of 100 s and set upper limits on emission in two energy bands. We set 2.5–4 keV limits on brightenings with timescales of 100 s, expressed as the temperature $T$ and emission measure $EM$ of a thermal plasma. We also set 10–20 keV limits on brightenings with timescales of 30, 60, and 100 s, expressed as model-independent photon fluxes. The limits in both bands are well below previous HXR microflare detections, though not low enough to detect events of equivalent $T$ and $EM$ as quiet-Sun brightenings seen in soft X-ray observations. We expect future observations during solar minimum to increase the NuSTAR sensitivity by over two orders of magnitude due to higher instrument livetime and reduced solar background.

General information
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Organisations: National Space Institute, Geodesy, Danish Coastal Authority
Authors: Thomsen, M. (Ekstern), Andersen, K. J. (Ekstern), Sørensen, C. S. (Intern)
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From Discrete Gravity Survey Data to a High-resolution Gravity Field Representation in the Nordic-Baltic Region

The deduction of a regularly spaced gravity anomaly grid from scattered survey data is studied, addressing mainly two aspects: reduction of gravity to anomalies and subsequent interpolation by various methods. The problem is illustrated in a heterogeneous study area and contrasting test areas including mountains, low terrains, and a marine area. Provided with realistic error estimates, Least Squares Collocation interpolation of Residual Terrain Model anomalies yields the highest quality gravity grid. In most cases, the Bouguer reduction and other interpolation methods tested are equally viable. However, spline-based interpolation should be avoided in marine areas with trackwise survey data.

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Organisations: National Space Institute, Geodynamics, Tallinn University of Technology, Lantmäteriet, Estonian Land Board, National Land Survey of Finland, The Norwegian Mapping Authority, Vilnius Gediminas Technical University, Latvian Geospatial Information Agency, Riga Technical University
Authors: Märdla, S. (Ekstern), Ågren, J. (Ekstern), Strykowski, G. (Intern), Oja, T. (Ekstern), Ellmann, A. (Ekstern), Forsberg, R. (Intern), Blikr-Koivula, M. (Ekstern), Omang, O. (Ekstern), Paršeliūnas, E. (Ekstern), Liepinš, I. (Ekstern), Kaminskis, J. (Ekstern)
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Web of Science (2015): Indexed yes
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Scopus rating (2013): SJR 0.98 SNIP 0.955 CiteScore 1.12
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BFI (2012): BFI-level 1
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ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.864 SNIP 0.904 CiteScore 1.1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.578 SNIP 0.976
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.552 SNIP 0.68
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.343 SNIP 0.435
Scopus rating (2007): SJR 1.448 SNIP 1.356
Global marine gravity field from recent satellites (DTU15) - Arctic improvements

Global marine gravity field modelling using satellite altimetry is currently undergoing huge improvements with the completion of the Jason-1 end-of-life geodetic mission, but particularly with the continuing Cryosat-2 mission. These new satellites provide three times as many geodetic mission altimetric sea surface height observations as ever before. The impact of these new geodetic mission data is a dramatic improvement of particularly the shorter wavelength of the gravity field (10-20 km) which is now being mapped at significantly higher accuracy. The quality of the altimetric gravity field is in many places surpassing the quality of gravity fields derived using non-commercial marine gravity observations. Cryosat-2 provides for the first time altimetry throughout the Arctic Ocean up to 88°N. Here, the huge improvement in marine gravity mapping is shown through comparison with high quality airborne data flown north of Greenland in 2009. An improvement of nearly 50% in terms of standard deviation with the airborne data was found when comparing with older gravity fields such as DTU10 and EGM08, which are the only global marine gravity fields available in the Arctic Ocean north of 80°N.

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Organisations: National Space Institute, Geodesy, S2 Analytics, NGA, SGT-inc
Authors: Andersen, O. B. (Intern), Knudsen, P. (Intern), Kenyon, S. (Ekstern), Factor, J. K. (Ekstern), Holmes, S. (Ekstern)
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Publication date: 2017
GPS phase scintillation and auroral electrojet currents during geomagnetic storms of March 17, 2013 and 2015

Interplanetary coronal mass ejections (ICMEs) compounded by high-speed plasma streams from coronal holes caused two intense geomagnetic storms on March 17–18, 2013 and 2015 during the current solar cycle. Ionospheric responses to the storms in the northern and southern hemispheres are compared in the context of solar wind coupling to the magnetosphere-ionosphere system. Phase scintillation is observed at high latitudes by arrays of high-rate GNSS Ionospheric Scintillation and TEC Monitors (GISTMs) and geodetic-quality GPS receivers sampling at 1 Hz. The high-rate GPS receivers are distributed in the northern and in the southern high latitudes with sparser coverage. In addition to GPS receivers, the high-latitude ionosphere dynamics is studied using arrays of ground-based instruments including HF radars, ionosondes, riometers, magnetometers, optical imagers as well as particle detectors and ultraviolet scanning imagers onboard the DMSP satellites.
Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A

On 2017 August 17, the gravitational-wave event GW170817 was observed by the Advanced LIGO and Virgo detectors, and the gamma-ray burst (GRB) GRB 170817A was observed independently by the Fermi Gamma-ray Burst Monitor, and the Anti-Coincidence Shield for the Spectrometer for the International Gamma-Ray Astrophysics Laboratory. The probability of the near-simultaneous temporal and spatial observation of GRB 170817A and GW170817 occurring by chance is $5.0 \times 10^{-8}$. We therefore confirm binary neutron star mergers as a progenitor of short GRBs. The association of GW170817 and GRB 170817A provides new insight into fundamental physics and the origin of short GRBs. We use the observed time delay of $(+1.74\pm 0.05) \text{s}$ between GRB 170817A and GW170817 to: (i) constrain the difference between the speed of gravity and the speed of light to be between $-3 \times 10^{-15}$ and $+7 \times 10^{-16}$ times the speed of light, (ii) place new bounds on the violation of Lorentz invariance, (iii) present a new test of the equivalence principle by constraining the Shapiro delay between gravitational and electromagnetic radiation. We also use the time delay to constrain the size and bulk Lorentz factor of the region emitting the gamma-rays. GRB 170817A is the closest short GRB with a known distance, but is between 2 and 6 orders of magnitude less energetic than other bursts with measured redshift. A new generation of gamma-ray detectors, and subthreshold searches in existing detectors, will be essential to detect similar short bursts at greater distances. Finally, we predict a joint detection rate for the Fermi Gamma-ray Burst Monitor and the Advanced LIGO and Virgo detectors of 0.1–1.4 per year during the 2018–2019 observing run and 0.3–1.7 per year at design sensitivity.

General information
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Kissel, J. S. (Ekstern), Kleybolte, L. (Ekstern), Klimenko, S. (Ekstern), Knowles, T. D. (Ekstern), Koch, P. (Ekstern),
Kimbrell, S. J. (Ekstern), King, E. J. (Ekstern), King, P. J. (Ekstern), Kinley-Hanlon, M. (Ekstern), Kirchhoff, R. (Ekstern),
Kim, C. (Ekstern), Kim, J. C. (Ekstern), Kim, K. (Ekstern), Kim, W. (Ekstern), Kim, W. S. (Ekstern), Kim, Y. (Ekstern),
(Ekstern), Khan, I. (Ekstern), Khan, S. (Ekstern), Khan, Z. (Ekstern), Khazanov, E. A. (Ekstern), Kijbunchoo, N. (Ekstern),
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Kim, W. (Ekstern), Kim, W. S. (Ekstern), Kim, Y. (Ekstern), Kimbell, A. J. (Ekstern), Kennedy, R. (Ekstern), Key, J. S. (Ekstern),
GRB 161219B / SN 2016jca: A low-redshift gamma-ray burst supernova powered by radioactive heating
Since the first discovery of a broad-lined type Ic supernova (SN) with a long-duration gamma-ray burst (GRB) in 1998, fewer than fifty gamma-ray burst supernovae (GRB-SNe) have been discovered. The intermediate-luminosity Swift GRB 161219B and its associated supernova SN 2016jca, which occurred at a redshift of $z = 0.1475$, represents only the seventh GRB-SN to have been discovered within 1 Gpc, and hence provides an excellent opportunity to investigate the observational and physical properties of these very elusive and rare type of SN. As such, we present optical to near-infrared photometry and optical spectroscopy of GRB 161219B and SN 2016jca, spanning the first three months since its discovery. GRB 161219B exploded in the disk of an edge-on spiral galaxy at a projected distance of 3.4 kpc from the galactic centre. GRB 161219B itself is an outlier in the $E_{p,1} - E_{\gamma,iso}$ plane, while SN 2016jca had a rest-frame, peak absolute V-band magnitude of $M_V = -19.0$, which it reached after 12.5 rest-frame days. We find that the bolometric properties of SN 2016jca are inconsistent with being powered solely by a magnetar central engine, as proposed by other authors, and demonstrate that it was likely powered exclusively by energy deposited by the radioactive decay of nickel and cobalt into their daughter products, which were nucleosynthesized when its progenitor underwent core collapse. We find that 0.22 M$_\odot$ of nickel is required to reproduce the peak luminosity of SN 2016jca, and we constrain an ejecta mass of 5.8 M$_\odot$ and a kinetic energy of $\approx 5 \times 10^{52}$ erg. Finally, we report on a chromatic, pre-maximum bump in the g-band light curve, and discuss its possible origin. [Abridged].

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Organisations: National Space Institute, Instituto de Astrofísica de Andalucía, Max-Planck Institut für Extraterrestrische Physik, University of Iceland, University of Copenhagen, Instituto de Astrofísica de Canarias, Universidad de Chile, National Institute for Astrophysics, University Paris Diderot - Paris 7, University of Nova Gorica, University of Amsterdam, Weizmann Institute of Science, Oskar Klein Centre, University of Leicester
Number of pages: 23
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Greenland and Antarctica Ice Sheet Mass Changes and Effects on Global Sea Level

Thirteen years of GRACE data provide an excellent picture of the current mass changes of Greenland and Antarctica, with mass loss in the GRACE period 2002–2015 amounting to 265 ± 25 GT/year for Greenland (including peripheral ice caps), and 95 ± 50 GT/year for Antarctica, corresponding to 0.72 and 0.26 mm/year average global sea level change. A significant acceleration in mass loss rate is found, especially for Antarctica, while Greenland mass loss, after a corresponding acceleration period, and a record mass loss in the summer of 2012, has seen a slight decrease in short-term mass loss trend. The yearly mass balance estimates, based on point mass inversion methods, have relatively large errors, both due to uncertainties in the glacial isostatic adjustment processes, especially for Antarctica, leakage from unmodelled ocean mass changes, and (for Greenland) difficulties in separating mass signals from the Greenland ice sheet and the adjacent Canadian ice caps. The limited resolution of GRACE affects the uncertainty of total mass loss to a smaller degree; we illustrate the “real” sources of mass changes by including satellite altimetry elevation change results in a joint inversion with GRACE, showing that mass change occurs primarily associated with major outlet glaciers, as well as a narrow coastal band. For Antarctica, the primary changes are associated with the major outlet glaciers in West Antarctica (Pine Island and Thwaites Glacier systems), as well as on the Antarctic Peninsula, where major glacier accelerations have been observed after the 2002 collapse of the Larsen B Ice Shelf.

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Scopus rating (2017): SNIP 1.943 SJR 1.813
Web of Science (2017): Indexed yes
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Scopus rating (2014): SJR 2.647 SNIP 1.499 CiteScore 3.94
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 3.573 SNIP 2.117 CiteScore 4.77
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BFI (2012): BFI-level 1
Greenland Ice Shelves and Ice Tongues

This chapter focuses on a review of the glaciers on north and northeast Greenland that terminate in fiords with long glacier tongues and floating, ice-shelf-like margins. There is some debate as to whether these glacier tongues can be classified as a traditional ice shelf, so the relevant literature and physical properties are reviewed. There exists a difference between: (1) Floating glaciers in northern Greenland (>77°N) which experience bottom melting as their dominant ablation mechanism and calve relatively thin, but large (km-sized) tabular icebergs ('ice islands'), and (2) Grounded glaciers further south (<77°N), where iceberg calving provides the dominant ablation mechanism. The relatively smaller iceberg discharge in northern Greenland is closely related to the occurrence of extended floating glacier sections, allowing bottom melting estimated at up to 10 m year⁻¹ for locations such as Petermann Glacier. A case study is described of the physical characteristics and historical changes of Nioghalvfjerdsfjorden Glacier, NE Greenland, based on field and remote sensing studies.

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Sådan kan samarbejde mellem industrien, universiteterne og sundhedsvæsenet skabe gode løsninger til forebyggelse, diagnostik, patientbehandling og rehabilitering.
Highly temporally resolved response to seasonal surface melt of the Zachariae and 79N outlet glaciers in Northeast Greenland

The seasonal response to surface melting of the Northeast Greenland Ice Stream outlets, Zachariae and 79N, is investigated using new highly temporally resolved surface velocity maps for 2016 combined with numerical modelling. The seasonal speed-up at 79N of 0.15km/yr is suggested to be driven by a decrease in effective basal pressure induced by surface melting, whereas for Zachariae its 0.11km/yr seasonal speed-up correlates equally well with the break-up of its large ice mélange. We investigate the influence 76km long floating tongue at 79N, finding it provides little resistance and that most of it could be lost without impacting the dynamics of the area. Furthermore, we show that reducing the slipperiness along the tongue–wall interfaces produces a velocity change spatially inconsistent with the observed seasonal speed-up. Finally, we find that subglacial sticky spots such as bedrock bumps play a negligible role in the large-scale response to a seasonally enhanced basal slipperiness of the region.

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Organisations: National Space Institute, Microwaves and Remote Sensing, University of Copenhagen, Geological Survey of Denmark and Greenland, British Antarctic Survey, Danish Meteorological Institute
Authors: Rathmann, N. M. (Ekstern), Hvidberg, C. S. (Ekstern), Solgaard, A. M. (Ekstern), Grinsted, A. (Ekstern), Gudmundsson, G. H. (Ekstern), Langen, P. L. (Ekstern), Nielsen, K. P. (Ekstern), Kusk, A. (Intern)
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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The crust–mantle boundary (the Moho) is a first order interface in the Earth and the depth to the Moho is therefore well studied in most regions. However, below regions which are covered by large ice sheets, such as Greenland and Antarctica, the Moho is only partly known and seismic data are difficult to obtain. Here, we take advantage of the global gravity model EIGEN-6C4, together with the Parker-Oldenburg algorithm, to estimate the depth to the Moho beneath Greenland and surroundings. The available free-air gravity data are corrected for the topographic effect and the effect of sedimentary basins. We also correct for the effect on gravity due to the weight of the ice sheet and the accompanying deflection of the Earth's surface, which has not previously been taken into account in gravity studies of currently glaciated regions. Our final Moho depth model for Greenland has an associated uncertainty of ±4.5 km for areas with sedimentary basins and ±4 km for areas without sedimentary basins. The model shows maximum Moho depths below east Greenland of up to 55 km and values less than 20 km offshore east Greenland. There is a marked increase in Moho depth of 10–15 km from northern to central Greenland, indicating a significant change in geology. A deep Moho at the northern coast of Greenland towards Ellesmere Island might be related to the location of the hot-spot track. Our Moho model is consistent with previous models, but has a higher lateral resolution of 0.1° and covers the entire area of on- and offshore Greenland.
Ice-dammed lake drainage in west Greenland: Drainage pattern and implications on ice flow and bedrock motion

Ice-dammed lakes drain frequently in Greenland, but the impacts of these events differ between sites. Here we study the quasi-cyclic behavior of the ~40 km² Lake Tininnilik in west Greenland and its impact on ice flow and crustal deformation. Data reveal rapid drainage of 1.83 ± 0.17 km³ of water in less than 7 days in 2010, leading to a speedup of the damming glacier, and an instantaneous modeled elastic bedrock uplift of 18.6 ± 0.1 mm confirmed by an independent lakeside GPS record. Since ice-dammed lakes are common on Greenland, our results highlight the importance of including other sources of surface loading in addition to ice mass change, when assessing glacial isostatic adjustment or elastic rebound using geodetic data. Moreover, the results illustrates a linkage between subglacial discharge and ice surface velocity, important for assessing ice flux, and thus mass balance, in a future warming climate.

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Organisations: National Space Institute, Geodesy, University of Copenhagen, University of California at Irvine
Authors: Kjeldsen, K. K. (Intern), Khan, S. A. (Intern), Bjørk, A. (Ekstern), Nielsen, K. (Intern), Mouginot, J. (Ekstern)
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BFI (2011): BFI-level 1
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Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Geological records reveal a number of ancient, large and rapid negative excursions of carbon-13 isotope. Such excursions can only be explained by massive injections of depleted carbon to the Earth System over a short duration. These injections may have forced strong global warming events, sometimes accompanied by mass extinctions, for example the Triassic-Jurassic and End-Permian extinctions, 201 and 252 million years ago. In many cases evidence points to methane as the dominant form of injected carbon, whether as thermogenic methane, formed by magma intrusions through overlying carbon-rich sediment, or from warming-induced dissociation of methane hydrate, a solid compound of methane and water found in ocean sediments. As a consequence of the ubiquity and importance of methane in major Earth events, Earth System models should include a comprehensive treatment of methane cycling but such a treatment has often been lacking. Here we implement methane cycling in the Danish Center for Earth System Science (DCESS) model, a simplified but well-tested Earth System Model of Intermediate Complexity. We use a generic methane input function that allows variation of input type, size, time scale and ocean-atmosphere partition. To be able to treat such massive inputs more correctly, we extend the model to deal with ocean suboxic/anoxic conditions and with radiative forcing and methane lifetimes appropriate for high atmospheric methane concentrations. With this new model version, we carried out an extensive set of simulations for methane inputs of various sizes, time scales and ocean-atmosphere partitions to probe model behaviour. We find that larger methane inputs over shorter time scales with more methane
dissolving in the ocean lead to ever-increasing ocean anoxia with consequences for ocean life and global carbon cycling. Greater methane input directly to the atmosphere leads to more warming and, for example, greater carbon dioxide release from land soils. Analysis of synthetic sediment cores from the simulations provides guidelines for the interpretation of real sediment cores spanning the warming events. With this improved DCESS model version and paleo-reconstructions, we are now better armed to gauge the amounts, types, time scales and locations of methane injections driving specific, observed deep time, global warming events.

General information
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Organisations: National Space Institute, Innovation and Research-based consultancy, University of Copenhagen, University of Chile, Purdue University, Danish Meteorological Institute
Authors: Shaffer, G. (Ekstern), Villanueva, E. F. (Ekstern), Rondanelli, R. (Ekstern), Pedersen, J. O. P. (Intern), Olsen, S. M. (Ekstern), Huber, M. (Ekstern)
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Implications of changing scattering properties on Greenland ice sheet volume change from Cryosat-2 altimetry
Long-term observations of surface elevation change of the Greenland ice sheet (GrIS) is of utmost importance when assessing the state of the ice sheet. Satellite radar altimetry offers a long time series of data over the GrIS, starting with ERS-1 in 1991. ESA's Cryosat-2 mission, launched in 2010, provides an invaluable radar altimetry dataset for monitoring the current changes of the ice sheets due to its dense spatial and temporal coverage of these areas. Here, we investigate
the effects of including different parameters which describe the shape of the return radar waveform (waveform parameters) in the elevation change algorithm, to correct for temporal changes in the ratio between surface- and volume-scatter in Cryosat-2 observations. We present elevation and volume changes for the Greenland ice sheet in the period from 2010 until 2014. The waveform parameters considered here are the backscatter coefficient, and the leading edge width, which are both available in the ESA Cryosat-2 Level-2i data product. Investigations into relocation of radar reflection points are also included. Inter-comparison of the Cryosat-2 derived elevation changes with those derived from Operation IceBridge laser data suggests waveform parameters to be applicable for correcting for changes in volume scattering. The best results in the Synthetic Aperture Radar Interferometric mode area of the GrIS are found when applying only the backscatter correction, whereas the best result in the Low Resolution Mode area is obtained by only applying a leading edge width correction. Using this approach to correct for the scattering properties, a volume loss of $-292\pm38\ \text{km}^3\ \text{yr}^{-1}$ is found for the GrIS for the time span November 2010 until November 2014. The inclusion of waveform parameter corrections and improved relocation for the GrIS, helps to reconcile the satellite-derived elevation changes with those observed by Operation IceBridge. However, the bias of temporal changes in the scattering horizons of Cryosat-2 is not entirely removed and suggests that future improvements could be made by including climate data and/or additional waveform parameters to make additional corrections in the Cryosat-2 radar altimetry.

**General information**

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Organisations: National Space Institute, Geodynamics  
Authors: Simonsen, S. B. (Intern), Sørensen, L. S. (Intern)  
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Scopus rating (2015): SJR 3.697 SNIP 3.044 CiteScore 7.27  
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Scopus rating (2013): SJR 3.148 SNIP 2.982 CiteScore 5.6  
ISI indexed (2013): ISI indexed yes  
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Scopus rating (2012): SJR 3.449 SNIP 3.663 CiteScore 5.99  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
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ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 2  
Scopus rating (2010): SJR 2.786 SNIP 2.789  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 2
Improving SAR Automatic Target Recognition Models with Transfer Learning from Simulated Data

Data-driven classification algorithms have proved to do well for automatic target recognition (ATR) in synthetic aperture radar (SAR) data. Collecting data sets suitable for these algorithms is a challenge in itself as it is difficult and expensive. Due to the lack of labeled data sets with real SAR images of sufficient size, simulated data play a big role in SAR ATR development, but the transferability of knowledge learned on simulated data to real data remains to be studied further. In this letter, we show the first study of Transfer Learning between a simulated data set and a set of real SAR images. The simulated data set is obtained by adding a simulated object radar reflectivity to a terrain model of individual point scatters, prior to focusing. Our results show that a Convolutional Neural Network (Convnet) pretrained on simulated data has a great advantage over a Convnet trained only on real data, especially when real data are sparse. The advantages of pretraining the models on simulated data show both in terms of faster convergence during the training phase and on the end accuracy when benchmarked on the Moving and Stationary Target Acquisition and Recognition data set. These results encourage SAR ATR development to continue the improvement of simulated data sets of greater size and complex scenarios in order to build robust algorithms for real life SAR ATR applications.

General information
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Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Terma A/S
Authors: Malmgren-Hansen, D. (Intern), Kusk, A. (Intern), Dall, J. (Intern), Nielsen, A. A. (Intern), Engholm, R. (Ekstern), Skriver, H. (Intern)
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Increased ionization supports growth of aerosols into cloud condensation nuclei

Ions produced by cosmic rays have been thought to influence aerosols and clouds. In this study, the effect of ionization on the growth of aerosols into cloud condensation nuclei is investigated theoretically and experimentally. We show that the mass-flux of small ions can constitute an important addition to the growth caused by condensation of neutral molecules. Under atmospheric conditions the growth from ions can constitute several percent of the neutral growth. We performed experimental studies which quantify the effect of ions on the growth of aerosols between nucleation and sizes >20nm and find good agreement with theory. Ion-induced condensation should be of importance not just in Earth’s present day atmosphere for the growth of aerosols into cloud condensation nuclei under pristine marine conditions, but also under elevated atmospheric ionization caused by increased supernova activity.

General information

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Hebrew University of Jerusalem
Authors: Svensmark, H. (Intern), Enghoff, M. B. (Intern), Shaviv, N. J. (Ekstern), Svensmark, J. (Intern)
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Industrialization of the mirror plate coatings for the ATHENA mission

In the frame of the development of the Advanced Telescope for High-ENergy Astrophysics (Athena) mission, currently in phase A, ESA is continuing to mature the optics technology and the associated mass production techniques. These efforts are driven by the programmatic and technical requirement of reaching TRL 6 prior to proposing the mission for formal adoption (planned for 2020). A critical part of the current phase A preparation activities is addressing the industrialization of the Silicon Pore Optics mirror plates coating. This include the transfer of the well-established coating processes and techniques, performed at DTU Space, to an industrial scale facility suitable for coating the more than 100,000 mirror plates required for Athena. In this paper, we explain the considerations for the planned coating facility including, requirement specification, equipment and supplier selection, preparing the coating facility for the deposition equipment, designing and fabrication.
Informing a hydrological model of the Ogooué with multi-mission remote sensing data

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Geodesy, DHI GRAS
Authors: Kittel, C. M. M. (Intern), Bauer-Gottwein, P. (Intern), Nielsen, K. (Intern), Tøttrup, C. (Ekstern)
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In-Situ Calibration of UFFO/Lomonosov for Observation of GRBs

The UFFO/Lomonosov has been successfully launched into Sun synchronous orbit and is operational through tests and calibrations since its launch on Apr. 28, 2016. As a pathfinder of UFFO, it will be the first space instrument to use a fast slewing mirror which reduce the trigger latency of optical telescope, less than a second, to explore early time domain of GRB evolution. In this article, we will report in detail the first mission, UFFO/Lomonosov, for the rapid response to observe early photons from GRBs in orbit.

INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817

We report the INTEGRAL detection of the first prompt gamma-ray signal coincident with the gravitational-wave event GW170817, measured by the SPI-ACS instrument about 2 s after the end of the GW event. We measure a fluence of $(1.4 \pm 0.4 \pm 0.6) \times 10^{-7}$ erg
cm$^{-2}$ (75–2000 keV), where, respectively, the statistical error is given at the 1σ confidence level, and the systematic error corresponds to the uncertainty in the spectral model and instrument response. We also report on the pointed follow-up observations carried out by INTEGRAL, starting 19.5 hr after the event, and lasting for 5.4 days. We provide a stringent upper limit on any electromagnetic signal in a very broad energy range, from 3 keV to 8 MeV, constraining the soft gamma-ray afterglow flux to $<7.1 \times 10^{-11}$ erg cm$^{-2}$ s$^{-1}$ (80–300 keV). Exploiting the unique capabilities of INTEGRAL, we constrained the gamma-ray line emission from radioactive decays that are expected to be the principal source of the energy behind a kilonova event following a BNS coalescence. Finally, we put a stringent upper limit on any delayed bursting activity, for example, from a newly formed magnetar.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Geneva, National Institute for Astrophysics, Max-Planck Institut für Extraterrestrische Physik, CAB/INTA-CSIC, University College Dublin, Université de Toulouse, University Paris Diderot - Paris 7, Russian Academy of Sciences, Moscow Institute of Physics and Technology, ESTEC

Authors: Savchenko, V. (Ekstern), Ferrigno, C. (Ekstern), Kuulkers, E. (Ekstern), Bazzano, A. (Ekstern), Bozzo, E. (Ekstern), Brandt, S. (Intern), Chenevez, J. (Intern), Courvoisier, T. J. (Ekstern), Diehl, R. (Ekstern), Domingo, A. (Ekstern), Hanlon, L. (Ekstern), Jourdain, E. (Ekstern), von Kienlin, A. (Ekstern), Laurent, P. (Ekstern), Lebrun, F. (Ekstern), Lutovinov, A. (Ekstern), Martin-Carrillo, A. (Ekstern), Mereghetti, S. (Ekstern), Natalucci, L. (Ekstern), Rodi, J. (Ekstern), Roques, J. (Ekstern), Sunyaev, R. (Ekstern), Ubertini, P. (Ekstern)

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**Relations**

Projects:

INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817

Press / Media items:

Sensationel tyngdebølgemåling åbner nyt kapitel i udforskningen af rummet

Ugens podcast: Dansk rumudstyr bidrog til årets astronihed
INTEGRAL IBIS, SPI, and JEM-X observations of LVT151012

During the first observing run of LIGO, two gravitational wave events and one lower-significance trigger (LVT151012) were reported by the LIGO/Virgo collaboration. At the time of LVT151012, the INTErnational Gamma-Ray Astrophysics Laboratory (INTEGRAL) was pointing at a region of the sky coincident with the high localization probability area of the event and thus permitted us to search for its electromagnetic counterpart (both prompt and afterglow emission). The imaging instruments on-board INTEGRAL (IBIS/ISGRI, IBIS/PI0sIT, SPI, and the two JEM-X modules) have been exploited to attempt the detection of any electromagnetic emission associated with LVT151012 over 3 decades in energy (from 3 keV to 8 MeV). The omni-directional instruments on-board the satellite, i.e. the SPI-ACSand the IBIS/Veto, complemented the capabilities of the IBIS/ISGRI and IBIS/PI0sIT for detections outside their imaging field of view in order to provide an efficient monitoring of the entire LVT151012 localization region at energies above 75 keV. We did not find any significant transient source that was spatially and/or temporally coincident with LVT151012, obtaining tight upper limits on the associated hard X-ray and γ-ray radiation. For typical spectral models, the upper limits on the fluence of the emission from any 1 s long-lasting counterpart of LVT151012 ranges from $F_{\gamma} = 3.5 \times 10^{-6}$ erg cm$^{-2}$ (20 – 200 keV), within the field of view of the imaging instruments, to $F_{\gamma} = 7.1 \times 10^{-7}$ erg cm$^{-2}$ (75 – 2000 keV), considering the least favorable location of the counterpart for a detection by the omni-directional instruments. These results can be interpreted as a tight constrain on the ratio of the isotropic equivalent energy released in the electromagnetic emission to the total energy of the gravitational waves: $E_{75-2000\; keV}/E_{GW} < 4.4 \times 10^{-5}$. Finally, we provide an exhaustive summary of the capabilities of all instruments on-board INTEGRAL to hunt for γ-ray counterparts of gravitational wave events, exploiting both serendipitous and pointed follow-up observations. This will serve as a reference for all future searches.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University Paris Diderot - Paris 7, National Institute for Astrophysics, University of Geneva, Max-Planck-Institut für extraterrestrische Physik, University College Dublin, Max-Planck Institut für Extraterrestrische Physik, ESTEC, CEA Saclay, Russian Academy of Sciences, Université de Toulouse
Authors: Savchenko, V. (Ekstern), Bazzano, A. (Ekstern), Bozzo, E. (Ekstern), Brandt, S. (Intern), Chenevez, J. (Intern), Courvoisier, T. J. L. (Ekstern), Diehl, R. (Ekstern), Ferrigno, C. (Ekstern), Hanlon, L. (Ekstern), von Kienlin, A. (Ekstern), Kuulkers, E. (Ekstern), Laurent, P. (Ekstern), Lebrun, F. (Ekstern), Lutovinov, A. A. (Ekstern), Martin-Carrillo, A. (Ekstern), Mereghetti, S. (Ekstern), Natalucci, L. (Ekstern), Roques, J. P. (Ekstern), Siegert, T. (Ekstern), Sunyaev, R. (Ekstern), Ubertini, P. (Ekstern)
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Scopus rating (2017): SJR 2.265 SNIP 1.099
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INTEGRAL Observations of GW170104

We used data from the International Gamma-Ray Astrophysics Laboratory (INTEGRAL) to set upper limits on the γ-ray and hard X-ray prompt emission associated with the gravitational-wave event GW170104, discovered by the Laser Interferometer Gravitational-wave Observatory (LIGO)/Virgo collaboration. The unique omnidirectional viewing capability of the instruments on board INTEGRAL allowed us to examine the full 90% confidence level localization region of the LIGO trigger. Depending on the particular spectral model assumed and the specific position within this region, the upper limits inferred from the INTEGRAL observations range from $F_\gamma = 1.9 \times 10^{-7}$ erg cm$^{-2}$ to $F_\gamma = 10^{-6}$ erg cm$^{-2}$ (75 keV–2 MeV energy range). This translates into a ratio between the prompt energy released in γ-rays along the direction to the observer and the gravitational-wave energy of $E_\gamma /E_{GW} < 2.6 \times 10^{-5}$. Using the INTEGRAL results, we cannot confirm the γ-ray proposed counterpart to GW170104 by the Astro—Rivelatore Gamma a Immagini Leggero (AGILE) team with the mini-Calorimeter (MCAL) instrument. The reported flux of the AGILE/MCAL event, $E_2$, is not compatible with the INTEGRAL upper limits within most of the 90% LIGO localization region. There is only a relatively limited portion of the sky where the sensitivity of the INTEGRAL instruments was not optimal and the lowest-allowed fluence estimated for $E_2$ would still be compatible with the INTEGRAL results. This region was also observed independently by Fermi/Gamma-ray Burst Monitor and AstroSAT, from which, as far as we are aware, there are no reports of any significant detection of a prompt high-energy event.
Intermediate-duration burst from AX J1754.2-2754 detected by INTEGRAL

The JEM-X instrument on-board INTEGRAL has detected a 15-minute long burst from the source AX J1754.2-2754 during an observation of the Galactic Center (PI J. Wilms) on March 12, 2017. This finding has been achieved in the framework of the INTEGRAL monitoring of long X-ray bursts (Chenevez et al. 2008, arXiv:0811.0904) and is only the second burst registered from this source (Chehadev & Grebenev, ATel #1094; AstL 33, 807, 2007). The 3-25 keV light curve shows that the burst started on MJD 57824.16535 (UT 12 March 2017 03:58:06) with a 30-s rise followed by a 2-minute long plateau at about 70% of the peak level. After the peak, the intensity slowly decreased back to the pre-burst level, which is below our detection threshold, about 15 minutes after the burst start. The burst is shorter in the hard energy band (10-25 keV) with respect to the soft energy band (3-10 keV), lasting only 200 sec. The start of the burst in the hard energy band has a delay of 30 seconds with respect to that of the soft energy band. This coincides with the peak of the burst in the 3-25 keV energy band, at a flux corresponding to 3.3 Crab. A preliminary time-resolved spectral analysis reveals an anti-correlation between the inferred black-body temperature and radius, in the first part of the burst. This is characteristic of a strong photospheric radius expansion phase. The highest flux is reached during the rise of the 3-25 keV light curve at an unabsorbed bolometric value of $7.3 \times 10^{-8}$ erg/cm$^2$/s. The source is not detected outside the burst interval, with a 3-$\sigma$ upper limit of 4 mCrab in the JEM-X range, and the burst is only marginally detected by the IBIS/ISGRI instrument in the 20-40 keV energy band. Previous observations regularly taken since February 13, when the region became visible by INTEGRAL, do not reveal any emission from the source, and we infer a 3-$\sigma$ upper limit on the persistent flux of 10-10 erg/cm$^2$/s between 3-40 keV. We tentatively interpret this as an intermediate-duration burst (see, e.g., Cumming et al., ApJ 646, 429, 2006) with a superexpansion phase (see in ‘t Zand & Weinberg, A&A 520, 81, 2010). This is consistent with the system being an ultra-compact X-ray binary, accreting pure helium at low rate (Bassa et al. 2008, ATel #1575). Assuming the Eddington luminosity at the burst peak equals $3.8 \times 10^{38}$ erg/s (Kuulkers et al., A&A 399, 663, 2003) we derive a source distance of 6.6 $\pm$ 0.4 kpc. At this distance, the upper-limit on the persistent emission translates to a 3-40 keV luminosity of $5.2 \times 10^{35}$ erg/s, which is consistent with previous values measured when the source was observed in outburst with Chandra (Jonker & Keek 2008, ATel #1643) and Swift (Maccarone et al. 2012, ATel #4109). INTEGRAL will continue to monitor the region around AX J 1754.2-2754 1-2 times per week until mid-April, which makes it possible to further follow the behavior of this very-faint neutron star X-ray binary.
Joint inversion of satellite-detected tidal and magnetospheric signals constrains electrical conductivity and water content of the upper mantle and transition zone

We present a new global electrical conductivity model of Earth's mantle. The model was derived by using a novel methodology, which is based on inverting satellite magnetic field measurements from different sources simultaneously. Specifically, we estimated responses of magnetospheric origin and ocean tidal magnetic signals from the most recent Swarm and CHAMP data. The challenging task of properly accounting for the ocean effect in the data was addressed through full three-dimensional solution of Maxwell's equations. We show that simultaneous inversion of magnetospheric and tidal magnetic signals results in a model with much improved resolution. Comparison with laboratory-based conductivity profiles shows that obtained models are compatible with a pyrolytic composition and a water content of 0.01 wt% and 0.1 wt% in the upper mantle and transition zone, respectively.
Jupiter's interior and deep atmosphere: The initial pole-to-pole passes with the Juno spacecraft

On 27 August 2016, the Juno spacecraft acquired science observations of Jupiter, passing less than 5000 kilometers above the equatorial cloud tops. Images of Jupiter's poles show a chaotic scene, unlike Saturn's poles. Microwave sounding reveals weather features at pressures deeper than 100 bars, dominated by an ammonia-rich, narrow low-latitude plume resembling a deeper, wider version of Earth's Hadley cell. Near-infrared mapping reveals the relative humidity within prominent downwelling regions. Juno's measured gravity field differs substantially from the last available estimate and is one order of magnitude more precise. This has implications for the distribution of heavy elements in the interior, including the existence and mass of Jupiter's core. The observed magnetic field exhibits smaller spatial variations than expected, indicative of a rich harmonic content.

General information
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Jupiter's magnetosphere and aurorae observed by the Juno spacecraft during its first polar orbits

The Juno spacecraft acquired direct observations of the jovian magnetosphere and auroral emissions from a vantage point above the poles. Juno's capture orbit spanned the jovian magnetosphere from bow shock to the planet, providing magnetic field, charged particle, and wave phenomena context for Juno's passage over the poles and traverse of Jupiter's hazardous inner radiation belts. Juno's energetic particle and plasma detectors measured electrons precipitating in the polar regions, exciting intense aurorae, observed simultaneously by the ultraviolet and infrared imaging spectographs. Juno transited beneath the most intense parts of the radiation belts, passed about 4000 kilometers above the cloud tops at closest approach, well inside the jovian rings, and recorded the electrical signatures of high-velocity impacts with small particles as it traversed the equator.
LCS-1: A high-resolution global model of the lithospheric magnetic field derived from CHAMP and Swarm satellite observations

We derive a new model, named LCS-1, of Earth’s lithospheric field based on four years (Sept 2006 – Sept 2010) of magnetic observations taken by the CHAMP satellite at altitudes lower than 350 km, as well as almost three years (April 2014 to December 2016) of measurements taken by the two lower Swarm satellites Alpha and Charlie. The model is determined entirely from magnetic “gradient” data (approximated by finite differences): the North-South gradient is approximated by first differences of 15 second along-track data (for CHAMP and each of the two Swarm satellites), while the East-West gradient is approximated by the difference between observations taken by Swarm Alpha and Charlie. In total, we used 6.2 mio data points. The model is parametrized by 35,000 equivalent point sources located on an almost equal-area grid at a depth of 100 km below the surface (WGS84 ellipsoid). The amplitudes of these point sources are determined by minimizing the misfit to the magnetic satellite “gradient” data together with the global average of |Br| at the ellipsoid surface (i.e. applying a L1 model regularisation of Br). In a final step we transform the point-source representation to a spherical harmonic expansion. The model shows very good agreement with previous satellite-derived lithospheric field models at low degree (degree correlation above 0.8 for degrees n ≤ 133). Comparison with independent near-surface
aeromagnetic data from Australia yields good agreement (coherency > 0.55) at horizontal wavelengths down to at least 250 km, corresponding to spherical harmonic degree $n \approx 160$. The LCS-1 vertical component and field intensity anomaly maps at Earth’s surface show similar features to those exhibited by the WDMAM2 and EMM2015 lithospheric field models truncated at degree 185 in regions where they include near-surface data and provide unprecedented detail where they do not. Example regions of improvement include the Bangui anomaly region in central Africa, the west African cratons, the East African Rift region, the Bay of Bengal, the southern 90° E ridge, the Cretaceous quiet zone south of the Walvis Ridge and the younger parts of the South Atlantic.

**General information**

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Linear Response of Field-Aligned Currents to the Interplanetary Electric Field

Many studies that have shown that the ionospheric, polar cap electric potentials (PCEP) exhibit a “saturation” behavior in response to the level of the driving by the solar wind. As the magnitude of the interplanetary magnetic field (IMF) and electric field (IEF) increase, the PCEP response is linear at low driving levels, followed with a roll-over to a more constant level. While there are several different theoretical explanations for this behavior, so far no direct observational evidence has existed to confirm any particular model. In most models of this saturation, the interaction of the field-aligned currents (FAC) with the solar wind/magnetosphere/ionosphere system has a role. As the FAC are more difficult to measure, their behavior in response to the IEF has not been investigated as thoroughly. In order to resolve the question of whether or not the FAC also exhibit saturation, we have processed the magnetic field measurements from the Ørsted, CHAMP, and Swarm missions, spanning more than a decade. As the amount of current in each region needs to be known, a new technique is used to separate and sum the current by region, widely known as R0, R1, and R2. These totals are found separately for the dawn and dusk sides. Results indicate that the total FAC has a response to the IEF that is highly linear, continuing to increase well beyond the level at which the electric potentials saturate. The currents within each region have similar behavior.

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Scopus rating (2010): SJR 3.056 SNIP 1.753
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Scopus rating (2009): SJR 2.85 SNIP 1.738
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 2.826 SNIP 1.529
Web of Science (2008): Indexed yes
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Web of Science (2007): Indexed yes
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Web of Science (2006): Indexed yes
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Web of Science (2005): Indexed yes
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Looking at A 0535+26 at low luminosities with NuSTAR

We report on two NuSTAR observations of the high-mass X-ray binary A 0535+26 taken toward the end of its normal 2015 outburst at very low 3–50 keV luminosities of $\sim 1.4 \times 10^{36}$ erg s$^{-1}$ and $\sim 5 \times 10^{35}$ erg s$^{-1}$, which are complemented by nine Swift observations. The data clearly confirm indications seen in earlier data that the source’s spectral shape softens as it becomes fainter. The smooth exponential rollover at high energies seen in the first observation evolves to a much more abrupt steepening of the spectrum at 20–30 keV. The continuum evolution can be nicely described with emission from a magnetized accretion column, modeled using the compmag model modified by an additional Gaussian emission component for the fainter observation. Between the two observations, the optical depth changes from $0.75 \pm 0.04$ to $0.56 \pm 0.01$, the electron temperature remains constant, and there is an indication that the column decreases in radius.

Since the energy-resolved pulse profiles remain virtually unchanged in shape between the two observations, the emission properties of the accretion column reflect the same accretion regime. This conclusion is also confirmed by our result that the energy of the cyclotron resonant scattering feature (CRSF) at $\sim 45$ keV is independent of the luminosity, implying that the magnetic field in the region in which the observed radiation is produced is the same in both observations. Finally, we also constrain the evolution of the continuum parameters with the rotational phase of the neutron star. The width of the CRSF could only be constrained for the brighter observation. Based on Monte Carlo simulations of CRSF formation in single accretion columns, its pulse phase dependence supports a simplified fan beam emission pattern. The evolution of the CRSF width is very similar to that of the CRSF depth, which is, however, in disagreement with expectations.

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Authors: Ballhausen, R. (Ekstern), Pottschmidt, K. (Ekstern), Fürst, F. (Ekstern), Wilms, J. (Ekstern), Tomsick, J. A. (Ekstern), Schwarm, F. (Ekstern), Kretschmar, P. (Ekstern), Caballero, I. (Ekstern), Harrison, F. A. (Ekstern), Boggs, S. E. (Ekstern), Christensen, P. E. (Intern), Craig, W. W. (Ekstern), Halley, C. J. (Ekstern), Zhang, W. W. (Ekstern)
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.883 SNIP 1.247 CiteScore 2.82
Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 2.903 SNIP 1.36 CiteScore 3.14
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Magnetic Field Perturbations from Currents in the Dark Polar Regions During Quiet Geomagnetic Conditions

In the day-side sunlit polar ionosphere the varying and IMF dependent convection creates strong ionospheric currents even during quiet geomagnetic conditions. Observations during such times are often excluded when using satellite data to model the internal geomagnetic field. Observations from the night-side or local winter during quiet conditions are, however, also influenced by variations in the IMF. In this paper we briefly review the large scale features of the ionospheric currents in the polar regions with emphasis on the current distribution during undisturbed conditions. We examine the distribution of scalar measurements of the magnetic field intensity minus predictions from a geomagnetic field model. These ‘residuals’ fall into two main categories. One category is consistently distributed according to the well-known ionospheric plasma convection and its associated Birkeland currents. The other category represent contributions caused by geomagnetic activity related to the substorm current wedge around local magnetic midnight. A new observation is a strong IMF $B_y$ control of the residuals in the midnight sector indicating larger ionospheric currents in the substorm current wedge in the northern polar region for $B_y > 0$ and correspondingly in the southern hemisphere for $B_y < 0$. 

General information
Magnetic signatures of ionospheric and magnetospheric current systems during geomagnetic quiet conditions - An overview

High-precision magnetic measurements taken by LEO satellites (flying at altitudes between 300 and 800 km) allow for studying the ionospheric and magnetospheric processes and electric currents that cause only weak magnetic signature of a few nanotesla during geomagnetic quiet conditions. Of particular importance for this endeavour are multipoint observations in space, such as provided by the Swarm satellite constellation mission, in order to better characterize the space-time-structure of the current systems. Focusing on geomagnetic quiet conditions, we provide an overview of ionospheric and magnetospheric sources and illustrate their magnetic signatures with Swarm satellite observations.

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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 6.45 SJR 2.891 SNIP 2.57
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.933 SNIP 2.797 CiteScore 5.97
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.265 SNIP 2.703 CiteScore 5.94
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.474 SNIP 2.342 CiteScore 4.88
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.189 SNIP 2.022 CiteScore 3.8
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
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ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.223 SNIP 1.724
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.176 SNIP 1.758
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.739 SNIP 1.313
Scopus rating (2007): SJR 2.307 SNIP 1.498
Scopus rating (2006): SJR 2.306 SNIP 1.394
Scopus rating (2005): SJR 1.76 SNIP 1.297
Scopus rating (2004): SJR 1.207 SNIP 0.944
Scopus rating (2003): SJR 1.397 SNIP 1.341
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.967 SNIP 0.903
Scopus rating (2001): SJR 1.285 SNIP 1.026
Measurement of the charging state of 4-70 nm aerosols

The charging state of aerosols in an 8 m3 reaction chamber was measured using an electrostatic classifier with a condensation particle counter at different levels of ionization in the chamber. By replacing the Kr-85 neutralizer in the classifier with a radioactively neutral dummy we were able to measure only the aerosols that were charged inside our reaction chamber. These measurements were then compared with measurements using the neutralizer to get the charging state of the aerosols, which refers to the charged fraction of the aerosols compared to an equilibrium charge distribution. Charging states were measured for both positively and negatively charged aerosols while the ionization in the chamber was varied using external gamma sources. We find that the negatively charged aerosols were overcharged (relative to the equilibrium) by up to about a factor of 10 below 10 nm and at 16±2% from 10 to 70 nm. At higher levels of radiation on the chamber the smaller aerosols were less overcharged while the large aerosols were more overcharged (23±2%). For the positively charged aerosols only the smallest aerosols were overcharged while those over 10 nm were undercharged (relative to the equilibrium) by 21±3%. Increasing the radiation on the chamber increased the undercharge above 10 nm to 25±2% while the overcharge below 10 nm disappeared. The split between positive and negative charges above 10 nm can be explained by differences in mobility of small negative and positive ions. The overcharge below 10 nm can be explained by ions participating in the formation of aerosols of both signs, while the reduction in this overcharge at higher levels of ionization may be explained by faster recombination.
Measuring water level in rivers and lakes from lightweight Unmanned Aerial Vehicles

The assessment of hydrologic dynamics in rivers, lakes, reservoirs and wetlands requires measurements of water level, its temporal and spatial derivatives, and the extent and dynamics of open water surfaces. Motivated by the declining number of ground-based measurement stations, research efforts have been devoted to the retrieval of these hydraulic properties from spaceborne platforms in the past few decades. However, due to coarse spatial and temporal resolutions, spaceborne missions have several limitations when assessing the water level of terrestrial surface water bodies and determining complex water dynamics. Unmanned Aerial Vehicles (UAVs) can fill the gap between spaceborne and ground-based observations, and provide high spatial resolution and dense temporal coverage data, in quick turn-around time, using flexible payload design. This study focused on categorizing and testing sensors, which comply with the weight constraint of small UAVs (around 1.5 kg), capable of measuring the range to water surface. Subtracting the measured range from the vertical position retrieved by the onboard Global Navigation Satellite System (GNSS) receiver, we can determine the water level (orthometric height). Three different ranging payloads, which consisted of a radar, a sonar and an in-house developed camera-based laser distance sensor (CLDS), have been evaluated in terms of accuracy, precision, maximum ranging distance and beam divergence. After numerous flights, the relative accuracy of the overall system was estimated. A ranging accuracy better than 0.5 % of the range and a maximum ranging distance of 60 m were achieved with the radar. The CLDS showed the lowest beam divergence, which is required to avoid contamination of the signal from interfering surroundings for narrow fields of view. With the GNSS system delivering a relative vertical accuracy better than 3-5 cm, water level can be retrieved with an overall accuracy better than 5-7 cm.
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BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.786 SNIP 1.712
Web of Science (2010): Indexed yes
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Scopus rating (2008): SJR 1.945 SNIP 1.744
Web of Science (2008): Indexed yes
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Scopus rating (2004): SJR 1.567 SNIP 1.746
Web of Science (2004): Indexed yes
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**MeV-range velocity-space tomography from gamma-ray and neutron emission spectrometry measurements at JET**

We demonstrate the measurement of a 2D MeV-range ion velocity distribution function by velocity-space tomography at JET. Deuterium ions were accelerated into the MeV-range by third harmonic ion cyclotron resonance heating. We made measurements with three neutron emission spectrometers and a high-resolution γ-ray spectrometer detecting the γ-rays released in two reactions. The tomographic inversion based on these five spectra is in excellent agreement with numerical simulations with the ASCOT–RFOF and the SPOT–RFOF codes. The length of the measured fast-ion tail corroborates the prediction that very few particles are accelerated above 2 MeV due to the weak wave-particle interaction at higher energies.

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MICROSCOPE Mission: on-orbit assessment of the Drag-Free and Attitude Control System

Microscope successfully completed in November 2016 its on-orbit assessment. The paper begins with a brief description of the mission, the challenging performances the DFACS has to comply with and how they led to the hardware and software design. Then we go through the major phases of the commissioning months for DFACS, from the first switch-on of the scientific instrument, the star-trackers and the propulsion system until getting all of them in the same control loop and carrying out definitive tunings to reach full performance. At the end of the commissioning, we look over the most striking on-orbit observations: the linear and angular perturbations and the micro-perturbations. We finally point out the DFACS overall performances: the finest ever achieved on low earth orbit.

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MiNDSTEp differential photometry of the gravitationally lensed quasars WFI2033-4723 and HE0047-1756: Microlensing and a new time delay

Aims. We present V and R photometry of the gravitationally lensed quasars WFI2033-4723 and HE0047-1756. The data were taken by the MiNDSTEp collaboration with the 1.54 m Danish telescope at the ESO La Silla observatory from 2008 to 2012. Methods. Differential photometry has been carried out using the image subtraction method as implemented in the HOTPanTS package, additionally using GALFIT for quasar photometry. Results. The quasar WFI2033-4723 showed brightness variations of order 0.5 mag in V and R during the campaign. The two lensed components of quasar HE0047-1756 varied by 0.2–0.3 mag within five years. We provide, for the first time, an estimate of the time delay of component B with respect to A of Δt = (7.6 ± 1.8) days for this object. We also find evidence for a secular evolution of the magnitude difference between components A and B in both filters, which we explain as due to a long-duration microlensing event. Finally we find that both quasars WFI2033-4723 and HE0047-1756 become bluer when brighter, which is consistent with previous studies.

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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.883 SNIP 1.247 CiteScore 2.82
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BFI (2013): BFI-level 2
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2011): SJR 2.737 SNIP 1.322 CiteScore 3.42
Monitoring recent lake level variations on the Tibetan Plateau using CryoSat-2 SARIn mode data

Lakes on the Tibetan Plateau (TP) are of great interest due to their value as water resources but also as an important indicator of climate change. However, in situ data in this region are extremely scarce and only a few lakes have gauge measurements. Satellite altimetry has been used successfully to monitor lake levels. In this study, Cryosat-2 SARIn mode data over the period 2010–2015 are used to investigate recent lake level variations. The estimated water levels of the 70 largest lakes (> 100 km²) on the TP show that 48 lakes reveal a rising trend (avg. 0.28 ± 0.06 m/yr) while the other 22 show a slightly decreasing trend (avg. −0.10 ± 0.04 m/yr). To compare with the change rates during 2003–2009, ICESat data which cover 42 of the 70 lakes are also used. When combining the data, the results show that during the period of 2003–2015, 28 lakes maintained a rising trend and the change rates are comparable. Lakes in the northern part of the TP experienced pronounced rising (avg. 0.37 ± 0.10 m/yr), while lakes in southern part were steady or decreasing even in glaciated basins with high precipitation. Factor analysis indicates that driving factors for lake change are variable due to high spatial heterogeneity. However, autumn/winter temperature plays an important role in lake level change. These results demonstrate that lakes on the TP are still rapidly changing under climate change, especially in northern part of the TP, but the driving factors are variable and more research is needed to understand the mechanisms behind observed changes.
Monument for Inge Lehmann på Frue Plads
En af Danmarks største, men oversete videnskabsfolk, geofysikeren Inge Lehmann, har nu fået sit monument på Frue Plads i København. Inge Lehmann er i dag kendt for opdagelsen af, at Jorden har en fast indrekerne, men i sin samtid havde hun svært ved at få anerkendelse for sin indsats, hvilket Københavns Universitet nu ønsker at rette op på med opstillingen af monumentet

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Multibeam bathymetry and CTD measurements in two fjord systems in southeastern Greenland
We present bathymetry and hydrological observations collected in the summer of 2014 from two fjord systems in southeastern Greenland with a multibeam sonar system. Our results provide a detailed bathymetric map of the fjord complex around the island of Skjoldungen in Skjoldungen Fjord and the outer part of Timmiarmiut Fjord and show far greater depths compared to the International Bathymetric Chart of the Arctic Ocean. The hydrography collected shows different properties in the fjords with the bottom water masses below 240 m in Timmiarmiut Fjord being 1–2°C warmer than in the two fjords around Skjoldungen, but data also illustrate the influence of sills on the exchange of deeper water masses within fjords. Moreover, evidence of subglacial discharge in Timmiarmiut Fjord, which is consistent with satellite observations of ice mélange set into motion, adds to our increasing understanding of the distribution of subglacial meltwater. Data are available through the PANGAEA website at https://doi.pangaea.de/10.1594/PANGAEA.860627.

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Authors: Kjeldsen, K. K. (Intern), Weinrebe, R. W. (Ekstern), Bendtsen, J. (Ekstern), Bjørk, A. A. (Ekstern), Kjær, K. H. (Ekstern)
Pages: 589-600

We present a multi-instrumented approach for the analysis of the Arctic ionosphere during the 19 February 2014 highly complex, multiphase geomagnetic storm, which had the largest impact on the disturbance storm-time (Dst) index that year. The geomagnetic storm was the result of two powerful Earth-directed coronal mass ejections (CMEs). It produced a strong long lasting negative storm phase over Greenland with a dominant energy input in the polar-cap. We employed GNSS networks, geomagnetic observatories, and a specific ionosonde station in Greenland. We complemented the approach with spaceborne measurements in order to map the state and variability of the Arctic ionosphere. In situ observations from the Canadian CASSIOPE (CAScade, Smallsat and IOnospheric Polar Explorer) satellite's ion mass spectrometer were used to derive ion flow data from the polar cap topside ionosphere during the event. Our research specifically found that, (1) Thermospheric O/N2 measurements demonstrated significantly lower values over the Greenland sector than prior to the storm-time. (2) An increased ion flow in the topside ionosphere was observed during the negative storm phase. (3) Negative storm phase was a direct consequence of energy input into the polar cap. (4) Polar patch formation was significantly decreased during the negative storm phase. This paper analyzes the physical processes that can be responsible for this ionospheric storm development in the northern high-latitudes. We conclude that ionospheric heating due to the CME's energy input caused changes in the polar atmosphere resulting in Ne upwelling, which was the major factor in high-latitude ionosphere dynamics for this storm.
Multi-Instrument Observations of Physical Processes in the Arctic Ionosphere and Derived Applications

The ionosphere is the source of the largest errors in satellite-based navigation and positioning, transionospheric radio communications, and certain satellite-based radar remote sensing techniques. A proper understanding of ionospheric dynamics and its coupling with space weather can help mitigate these errors. Specifically, ionospheric electron density and scintillation forecasting would significantly improve reliability of navigation and positioning systems.

This Ph.D. thesis is primarily concerned with the physical processes in the terrestrial Arctic upper atmosphere. Additionally to this, two studies about lower-latitude regimes and a global ionosphere mapping study are also presented. Whenever multi-instrument observations were available, these measurements were combined to obtain a more complete physical description of the underlying processes. All of the studies presented employ the observation-based approach with utilization of GNSS-derived measurements as the primary data source, and the primary subject of the research being the terrestrial atmosphere (the ionized part, the neutral part, or both). The collected measurements are used to construct a model of the underlying physical processes. The complexity of the studied atmospheric processes often required multiple, independent measurements of various physical parameters. These results are then combined such that they complement each other and provide validation.

Some of the important findings of this work include (1) the analysis of an interplanetary coronal mass ejection (ICME) induced negative storm phase at high latitudes in February 2014 exhibited thermospheric O/N2 decrease due to atmospheric heating, increased ion flow in the topside ionosphere, and an increase in polar patch formation inhibition, all of which lasts for several days. These appear to be general features of these types of geomagnetic storms. (2) During an energetic, mixed high-speed stream (HSS) and ICME-induced storm in March 2015, GPS phase scintillation II was found to be mapped to the poleward side of the westward electrojet and to the edge of the eastward electrojet region. At the same time, the scintillation was largely collocated with fluxes of energetic electron precipitation observed by DMSP satellites, with the exception of a period of pulsating aurora when only very weak currents were observed. (3) Based on measurements employing a space-qualified GPS receiver placed on a mountain at the Haleakala observatory on the Hawaiian island of Maui, it was found that simulated surface-reflection signals and the measured reflection signals were revealing matching spectral structures of the reflected signals that could lead to extraction of parameters of sea surface roughness, surface wind speed, and direction. (4) 4-year long regional electron density observations from Thule, Greenland revealed a series of findings: strong correlation with solar extreme ultraviolet (EUV) spectral irradiance that is related to solar rotation and sunspot numbers, increased electron density variability during equinoxes that is related to the Russell-McPherron effect, and a strong influence of ambipolar diffusion as a function of ionospheric E layer conductivity. (5) The polar cap index rate of change showed significant differences during ICME and HSS-induced storms. This indicates that the energy input into the polar cap occurs at significantly different rates for these two phenomena which results in some differences in the induced geomagnetic storm evolution.

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Multi-messenger Observations of a Binary Neutron Star Merger
On 2017 August 17 a binary neutron star coalescence candidate (later designated GW170817) with merger time 12:41:04 UTC was observed through gravitational waves by the Advanced LIGO and Advanced Virgo detectors. The Fermi
Gamma-ray Burst Monitor independently detected a gamma-ray burst (GRB 170817A) with a time delay of with respect to the merger time. From the gravitational-wave signal, the source was initially localized to a sky region of 31 deg² at a luminosity distance of Mpc with component masses consistent with neutron stars. The component masses were later measured to be in the range 0.86 to 2.26. An extensive observing campaign was launched across the electromagnetic spectrum leading to the discovery of a bright optical transient (SSS17a, now with the IAU identification of AT 2017gfo) in NGC 4993 within 48 hours. Optical and infrared observations showed a redward evolution over ~10 days. Following early non-detections, X-ray and radio emission were discovered at the transient’s position and days, respectively, after the merger. Both the X-ray and radio emission likely arise from a physical process that is distinct from the one that generates the UV/optical/near-infrared emission. No ultra-high-energy gamma-rays and no neutrino candidates consistent with the source were found in follow-up searches. These observations support the hypothesis that GW170817 was produced by the merger of two neutron stars in NGC 4993 followed by a short gamma-ray burst (GRB 170817A) and a kilonova/macronova powered by the radioactive decay of r-process nuclei synthesized in the ejecta.

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Relations
Projects:
Multi-messenger Observations of a Binary Neutron Star Merger
Press / Media items:
Sensationel tyngdebølgemåling åbner nyt kapitel i udforskningen af rummet
Ugens podcast: Dansk rumdustyr bidrog til årets astronyhed
'Menneskeheden har aldrig set noget lignende': Forskere aflæser banebrydende observationer
Dansk røntgendetektor på rumfartøj står bag historisk fund
Einstein havde ret
DTU-forskere med i historisk opdagelse i rummet
Ugens profil: "Vi fejrer en milepæl i astronomien"
Astronomer jubler over den første observation af sammenstød mellem to neutronstjerner
Science: Neutronstjerners sammenstød er årets videnskabelige gennembrud
DTU researchers involved in historic discovery in outer space
Near-Earth Magnetic Field Effects of Large-Scale Magnetospheric Currents

Magnetospheric currents play an important role in the electrodynamics of near-Earth space. This has been the topic of many space science studies. Here we focus on the magnetic fields they cause close to Earth. Their contribution to the geomagnetic field is the second largest after the core field. Significant progress in interpreting the magnetic fields from the different sources has been achieved thanks to magnetic satellite missions like Ørsted, CHAMP and now Swarm. Of particular interest for this article is a proper representation of the magnetospheric ring current effect. Uncertainties in modelling its effect still produce the largest residuals between observations and present-day geomagnetic field models. A lot of progress has been achieved so far, but there are still open issues like the characteristics of the partial ring current. Other currents discussed are those flowing in the magnetospheric tail. Also their magnetic contribution at LEO orbits is non-negligible. Treating them as an independent source is a more recent development, which has cured some of the problems in geomagnetic field modelling. Unfortunately there is no index available for characterising the tail current intensity. Here we propose an approach that may help to properly quantify the magnetic contribution from the tail current for geomagnetic field modelling. Some open questions that require further investigation are mentioned at the end.
Near-Earth supernova activity during the past 35 Myr

Here we combine observations of open clusters (OCs) with single- and binary population synthesis models and a Galactic potential to reconstruct the SN activity of these OCs during the past 35 Myr. We find that several OCs potentially hosting SN progenitors have passed within 100 pc of the Sun during the past 35 Myr. In particular we find that ASCC 19, NGC 1981, and NGC 1976 are likely to have hosted one or more SNe while passing within 200 pc of the solar system in the period 17 - 12 Myr BP which might have affected Earth's geology and climate. Besides the stellar history of the individual OCs we also compute 1) a spatial and temporal 2D-probability density map showing the most likely position and time of SN from our sample of OCs within 1 kpc during the past 35 Myr, 2) the time series of the SN rate per volume and 3) the relative SN rate compared with today and corrected for OC evaporation of older generations. The SN rate today from core collapse is estimated to be $37.8 \pm 6.1 \text{ kpc}^{-3} \text{Myr}^{-1}$. During the past 35 Myr we find a peak SN rate around 10 Myr before present (BP) where the rate was 40% higher relative to the past 1 Myr. Finally we discuss possible effects of binary stellar evolution in relation to the history of SN production in the solar neighbourhood and the detected 60Fe signal in terrestrial geological samples induced between $\sim 2.2 - 2.8$ Myr BP.

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BFI (2014): BFI-level 2
When the upper layer of an accreting neutron star experiences a thermonuclear runaway of helium and hydrogen, it exhibits an X-ray burst of a few keV with a cool-down phase of typically 1-2 minutes. When there is a surplus of hydrogen, hydrogen fusion is expected to simmer during that same minute due to the r-process, which consists of rapid proton captures and slow beta-decays of proton-rich isotopes. We have analyzed the high-quality light curves of 1254 X-ray bursts, obtained with the Proportional Counter Array on the Rossi X-ray Timing Explorer between 1996 and 2012, to systematically study the cooling and r-process. This is a follow-up of a study on a selection of 37 bursts from systems that lack hydrogen and show only cooling during the bursts. We find that the bolometric light curves are well described by the combination of a power law and a one-sided Gaussian. The power-law decay index is between 1.3 and 2.1 and similar to that for the 37-bursts sample. There are individual bursters with a narrower range. The Gaussian is detected in half of all bursts, with a typical standard deviation of 50 s and a fluence ranging up to 60% of the total fluence. The Gaussian appears consistent with being due to the r-process. The Gaussian fluence fraction suggests that the layer where the r-process is active is underabundant in H by a factor of at least five with respect to cosmic abundances. Ninety-four percent of all bursts from ultracompact X-ray binaries lack the Gaussian component, and the remaining 6% are marginal detections. This is consistent with a hydrogen deficiency in these binaries. We find no clear correlation between the power law and Gaussian light-curve components.
New CAST limit on the axion–photon interaction

Hypothetical low-mass particles, such as axions, provide a compelling explanation for the dark matter in the universe. Such particles are expected to emerge abundantly from the hot interior of stars. To test this prediction, the CERN Axion Solar Telescope (CAST) uses a 9 T refurbished Large Hadron Collider test magnet directed towards the Sun. In the strong magnetic field, solar axions can be converted to X-ray photons which can be recorded by X-ray detectors. In the 2013–2015 run, thanks to low-background detectors and a new X-ray telescope, the signal-to-noise ratio was increased by about a factor of three. Here, we report the best limit on the axion–photon coupling strength ($3.66 \times 10^{-10}$ GeV$^{-1}$ at 95% confidence level) set by CAST, which now reaches similar levels to the most restrictive astrophysical bounds.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Istanbul Bilgi University, University of Patras, Centre d'Etudes Nucléaires de Saclay, CERN, Russian Academy of Sciences, Max Planck Institute, University of Trieste, Universidad de Zaragoza, University of Zaragoza, Lawrence Livermore National Laboratory, University of Bonn, University of Freiburg, University of Chicago, Aristotle University of Thessaloniki, National Centre for Scientific Research "Demokritos", University of British Columbia, Technical University of Denmark, Commisariat Energie Atomique, Columbia University, Technische Universität Darmstadt, Rudjer Boskovic Institute, Universität Bonn, Dogus University, Johann Wolfgang Goethe-Universität Frankfurt, University of Rijeka, Institute for Basic Science, Max-Planck-Institut für Sonnenphysik, National Technical University of Athens, Technische Universität Darmstadt


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New Position Algorithms for the 3-D CZT Drift Detector

The 3-D position sensitive CZT detector for high-energy astrophysics developed at DTU has been investigated with a digitizer readout system. The 3-D CZT detector is based on the CZT drift-strip detector principle and was fabricated using a REDLEN CZT crystal (20 mm x 20 mm x 5 mm). The detector contains 12 drift cells, each comprising one collecting anode strip with four drift strips, biased such that the electrons are focused and collected by the anode strips. Three-
dimensional position determination is achieved using the anode strip signals, the drift-strip signals, and the signals from ten cathode strips. For the characterization work, we used a DAQ system with a 16 channels 250-MHz 14-b digitizer, SIS3316. It allowed us to analyze the pulse shapes of the signals from four detector cells at a time. The 3-D CZT setup was characterized with a finely collimated radioactive source of Cs-137 at 662 keV. The analysis required development of novel position determination algorithms which are the subject of this paper. Using the digitizer readout, we demonstrate improved position determination compared to the previous read out system based on analog electronics. Position resolutions of 0.4-mm full width at half maximum (FWHM) in the x-, y-, and z-directions were achieved and the energy resolution was 7.2-keV FWHM at 662 keV. The timing information allows identification of multiple interaction events within one detector cell, e.g., Compton scattering followed by photoelectric absorption. These characteristics are very important for a high-energy spectral-imager suitable for use in advanced Compton telescopes, or as focal detector for new hard X-ray and soft gamma-ray focusing telescopes or in polarimeter instrumentation. CZT detectors are attractive for these applications since they offer relatively high-quantum efficiency. From a technical point of view it is advantageous that their cooling requirements are modest.

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BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 0.608 SNIP 1.324 CiteScore 1.48  
BFI (2013): BFI-level 1  
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ISI indexed (2013): ISI indexed yes  
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ISI indexed (2011): ISI indexed yes  
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Scopus rating (2010): SJR 1.03 SNIP 1.517  
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Scopus rating (2009): SJR 0.809 SNIP 1.511  
Web of Science (2009): Indexed yes  
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Scopus rating (2008): SJR 0.79 SNIP 1.393  
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Scopus rating (2007): SJR 0.755 SNIP 1.887
NuSTAR Hard X-Ray Observation of the Gamma-Ray Binary Candidate HESS J1832–093

We present a hard X-ray observation of the TeV gamma-ray binary candidate HESS J1832–093, which is coincident with the supernova remnant G22.7–0.2, using the Nuclear Spectroscopic Telescope Array. Non-thermal X-ray emission from XMMU J183245–0921539, the X-ray source associated with HESS J1832–093, is detected up to ~30 keV and is well-described by an absorbed power-law model with a best-fit photon index . A re-analysis of archival Chandra and XMM-Newton data finds that the long-term X-ray flux increase of XMMU J183245–0921539 is (90% C.L.), much less than previously reported. A search for a pulsar spin period or binary orbit modulation yields no significant signal to a pulse fraction limit of in the range 4 ms ks. No red noise is detected in the FFT power spectrum to suggest active accretion from a binary system. While further evidence is required, we argue that the X-ray and gamma-ray properties of XMMU J183245–0921539 are most consistent with a non-accreting binary generating synchrotron X-rays from particle acceleration in the shock formed as a result of the pulsar and stellar wind collision. We also report on three nearby hard X-ray sources, one of which may be associated with diffuse emission from a fast-moving supernova fragment interacting with a dense molecular cloud.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Columbia University, Institute of Space Sciences, Harvard-Smithsonian Center for Astrophysics, University of California at Berkeley, Massachusetts Institute of Technology, California Institute of Technology, NASA Goddard Space Flight Center
Authors: Mori, K. (Ekstern), Gotthelf, E. V. (Ekstern), Hailey, C. J. (Ekstern), Hord, B. J. (Ekstern), Wilhelm, E. D. O. (Ekstern), Rahoui, F. (Ekstern), Tomick, J. A. (Ekstern), Zhang, S. (Ekstern), Hong, J. (Ekstern), Garvin, A. M. (Ekstern), Bogg, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Harrison, F. A. (Ekstern), Stern, D. (Ekstern), Zhang, W. W. (Ekstern)
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Hot dust-obscured galaxies (hot DOGs), selected from Wide-Field Infrared Survey Explorer’s all-sky infrared survey, host some of the most powerful active galactic nuclei known and may represent an important stage in the evolution of galaxies. Most known hot DOGs are located at $z > 1.5$, due in part to a strong bias against identifying them at lower redshift related to the selection criteria. We present a new selection method that identifies 153 hot DOG candidates at $z \sim 1$, where they are significantly brighter and easier to study. We validate this approach by measuring a redshift $z = 1.009$ and finding a spectral energy distribution similar to that of higher-redshift hot DOGs for one of these objects, WISE J1036+0449 ($L_{\text{bol}} \approx 8 \times 10^{46}$ erg s$^{-1}$). We find evidence of a broadened component in Mg II, which would imply a black hole mass of $M_{\text{BH}} \approx 2 \times 10^8 M_{\odot}$ and an Eddington ratio of $\lambda_{\text{Edd}} \approx 2.7$. WISE J1036+0449 is the first hot DOG detected by the Nuclear Spectroscopic Telescope Array, and observations show that the source is heavily obscured, with a column density of $N_{\text{H}} \sim (2-15) \times 10^{23}$ cm$^{-2}$. The source has an intrinsic 2-10 keV luminosity of $\sim 6 \times 10^{44}$ erg s$^{-1}$, a value significantly lower than that expected from the mid-infrared/X-ray correlation. We also find that other hot DOGs observed by X-ray facilities show a similar deficiency of X-ray flux. We discuss the origin of the X-ray weakness and the absorption properties of hot DOGs. Hot DOGs at $z \lesssim 1$ could be excellent laboratories to probe the characteristics of the accretion flow and of the X-ray emitting plasma at extreme values of the Eddington ratio.
Observational artifacts of Nuclear Spectroscopic Telescope Array: Ghost rays and stray light
The Nuclear Spectroscopic Telescope Array (NuSTAR) launched in June 2012, flies two conical approximation Wolter-I mirrors at the end of a 10.15-m mast. The optics are coated with multilayers of Pt/C and W/Si that operate from 3 to 80 keV. Since the optical path is not shrouded, aperture stops are used to limit the field of view (FoV) from background and sources outside the FoV. However, there is still a sliver of sky (∼1.0 deg to 4.0 deg) where photons may bypass the optics altogether and fall directly on the detector array. We term these photons stray light. Additionally, there are also photons that do not undergo the focused double reflections in the optics, and we term these ghost rays. We present detailed analysis and characterization of these two components and discuss how they impact observations. Finally, we discuss how they could have been prevented and should be in future observatories.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of California at Berkeley, California Institute of Technology
Authors: Madsen, K. K. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Forster, K. W. (Ekstern), Grefenstette, B. W. (Ekstern), Harrison, F. A. (Ekstern), Miyasaka, H. (Ekstern), Rana, V. (Ekstern)
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Observations of interplanetary dust by the Juno magnetometer investigation
One of the Juno magnetometer investigation's star cameras was configured to search for unidentified objects during Juno's transit en route to Jupiter. This camera detects and registers luminous objects to magnitude 8. Objects persisting in more than five consecutive images and moving with an apparent angular rate of between 2 and 18,000 arcsec/s were recorded. Among the objects detected were a small group of objects tracked briefly in close proximity to the spacecraft. The trajectory of these objects demonstrates that they originated on the Juno spacecraft, evidently excavated by
micrometeoroid impacts on the solar arrays. The majority of detections occurred just prior to and shortly after Juno’s transit of the asteroid belt. This rather novel detection technique utilizes the Juno spacecraft’s prodigious 60 m² of solar array as a dust detector and provides valuable information on the distribution and motion of interplanetary (>μm sized) dust.

**General information**

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Organisations: National Space Institute, Measurement and Instrumentation Systems, University of Copenhagen, NASA Goddard Space Flight Center, Southwest Research Institute, Jet Propulsion Laboratory, California Institute of Technology  
Authors: Benn, M. (Intern), Jørgensen, J. L. (Intern), Denver, T. (Intern), Brauer, P. (Intern), Jørgensen, P. S. (Intern), Andersen, A. C. (Ekstern), Connerney, J. E. P. (Ekstern), Oliversen, R. J. (Ekstern), Bolton, S. J. (Ekstern), Levin, S. M. (Ekstern)  
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Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82  
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Web of Science (2012): Indexed yes  
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Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79  
ISI indexed (2011): ISI indexed yes  
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Scopus rating (2010): SJR 2.934 SNIP 1.416  
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BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 2.742 SNIP 1.387  
Web of Science (2009): Indexed yes  
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Scopus rating (2008): SJR 2.573 SNIP 1.325  
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.361 SNIP 1.248
Web of Science (2007): Indexed yes
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Observations of MeV electrons in Jupiter's innermost radiation belts and polar regions by the Juno radiation monitoring investigation: Perijoves 1 and 3
Juno's “Perijove 1” (27 August 2016) and “Perijove 3” (11 December 2016) flybys through the innermost region of Jupiter's magnetosphere (radial distances <2 Jovian radii, 1.06 RJ at closest approach) provided the first in situ look at this region's radiation environment. Juno's Radiation Monitoring Investigation collected particle counts and noise signatures from penetrating high-energy particle impacts in images acquired by the Stellar Reference Unit and Advanced Stellar Compass star trackers, and the Jupiter Infrared Auroral Mapper infrared imager. This coordinated observation campaign sampled radiation at the inner edges of the high-latitude lobes of the synchrotron emission region and more distant environments. Inferred omnidirectional >5 MeV and >10 MeV electron fluxes derived from these measurements provide valuable constraints for models of relativistic electron environments in the inner radiation belts. Several intense bursts of high-energy particle counts were also observed by the Advanced Stellar Compass in polar regions outside the radiation belts.

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On the usage of geomagnetic indices for data selection in internal field modelling
We present a review on geomagnetic indices describing global geomagnetic storm activity (Kp, am, Dst and dDst/dt) and on indices designed to characterize high latitude currents and substorms (PC and AE-indices and their variants). The focus in our discussion is in main field modelling, where indices are primarily used in data selection criteria for weak magnetic activity. The publicly available extensive data bases of index values are used to derive joint conditional Probability Distribution Functions (PDFs) for different pairs of indices in order to investigate their mutual consistency in describing quiet conditions. This exercise reveals that Dst and its time derivative yield a similar picture as Kp on quiet conditions as determined with the conditions typically used in internal field modelling. Magnetic quiescense at high latitudes is typically searched with the help of Merging Electric Field (MEF) as derived from solar wind observations. We use in our PDF analysis the PC-index as a proxy for MEF and estimate the magnetic activity level at auroral latitudes with the AL-index. With these boundary conditions we conclude that the quiet time conditions that are typically used in main field modelling (PC < 0.8, Kp < 2and Dst < 30 nT) correspond to weak auroral electrojet activity quite well: Standard size substorms are unlikely to happen, but other type of activations (e.g. pseudo breakups AL > -300 nT) can take place, when these criteria prevail. Although AE-indices have been designed to probe electrojet activity only in average conditions and thus their performance is not optimal during weak activity, we note that careful data selection with advanced AE-variants may appear to be the most practical way to lower the elevated RMS-values which still exist in the residuals between modelled and observed values at high latitudes. Recent initiatives to upgrade the AE-indices, either with a better coverage of observing stations and improved baseline corrections (the Super-MAG concept) or with higher accuracy in pinpointing substorm activity (the Midlatitude Positive Bay-index) will most likely be helpful in these efforts.

General information
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Organisations: National Space Institute, Geomagnetism, Finnish Meteorological Institute, German Research Centre for Geosciences, University of California, Los Angeles, John Hopkins University, Swedish Institute of Space Physics
On X-ray telescopes in general and the Athena optics in particular

The optical design of the most common type of X-ray telescopes is reviewed in this contribution and the imaging properties of these are discussed. Then the newest mostly European large mission, Athena, is presented and some of the
most important properties imaging-wise are reviewed. Finally the science program for Athena is described where the emphasis is on the cosmic web and the population of AGNs.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics  
Authors: Westergaard, N. J. (Intern), Ferreira, D. D. M. (Intern), Massahi, S. (Intern)  
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Web of Science (2017): Indexed Yes  
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Scopus rating (2015): SJR 0.965 SNIP 1.284 CiteScore 1.21  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 0.852 SNIP 1.265 CiteScore 1.24  
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Scopus rating (2012): SJR 0.832 SNIP 1.36 CiteScore 1.19  
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Scopus rating (2011): SJR 0.956 SNIP 1.414 CiteScore 1.29  
ISI indexed (2011): ISI indexed yes  
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Scopus rating (2010): SJR 0.894 SNIP 1.11  
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Scopus rating (2009): SJR 0.759 SNIP 1.372  
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Scopus rating (2008): SJR 0.755 SNIP 1.077  
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Scopus rating (2007): SJR 0.728 SNIP 1.384  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 0.84 SNIP 1.213  
Web of Science (2006): Indexed yes  
Scopus rating (2005): SJR 0.858 SNIP 1.135
Optical simulations for design, alignment, and performance prediction of silicon pore optics for the ATHENA x-ray telescope

The ATHENA X-ray observatory is a large-class ESA approved mission, with launch scheduled in 2028. The technology of silicon pore optics (SPO) was selected as baseline to assemble ATHENA’s optic with hundreds of mirror modules, obtained by stacking wedged and ribbed silicon wafer plates onto silicon mandrels to form the Wolter-I configuration. In the current configuration, the optical assembly has a 3 m diameter and a 2 m² effective area at 1 keV, with a required angular resolution of 5 arcsec. The angular resolution that can be achieved is chiefly the combination of 1) the focal spot
size determined by the pore diffraction, 2) the focus degradation caused by surface and profile errors, 3) the aberrations introduced by the misalignments between primary and secondary segments, 4) imperfections in the co-focality of the mirror modules in the optical assembly. A detailed simulation of these aspects is required in order to assess the fabrication and alignment tolerances; moreover, the achievable effective area and angular resolution depend on the mirror module design. Therefore, guaranteeing these optical performances requires: a fast design tool to find the most performing solution in terms of mirror module geometry and population, and an accurate point spread function simulation from local metrology and positioning information. In this paper, we present the results of simulations in the framework of ESA-financed projects (SIMPosiUM, ASPHEA, SPIRIT), in preparation of the ATHENA X-ray telescope, analyzing the mentioned points: 1) we deal with a detailed description of diffractive effects in an SPO mirror module, 2) we show ray-tracing results including surface and profile defects of the reflective surfaces, 3) we assess the effective area and angular resolution degradation caused by alignment errors between SPO mirror module’s segments, and 4) we simulate the effects of co-focality errors in X-rays and in the UV optical bench used to study the mirror module alignment and integration.

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**Optimizing sensitivity of Unmanned Aerial System optical sensors for low zenith angles and cloudy conditions**

Satellite-based imaging in optical domains cannot provide information on the land surface during periods of cloud cover. This issue is especially relevant for high latitudes where overcast days and low solar zenith angles are common. Current remote sensing-based models of evapotranspiration or carbon assimilation are biased towards clear sky conditions, lacking important information on biophysical processes under cloudy conditions. Unmanned Aerial Vehicle (UAV) imagery has great potential to monitor and understand surface fluxes under cloudy conditions. For instance, in Denmark 73.54% of all days are non-clear (fraction of direct radiation less than 50%). UAV multispectral imagery acquired in these conditions tends to present low brightness and dynamic ranges, and high noise levels. Another problem is the influence of land cover types on the signal. For instance, over vegetated areas, even with low irradiance, saturation is reached in the near Infrared, while visible channels have low brightness. An individual camera setting for each channel and light conditions can improve sensor sensitivity while preventing saturation. This study aims to optimize the settings and radiometric corrections of a multispectral camera to produce high quality UAV imagery under low but homogeneous irradiance conditions. Laboratory experiments were conducted to link irradiance levels to different camera settings and calibration procedures. Results were tested outdoors over homogeneous and vegetated surfaces. The multispectral camera (Tetra Mini-MCA6) has 6 channels in the visible and near Infrared. For the laboratory calibration experiment, different camera settings and typical irradiance levels from cloudy to clear sky were designed. The light-source is based on super-continuum generation to produce a continuous solar spectrum. It allows more flexible settings in illumination levels than tungsten halogen lamps. A Li-Cor 1800 integrating sphere and an ASD spectroradiometer
(FieldSpec HandHeld 2) were also used. Images were acquired under varying integration time and illumination levels from 0.005 to 0.2 W·m⁻²·nm⁻¹·sr⁻¹. Two radiometric calibration methods were applied to find gains to convert digital numbers (DN) into radiance and also to correct vignetting effects, apparent as the fall-off pixel intensity from the image center towards edges. The first is to apply a pixel-wise calibration from DN to radiance. The second performs a vignetting correction based on distance from each pixel to the highest DN pixel and then a global image calibration of averaged DN to radiance. To test calibration performance, images were acquired outdoors over (i) homogeneous targets (Teflon panels, grass and soil plots) and (ii) with UAV flight campaigns over a willow eddy covariance flux site under different cloudiness levels and solar zenith angles using varying camera settings. Radiance, reflectance, and vegetation indices were validated with ASD measurements and signal to noise metrics and dynamic ranges were assessed. Our results indicate that the spectral gains and camera settings can be tuned to allow higher signal to noise ratio and optimize the sensor sensitivity. This maximizes the image radiometric resolution and prevents sensor saturation for each channel. This paper is a step forward for UAV campaigns using optical cameras for low zenith angles and/or cloudy conditions.

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Organisations: Department of Environmental Engineering, Water Resources Engineering, Department of Photonics Engineering, Diode Lasers and LED Systems, Plasmonics and Metamaterials, DTU Danchip, National Space Institute, Geodesy, Atmospheric Environment, European Commission - Joint Research Center
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Perturbations to the Lower Ionosphere by Tropical Cyclone Evan in the South Pacific Region
Very Low Frequency (VLF) electromagnetic signals from navigational transmitters propagate worldwide in the earth-ionosphere waveguide formed by the earth and the electrically conducting lower ionosphere. Changes in the signal properties are signatures of variations in the conductivity of the reflecting boundary of the lower ionosphere which is located in the mesosphere and lower thermosphere, and their analysis is, therefore, a way to study processes in these remote regions. Here we present a study on amplitude perturbations of local origin on the VLF transmitter signals (NPM, NLK, NAA and JJI) observed during tropical cyclone (TC) Evan, 9-16 December 2012 when TC was in the proximity of the transmitter-receiver links. We observed a maximum amplitude perturbation of 5.7 dB on JJI transmitter during 16 December event. From Long Wave Propagation Capability model applied to three selected events we estimate a maximum decrease in the nighttime D-region reference height (H') by ~5.2 km (13 December, NPM) and maximum increase in the daytime D-region H' by 6.1 km and 7.5 km (14 & 16 December, JJI). The results suggest that the TC caused the neutral densities of the mesosphere and lower thermosphere to lift and sink (bringing the lower ionosphere with it), an effect that may be mediated by gravity waves generated by the TC. The perturbations were observed before the storm was classified as a TC, at a time when it was a tropical depression, suggesting the broader conclusion that severe convective storms, in general, perturb the mesosphere and the stratosphere through which the perturbations propagate.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of the South Pacific, CRAAG
Authors: Kumar, S. (Ekstern), Amor, S. N. (Ekstern), Chanrion, O. (Intern), Neubert, T. (Intern)
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Planck intermediate results L. Evidence of spatial variation of the polarized thermal dust spectral energy distribution and implications for CMB B-mode analysis

The characterization of the Galactic foregrounds has been shown to be the main obstacle in the challenging quest to detect primordial B-modes in the polarized microwave sky. We make use of the Planck-HFI 2015 data release at high frequencies to place new constraints on the properties of the polarized thermal dust emission at high Galactic latitudes. Here, we specifically study the spatial variability of the dust polarized spectral energy distribution (SED), and its potential impact on the determination of the tensor-to-scalar ratio, r. We use the correlation ratio of the CBB $^\prime$ angular power spectra between the 217 and 353 GHz channels as a tracer of these potential variations, computed on different high Galactic latitude regions, ranging from 80% to 20% of the sky. The new insight from Planck data is a departure of the correlation ratio from unity that cannot be attributed to a spurious decorrelation due to the cosmic microwave background, instrumental noise, or instrumental systematics. The effect is marginally detected on each region, but the statistical combination of all the regions gives more than 99% confidence for this variation in polarized dust properties. In addition, we show that the decorrelation increases when there is a decrease in the mean column density of the region of the sky being considered, and we propose a simple power-law empirical model for this dependence, which matches what is seen in the Planck data. We explore the effect that this measured decorrelation has on simulations of the BICEP2-Keck Array/Planck analysis and show that the 2015 constraints from these data still allow a decorrelation between the dust at 150 and 353 GHz that is compatible with our measured value. Finally, using simplified models, we show that either spatial variation of the dust SED or of the dust polarization angle are able to produce decorrelations between 217 and 353 GHz data similar to the values we observe in the data.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Copenhagen

Planck intermediate results LI. Features in the cosmic microwave background temperature power spectrum and shifts in cosmological parameters

The six parameters of the standard ΛCDM model have best-fit values derived from the Planck temperature power spectrum that are shifted somewhat from the best-fit values derived from WMAP data. These shifts are driven by features in the Planck temperature power spectrum at angular scales that had never before been measured to cosmic-variance level precision. We have investigated these shifts to determine whether they are within the range of expectation and to understand their origin in the data. Taking our parameter set to be the optical depth of the reionized intergalactic medium τ, the baryon density ωb, the matter density ωm, the angular size of the sound horizon θ∗, the spectral index of the primordial power spectrum, n_s, and A_s e^{-2τ} (where A_s is the amplitude of the primordial power spectrum), we have examined the change in best-fit values between a WMAP-like large angular-scale data set (with multipole moment ℓ < 800 in the Planck temperature power spectrum) and an all angular-scale data set (ℓ < 2500Planck temperature power spectrum), each with a prior on τ of 0.07 ± 0.02. We find that the shifts, in units of the 1σ expected dispersion for each parameter, are \{Δτ, ΔA_s e^{-2τ}, Δω_b, Δω_m, Δθ∗\} = \{-1.7, -2.2, 1.2, -2.0, 1.1, 0.9\}, with a χ^2 value of 8.0. We find that this χ^2 value is exceeded in 15% of our simulated data sets, and that a parameter deviates by more than 2.2σ in 9% of simulated data sets, meaning that the shifts are not unusually large. Comparing ℓ < 800 instead to ℓ > 800, or splitting at a different multipole, yields similar results. We examined the ℓ < 800 model residuals in the ℓ > 800 power spectrum data and find that the features there that drive these shifts are a set of oscillations across a broad range of angular scales. Although they partly appear similar to the effects of enhanced gravitational lensing, the shifts in ΛCDM parameters that arise in response to these features correspond to model spectrum changes that are predominantly due to non-lensing effects; the only exception is τ, which, at fixed A_s e^{-2τ}, affects the ℓ > 800 temperature power spectrum solely through the associated change in A_s and the impact of that on the lensing potential power spectrum. We also ask, "what is it about the power spectrum at ℓ < 800 that leads to somewhat different best-fit parameters than come from the full ℓ range?" We find that if we discard the data at ℓ < 30, where there is a roughly 2σ downward fluctuation in power relative to the model that best fits the full ℓ range, the ℓ < 800 best-fit parameters shift significantly towards the ℓ < 2500 best-fit parameters. In contrast, including ℓ < 30, this previously noted "low-ℓ deficit" drives ns up and impacts parameters correlated with ns, such as ωm and H0. As expected, the ℓ < 30 data have a much greater impact on the ℓ < 800 best fit than on the ℓ < 2500 best fit. So although the shifts are not very significant, we find that they can be understood through the combined effects of an oscillatory-like set of high-ℓ residuals and the deficit in low-ℓ power, excursions consistent with sample variance that happen to map onto changes in cosmological parameters. Finally, we examine agreement between PlanckTT data and two other CMB data sets, namely the Planck lensing reconstruction and the TT power spectrum measured by the South Pole Telescope, again finding a lack of convincing evidence of any significant deviations in parameters, suggesting that current CMB data sets give an internally consistent picture of the ΛCDM model.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics
Measurements of flux density are described for five planets, Mars, Jupiter, Saturn, Uranus, and Neptune, across the six Planck High Frequency Instrument frequency bands (100–857 GHz) and these are then compared with models and existing data. In our analysis, we have also included estimates of the brightness of Jupiter and Saturn at the three frequencies of the Planck Low Frequency Instrument (30, 44, and 70 GHz). The results provide constraints on the intrinsic brightness and the brightness time-variability of these planets. The majority of the planet flux density estimates are limited by systematic errors, but still yield better than 1% measurements in many cases. Applying data from Planck HFI, the Wilkinson Microwave Anisotropy Probe (WMAP), and the Atacama Cosmology Telescope (ACT) to a model that incorporates contributions from Saturn’s rings to the planet’s total flux density suggests a best fit value for the spectral index of Saturn’s ring system of $\beta_{\text{ring}} = 2.30 \pm 0.03$ over the 30–1000 GHz frequency range. Estimates of the polarization amplitude of the planets have also been made in the four bands that have polarization-sensitive detectors (100–353 GHz); this analysis provides a 95% confidence level upper limit on Mars’s polarization of 1.8, 1.7, 1.2, and 1.7% at 100, 143, 217, and 353 GHz, respectively. The average ratio between the Planck-HFI measurements and the adopted model predictions for all five planets (excluding Jupiter observations for 353 GHz) is 1.004, 1.002, 1.021, and 1.033 for 100, 143, 217, and 353 GHz, respectively. Model predictions for planet thermodynamic temperatures are therefore consistent with the absolute calibration of Planck-HFI detectors at about the three-percent level. We compare our measurements with published results from recent cosmic microwave background experiments. In particular, we observe that the flux densities measured by Planck HFI and WMAP agree to within 2%. These results allow experiments operating in the mm-wavelength range to cross-calibrate against Planck and improve models of radiative transport used in planetary science.
Grazing altimetry measurements based on the interferometric method

The exploitation of signals stemming from global navigation systems for passive bistatic radar applications has been proposed and implemented within numerous studies. The fact that such missions do not rely on high power amplifiers and that the need of high gain antennas with large geometrical dimensions can be avoided, makes them suitable for small satellite missions. Applications where a continuous high coverage is needed, as for example disaster warning, have the demand for a large number of satellites in orbit, which in turn requires small and relatively low cost satellites. The proposed PRETTY (Passive Reflectometry and Dosimetry) mission includes a demonstrator payload for passive reflectometry and scatterometry focusing on very low incidence angles whereby the direct and reflected signal will be received via the same antenna. The correlation of both signals will be done by a specific FPGA based hardware implementation. The demonstration of a passive reflectometer without the use of local code replica implicitly shows that also signals of unknown data modulation can be exploited for such a purpose. The PRETTY mission is proposed by an Austrian consortium with RUAG GmbH as prime contractor, relying on the results from a previous CubeSat mission (OPS-SAT) conducted by TU Graz under ESA contract [18]. Within the present paper we will describe the architecture of the passive reflectometer payload within this 3U CubeSat mission and discuss operational routines and constraints to be elaborated in the frame of the proposed activity.

General information
State: Published
Production mechanisms of leptons, photons, and hadrons and their possible feedback close to lightning leaders

It has been discussed that lightning flashes emit high-energy electrons, positrons, photons, and neutrons with single energies of several tens of MeV. In the first part of this paper we study the absorption of neutron beams in the atmosphere. We initiate neutron beams of initial energies of 350 keV, 10 MeV, and 20 MeV at source altitudes of 4 km and 16 km upward and downward and see that in all these cases neutrons reach ground altitudes and that the cross-section areas extend to several km². We estimate that for terrestrial gamma-ray flashes approximately between 10 and 2000 neutrons per ms and m² are possibly detectable at ground, at 6 km, or at 500 km altitude. In the second part of the paper we discuss a feedback model involving the generation and motion of electrons, positrons, neutrons, protons, and photons close to the vicinity of lightning leaders. In contrast to other feedback models, we do not consider large-scale thundercloud fields but enhanced fields of lightning leaders. We launch different photon and electron beams upward at 4 km altitude. We present the spatial and energy distribution of leptons, hadrons, and photons after different times and see that leptons, hadrons, and photons with energies of at least 40 MeV are produced. Because of their high rest mass hadrons are measurable on a longer time scale than leptons and photons. The feedback mechanism together with the field enhancement by lightning leaders yields particle energies even above 40 MeV measurable at satellite altitudes.
Profuse activity of blue electrical discharges at the tops of thunderstorms

Thunderstorm clouds may reach the lower stratosphere, affecting the exchange of greenhouse gases between the troposphere and stratosphere. This region of the atmosphere is difficult to access experimentally and our knowledge of the processes taking place here is incomplete. We recently recorded a color video footage of thunderstorms over the Bay of Bengal from the International Space Station. The observations show a multitude of blue, km-scale, discharges at the cloud top layer at ~18 km altitude and a pulsating blue discharge propagating into the stratosphere reaching ~40 km altitude. The emissions are related to the so-called blue jets, blue starters and possibly pixies. The observations are the first of their kind and give a new perspective on the electrical activity at the top of tropical thunderstorms; further, they underscore that thunderstorm discharges directly perturb the chemistry of the stratosphere with possible implications for the Earth's radiation balance.

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Authors: Chanrion, O. (Intern), Neubert, T. (Intern), Mogensen, A. (Intern), Yair, Y. (Ekstern), Stendel, M. (Ekstern), Singh, R. (Ekstern), Singh, D. (Ekstern)
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Quasi-biennial oscillations in the geomagnetic field: Their global characteristics and origin

Quasi-biennial oscillations (QBOs), with periods in the range 1–3 years, have been persistently observed in the geomagnetic field. They provide unique information on the mechanisms by which magnetospheric and ionospheric current systems are modulated on interannual timescales and are also of crucial importance in studies of rapid core field variations. In this paper, we document the global characteristics of the geomagnetic QBO, using ground-based data collected by geomagnetic observatories between 1985 and 2010, and reexamine the origin of the signals. Fast Fourier transform analysis of second-order derivatives of the geomagnetic X, Y, and Z components reveals salient QBO signals at periods of 1.3, 1.7, 2.2, 2.9, and 5.0 years, with the most prominent peak at 2.2 years. The signature of geomagnetic QBO is generally stronger in the X and Z components and with larger amplitudes on geomagnetically disturbed days. The amplitude of the QBO in the X component decreases from the equator to the poles, then shows a local maximum at subauroral and auroral zones. At high latitudes (poleward of 50°) the geomagnetic QBO exhibits stronger amplitudes during LT 00:00–06:00, depending strongly on the geomagnetic activity level, while at low latitudes the main effect is in the afternoon sector. These results indicate that the QBOs at low-to-middle latitudes and at high latitudes are influenced by different magnetospheric and ionospheric current systems. The characteristics of the multiple peaks in the QBO range are found to display similar latitudinal and local time distributions, suggesting that these oscillations are derived from a common source. The features, including the strong amplitudes seen on disturbed days and during postmidnight sectors, and the results from spherical harmonic analysis, verify that the majority of geomagnetic QBO is of external origin. We furthermore find a very high correlation between the geomagnetic QBO and the QBOs in solar wind speed and solar wind dynamic pressure. This suggests the geomagnetic QBO primarily originates from the current systems due to the solar wind-magnetosphere-ionosphere coupling process.
Rapid ice unloading in the Fleming Glacier region, southern Antarctic Peninsula, and its effect on bedrock uplift rates

Rapid regional warming in the Antarctic Peninsula has led to the significant retreat and eventual collapse of several major ice shelves since the 1970s, triggering the subsequent acceleration and thinning of their feeding glaciers. The Wordie Ice Shelf, lying off the west coast of the Antarctic Peninsula, has undergone long-term disintegration since the 1960s with a substantial calving event occurring around 1989, followed by continuous steady retreat and its almost-complete disappearance. The dynamic response of the upstream glaciers to the ice shelf collapse and the response of the solid Earth to the associated mass loss are not fully understood. To quantify the mass loss from the system, we generated a digital elevation model (DEM) using airborne vertical and oblique imagery from 1966 and compared it to a DEM derived from 2008 SPOT data. This analysis reveals lowering over that time of approximately 60 m at the front of Fleming Glacier. Using IceBridge and ICESat-2/GLAS data spanning 2002–2014, we show an increased rate of mean ice-surface lowering, with rates post-2008 more than twice those of 2002–2008. We use these load change data as a basis for the simulation of viscoelastic solid Earth deformation. We subtract modeled elastic deformation rates, and a suite of modeled viscous rates, from GPS-derived three-dimensional bedrock velocities at sites to the south of Fleming Glacier to infer properties of Earth rheology. Assuming the pre-breakup bedrock uplift was positive due to post-Last Glacial Maximum (LGM) ice retreat, our viscoelastic-corrected GPS uplift rates suggest upper mantle viscosities are >2×10¹⁹ Pas and likely >1×10²⁰ Pas in this region, 1–2 orders of magnitude greater than previously found for the northern Antarctic Peninsula. Horizontal velocities at the GPS site nearest the Fleming Glacier, after the application of elastic and plate tectonic corrections, point away from Marguerite Bay rather than the present glacier front. This suggests that horizontal motion in the region reflects the earlier retreat of the glacier system following the LGM, compatible with a relatively strong mantle in this region. These findings highlight the need for improved understanding of ice load changes in this region through the late Holocene in order to accurately model glacial isostatic adjustment.

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Recovering the Properties of High-redshift Galaxies with Different JWST Broadband Filters

Imaging with the James Webb Space Telescope (JWST) will allow observations of the bulk of distant galaxies at the epoch of reionization. The recovery of their properties, such as age, color excess, specific star formation rate (sSFR), and stellar mass, will mostly rely on spectral energy distribution fitting, based on the data provided by JWST’s two imager cameras, namely the Near Infrared Camera (NIRCam) and the Mid Infrared Imager (MIRI). In this work we analyze the effect of choosing different combinations of NIRCam and MIRI broadband filters, from 0.6 to 7.7 μm, on the recovery of these galaxy properties. We performed our tests on a sample of 1542 simulated galaxies, with known input properties, at z = 7–10. We found that, with only eight NIRCam broadbands, we can recover the galaxy age within 0.1 Gyr and the color excess within 0.06 mag for 70% of the galaxies. Additionally, the stellar masses and sSFR are recovered within 0.2 and 0.3 dex, respectively, at z = 7–9. Instead, at z = 10, no NIRCam band traces purely the λ > 4000 Å regime and the percentage of outliers in stellar mass (sSFR) increases by >20% (>90%), in comparison to z = 9. The MIRI F560W and F770W bands are crucial to improve the stellar mass and the sSFR estimation at z = 10. When nebular emission lines are present, deriving correct galaxy properties is challenging at any redshift and with any band combination. In particular, the
stel lar mass is systematically overestimated in up to 0.3 dex on average with NIRCam data alone and including MIRI observations only marginally improves the estimation.
Reflectivity around the gold L-edges of X-ray reector of the soft X-ray telescope onboard ASTRO-H

We report the atomic scattering factor in the 11.2-15.4 keV for the ASTRO-H Soft X-ray Telescope (SXT) obtained in the ground based measurements. The large effective area of the SXT covers above 10 keV. In fact, the flight data show the spectra of the celestial objects in the hard X-ray band. In order to model the area, the reflectivity measurements in the 11.2-15.4 keV band with the energy pitch of 0.4-0.7 eV were made in the synchrotron beamline Spring-8 BL01B1. We obtained atomic scattering factors f1 and f2 by the curve fitting to the reflectivities of our witness sample. The edges associated with the gold's L-I, II, and III transitions are identified, of which the depths are found to be roughly 60% shallower than those expected from the Henke’s atomic scattering factor.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Japan Aerospace Exploration Agency, Graduate University for Advanced Studies, NASA Goddard Space Flight Center, Nagoya University, Lawrence Livermore National Laboratory, JASRI/SPring-8
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River levels derived with CryoSat-2 SAR data classification - A case study in the Mekong River Basin

In this study we use CryoSat-2 SAR (delay-Doppler synthetic-aperture radar) data in the Mekong River Basin to estimate water levels. Compared to classical pulse limited radar altimetry, medium- and small-sized inland waters can be observed with CryoSat-2 SAR data with a higher accuracy due to the smaller along track footprint. However, even with this SAR data the estimation of water levels over a medium-sized river (width less than 500 m) is still challenging with only very few consecutive observations over the water. The target identification with land-water masks tends to fail as the river becomes smaller. Therefore, we developed a classification approach to divide the observations into water and land returns based solely on the data. The classification is done with an unsupervised classification algorithm, and it is based on features derived from the SAR and range-integrated power (RIP) waveforms. After the classification, classes representing water and land are identified. Better results are obtained when the Mekong River Basin is divided into different geographical regions: upstream, middle stream, and downstream. The measurements classified as water are used in a next step to estimate water levels for each crossing over a river in the Mekong River network. The resulting water levels are validated and compared to gauge data, Envisat data, and CryoSat-2 water levels derived with a land-water mask. The CryoSat-2 water levels derived with the classification lead to more valid observations with fewer outliers in the upstream region than with a land-water mask (1700 with 2% outliers vs. 1500 with 7% outliers). The median of the annual differences that is used in the validation is in all test regions smaller for the CryoSat-2 classification results than for Envisat or CryoSat-2
land-water mask results (for the entire study area: 0.76 m vs. 0.96 m vs. 0.83 m, respectively). Overall, in the upstream region with small- and medium-sized rivers the classification approach is more effective for deriving reliable water level observations than in the middle stream region with wider rivers.

**General information**

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**Authors:** Boergens, E. (Ekstern), Nielsen, K. (Intern), Andersen, O. B. (Intern), Dettmering, D. (Ekstern), Seitz, F. (Ekstern)  
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**Sagittarius A* High-energy X-Ray Flare Properties during NuSTAR Monitoring of the Galactic Center from 2012 to 2015**

Understanding the origin of the flaring activity from the Galactic center supermassive black hole Sagittarius A* is a major scientific goal of the NuSTAR Galactic plane survey campaign. We report on the data obtained between 2012 July and 2015 April, including 27 observations on Sgr A*, with a total exposure of ∼1 Ms. We found a total of 10 X-ray flares detected in the NuSTAR observation window, with luminosities in the range of \(L_{3-79\text{keV}} \sim (0.2-4.0) \times 10^{35} \text{erg s}^{-1}\). With this largest hard X-ray Sgr A* flare data set to date, we studied the flare spectral properties. Seven flares are detected above significance, showing a range of photon indices (\(\Gamma \sim 2.0—2.8\)) with typical uncertainties of ±0.5 (90% confidence level). We found no significant spectral hardening for brighter flares, as indicated by a smaller sample. The accumulation of all of the flare spectra in 1–79 keV can be well fit with an absorbed power-law model with \(\Gamma\), and does not require the existence of a spectral break. The lack of variation in the X-ray spectral index with luminosity would point to a single mechanism for the flares and is consistent with the synchrotron scenario. Lastly, we present the quiescent-state spectrum of Sgr A*, and derive an upper limit on the quiescent luminosity of Sgr A* above 10 keV to be \(L_{xq,10-79\text{keV}} < (2.9 \pm 0.2)\)
\( x \times 10^{34} \text{ erg s}^{-1}. \)

**General information**

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BFI (2008): BFI-level 2
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Sea Surface Roughness Determination from GNSS Ocean Scatterometry

A wave propagator, used to simulate Global Navigation Satellite Systems (GNSS) reflected signals from ocean surfaces, is presented and results are discussed. The wave propagator simulates the characteristics of a bi-static scattering system. The wave propagation is performed using a full-wave solution to a parabolic equation approximating the electromagnetic wave equation. The parabolic equation in the simulator is solved using the split-step sine transformation. The Earth’s surface is modeled with the use of an impedance model. The impedance concept gives an accurate lower boundary condition in the determination of the electromagnetic field, thus making it possible to simulate reflections and the effects of transitions between different media. Simulated GPS ocean surface reflections for different ocean characteristics will be presented and analyzed. The analysis of the simulated surface reflection signals will in general reveal spectral structures of the reflected signals that lead to the extraction of sea surface roughness, and surface wind speed.

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Ship-Iceberg Discrimination in Sentinel-2 Multispectral Imagery by Supervised Classification

The European Space Agency Sentinel-2 satellites provide multispectral images with pixel sizes down to 10 m. This high resolution allows for fast and frequent detection, classification and discrimination of various objects in the sea, which is relevant in general and specifically for the vast Arctic environment. We analyze several sets of multispectral image data from Denmark and Greenland fall and winter, and describe a supervised search and classification algorithm based on physical parameters that successfully finds and classifies all objects in the sea with reflectance above a threshold. It discriminates between objects like ships, islands, wakes, and icebergs, ice floes, and clouds with accuracy better than 90%. Pan-sharpening the infrared bands leads to classification and discrimination of ice floes and clouds better than 95%. For complex images with abundant ice floes or clouds, however, the false alarm rate dominates for small non-sailing boats.

General information
State: Published
Organisations: National Space Institute, University of Copenhagen
Authors: Heiselberg, P. (Ekstern), Heiselberg, H. (Intern)
Number of pages: 19
Short-term variations of Icelandic ice cap mass inferred from cGPS coordinate time series

As the global climate changes, understanding short-term variations in water storage is increasingly important. Continuously operating Global Positioning System (cGPS) stations in Iceland record annual periodic motion—the elastic response to winter accumulation and spring melt seasons—with peak-to-peak vertical amplitudes over 20 mm for those sites in the Central Highlands. Here for the first time for Iceland, we demonstrate the utility of these cGPS-measured displacements for estimating seasonal and shorter-term ice cap mass changes. We calculate unit responses to each of the five largest ice caps in central Iceland at each of the 62 cGPS locations using an elastic half-space model and estimate ice mass variations from the cGPS time series using a simple least squares inversion scheme. We utilize all three components of motion, taking advantage of the seasonal motion recorded in the horizontal. We remove secular velocities and accelerations and explore the impact that seasonal motions due to atmospheric, hydrologic, and nontidal ocean loading have on our inversion results. Our results match available summer and winter mass balance measurements well, and we reproduce the seasonal stake-based observations of loading and melting within the 1 math formula confidence bounds of the inversion. We identify nonperiodic ice mass changes associated with interannual variability in precipitation and other processes such as increased melting due to reduced ice surface albedo or decreased melting due to ice cap insulation in response to tephra deposition following volcanic eruptions, processes that are not resolved with once or twice-yearly stake measurements.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Space Institute, Geodynamics, University of Arizona, University of Iceland, University of Luxembourg, University of Urbino "Carlo Bo"
Authors: Compton, K. (Ekstern), Bennett, R. A. (Ekstern), Hreinsdóttir, S. (Ekstern), van Dam, T. (Ekstern), Bordoni, A. (Intern), Barletta, V. R. (Intern), Spada, G. (Ekstern)
Number of pages: 21
Silicon pore optics for future X-ray telescopes

Lightweight X-ray Wolter optics with a high angular resolution will enable the next generation of X-ray telescopes in space. The candidate mission ATHENA (Advanced Telescope for High Energy Astrophysics) required a mirror assembly of 1 m² effective area (at 1 keV) and an angular resolution of 10 arcsec or better. These specifications can only be achieved with a novel technology like Silicon Pore Optics, which is being developed by ESA together with a consortium of European industry. Silicon Pore Optics are made of commercial Si wafers using process technology adapted from the semiconductor industry. We present the recent upgrades made to the manufacturing processes and equipment, ranging from the manufacture of single mirror plates towards complete focusing mirror modules mounted in flight configuration, and results from first vibration tests. The performance of the mirror modules is tested at X-ray facilities that were recently extended to measure optics at a focal distance up to 20 m.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Cosine Science and Computing B.V., SRON Netherlands Institute for Space Research, European Space Agency, Kayer-Threde GmbH, Physikalisch-Technische Bundesanstalt, Max-Planck-Institute for Extraterrestrial Physics
Number of pages: 6
Publication date: 2017

Simulated and measured performance of a real-time processor for RFI detection and mitigation on-board spaceborne microwave radiometers

An RFI processor breadboard has been designed and developed for future spaceborne microwave radiometer systems. RFI detection is based on the anomalous amplitude, kurtosis, and cross-frequency algorithms. These are implemented in VHDL code in an FPGA. Thus algorithm performance can be assessed by proper code simulation. The breadboard has been integrated with a Ku band radiometer subjected to RFI-like signals from a laboratory generator. Simulations show that the algorithms as implemented work according to theory when subjected to pulsed sinusoidal and QPSK signals. The laboratory measurements confirm the performance for pulsed signals.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Harp Technologies Ltd.
Authors: Skou, N. (Intern), Kristensen, S. S. (Intern), Søbjærg, S. S. (Intern), Kovanen, Å. (Ekstern), Lahtinen, J. (Ekstern)
Number of pages: 4
Pages: 1247-1250
Publication date: 2017
To observe the early optical emissions from gamma ray bursts (GRBs), we built the Slew Mirror Telescope. It utilizes a 150 mm motorized mirror to redirect incoming photons from astrophysical objects within seconds and to track them as compensating satellite movements. The SMT is a major component of the UFFO-pathfinder payload, which was launched on April 28, 2016, onboard the Lomonosov satellite. For the first time, the slewing mirror system has been proven for the precision tracking of astrophysical objects during space operation. We confirmed that the SMT has 1.4 seconds of response time to the X-gamma-ray trigger, and is able to compensate for satellite drift and to track astrophysical objects with magnitudes from 7 to 18.
In order to evaluate a potential calibration target for spaceborne L-band radiometer systems, a 350 × 350 km area near the Concordia station on the East Antarctica plateau was mapped by an airborne L-band radiometer. Unexpectedly, the area showed significant brightness temperature spatial variations, well correlated with bedrock topography, hence ice thickness. Using SMOS data over a poorly known part of Antarctica, ice thickness in this area has been assessed, and an existing bedrock map has been improved.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing
Authors: Skou, N. (Intern), Kristensen, S. S. (Intern)
Number of pages: 4
Pages: 2825-2828
SN2015bh: NGC2770’s 4th supernova or a luminous blue variable on its way to a Wolf-Rayet star?

Very massive stars in the final phases of their lives often show unpredictable outbursts that can mimic supernovae, so-called, “SN impostors”, but the distinction is not always straightforward. Here we present observations of a luminous blue variable (LBV) in NGC2770 in outburst over more than 20 yr that experienced a possible terminal explosion as type IIn SN in 2015, named SN 2015bh. This possible SN (or “main event”) had a precursor peaking similar to 40 days before maximum. The total energy release of the main event is similar to $1.8 \times 10^{49}$ erg, consistent with a $<0.5 \, M_\odot$ shell plunging into a dense CSM. The emission lines show a single narrow P Cygni profile during the LBV phase and a double P Cygni profile post maximum suggesting an association of the second component with the possible SN. Since 1994 the star has been redder than an LBV in an S-Dor-like outburst. SN 2015bh lies within a spiral arm of NGC2770 next to several small star-forming regions with a metallicity of similar to 0.5 solar and a stellar population age of 7-10 Myr. SN 2015bh shares many similarities with SN 2009ip and may form a new class of objects that exhibit outbursts a few decades prior to a “hyper eruption” or final core-collapse. If the star survives this event it is undoubtedly altered, and we suggest that these “zombie stars” may evolve from an LBV to a Wolf-Rayet star over the timescale of only a few years. The final fate of these stars can only be determined with observations a decade or more after the SN-like event.
Soft X-ray focusing Telescope aboard AstroSat: Early results
The Soft X-ray focusing Telescope (SXT) is a moderate-resolution X-ray imaging spectrometer supplementing the ultraviolet and hard X-ray payloads for broadband studies of cosmic sources with AstroSat. Well suited for observing bright X-ray sources, SXT observations of nearby active galactic nuclei (AGN), binary star systems with compact companions, active stars, etc. are producing long soft X-ray light curves and high-quality spectra. The strong X-ray variability and multiple spectral components exhibited by SXT observations of nearby Seyfert 1 galaxies show excellent promise to probe...
accretion disks and central engines in AGN through multi-band variability and spectroscopy.

**General information**
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Tata Institute of Fundamental Research, Inter-University Centre for Astronomy and Astrophysics India, University of Leicester
Authors: Singh, K. P. (Ekstern), Dewangan, G. C. (Ekstern), Chandra, S. (Ekstern), Bhattacharayya, S. (Ekstern), Chitnis, V. (Ekstern), Stewart, G. C. (Ekstern), Westergaard, N. J. (Intern)
Pages: 587-590
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Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.709 SJR 0.311
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.64 SJR 0.289 SNIP 0.717
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.324 SNIP 0.778 CiteScore 0.6
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.313 SNIP 0.907 CiteScore 0.56
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.283 SNIP 0.796 CiteScore 0.51
SI indexed (2013): SI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.334 SNIP 0.863 CiteScore 0.57
SI indexed (2012): SI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.32 SNIP 0.732 CiteScore 0.57
SI indexed (2011): SI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.307 SNIP 0.764
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.338 SNIP 0.847
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.342 SNIP 0.805
Scopus rating (2007): SJR 0.334 SNIP 0.785
Scopus rating (2006): SJR 0.347 SNIP 0.751
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.289 SNIP 0.718
Scopus rating (2004): SJR 0.279 SNIP 0.639
Scopus rating (2003): SJR 0.276 SNIP 0.699
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.239 SNIP 0.572
Scopus rating (2001): SJR 0.277 SNIP 0.635
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.259 SNIP 0.553
Soft X-ray Focusing Telescope Aboard AstroSat: Design, Characteristics and Performance

The Soft X-ray focusing Telescope (SXT), India’s first X-ray telescope based on the principle of grazing incidence, was launched aboard the AstroSat and made operational on October 26, 2015. X-rays in the energy band of 0.3–8.0 keV are focussed on to a cooled charge coupled device thus providing medium resolution X-ray spectroscopy of cosmic X-ray sources of various types. It is the most sensitive X-ray instrument aboard the AstroSat. In its first year of operation, SXT has been used to observe objects ranging from active stars, compact binaries, supernova remnants, active galactic nuclei and clusters of galaxies in order to study its performance and quantify its characteristics. Here, we present an overview of its design, mechanical hardware, electronics, data modes, observational constraints, pipeline processing and its in-orbit performance based on preliminary results from its characterization during the performance verification phase.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Tata Institute of Fundamental Research, University of Leicester, Inter-University Center for Astronomy and Astrophysics, Vikram Sarabhai Space Centre, ISRO Satellite Centre, Space Application Centre
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.288 SJR 0.266
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.45 SJR 0.291 SNIP 0.335
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.229 SNIP 0.154 CiteScore 0.28
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.434 SNIP 0.54 CiteScore 0.62
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.404 SNIP 0.194 CiteScore 0.55
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.305 SNIP 0.23 CiteScore 0.33
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.313 SNIP 0.467 CiteScore 0.49
Stellar aberration correction and thermoelastic compensation of Swarm μASC attitude observations: A comment to the Express Letter “Mysterious misalignments between geomagnetic and stellar reference frames seen in CHAMP and Swarm satellite measurements”, by Stefan Maus

The Swarm constellation of three satellites measures the magnetic signal of the Earth using both a Vector Field Magnetometer and an Absolute Scalar Magnetometer. A Micro Advanced Stellar Compass (μASC) mounted on a common, supposedly stable, optical bench precisely determines its inertial attitude. However, comparison of the Inter Boresight Angle shows a relative attitude variation between the μASC Camera Head Units. These misalignments between Camera Head Units and a geomagnetic reference frame cannot be explained by incorrect aberration correction (as theorized by Maus). Herceg et al. found them to be caused by thermal gradient sensitivity of the optical bench system, opposing the underlying assumption of perfect platform stability. The results after applying thermal corrections show significant decrease in root mean square, with Inter Boresight Angle of thermally corrected data being nearly flat and clean from any variation caused by thermoelastic effects.

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Herceg, M. (Intern), Jørgensen, P. S. (Intern), Jørgensen, J. L. (Intern)
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Main Research Area: Technical/natural sciences

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Journal: Geophysical Journal International
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Ratings:
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Web of Science (2018): Indexed yes
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Scopus rating (2017): SNIP 1.195 SJR 1.506
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.61 SJR 1.749 SNIP 1.465
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Storm-induced water dynamics and thermohaline structure at the tidewater Flade Isblink Glacier outlet to the Wandel Sea (NE Greenland)

In April 2015, an ice-tethered conductivity-temperature-depth (CTD) profiler and a down-looking acoustic Doppler current profiler (ADCP) were deployed from the landfast ice near the tidewater glacier terminus of the Flade Isblink Glacier in the Wandel Sea, NE Greenland. The 3-week time series showed that water dynamics and the thermohaline structure were modified considerably during a storm event on 22-24 April, when northerly winds exceeded 15 ms\(^{-1}\). The storm initiated downwelling-like water dynamics characterized by on-shore water transport in the surface (0-40 m) layer and compensating offshore flow at intermediate depths. After the storm, currents reversed in both layers, and the relaxation phase of down-welling lasted similar to 4 days. Although current velocities did not exceed 5 cm s\(^{-1}\), the enhanced circulation during the storm caused cold turbid intrusions at 75-95 m depth, which are likely attributable to subglacial water from the Flade Isblink Ice Cap. It was also found that the semidiurnal periodicities in the temperature and salinity time series were associated with the lunar semidiurnal tidal flow. The vertical structure of tidal currents corresponded to the first baroclinic mode of the internal tide with a velocity minimum at similar to 40 m. The tidal ellipses rotate in opposite directions above and below this depth and cause a divergence of tidal flow, which was observed to induce semidiurnal internal waves of about 3 m height at the front of the glacier terminus. Our findings provide evidence that shelf-basin interaction and tidal forcing can potentially modify coastal Wandel Sea waters even though they are isolated from the atmosphere by landfast sea ice almost year-round. The northerly storms over the continental slope cause an enhanced circulation facilitating a release of cold and turbid subglacial water to the shelf. The tidal flow may contribute to the removal of such water from the glacial terminus.

General information
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Organisations: National Space Institute, Microwaves and Remote Sensing, University of Manitoba, Aarhus University
Authors: Kirillov, S. (Ekstern), Dmitrenko, I. (Ekstern), Rysgaard, S. (Ekstern), Babb, D. (Ekstern), Pedersen, L. T. (Intern), Ehn, J. (Ekstern), Bendtsen, J. (Ekstern), Barber, D. (Ekstern)
Number of pages: 13
Pages: 947-959
Publication date: 2017
Main Research Area: Technical/natural sciences

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Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.05 SJR 1.554
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.9 SJR 1.881 SNIP 1.358
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.88 SNIP 1.256 CiteScore 2.7
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.528 SNIP 1.073 CiteScore 2.14
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.551 SNIP 1.052 CiteScore 2.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.752 SNIP 1.032 CiteScore 1.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.512 SNIP 0.965 CiteScore 2.21
ISI indexed (2011): ISI indexed no
Strapdown Airborne Gravimetry Using a Combination of Commercial Software and Stable-Platform Gravity Estimates

For the past two decades, airborne gravimetry using a Strapdown Inertial Measurement Unit (SIMU) has been producing gravity estimates comparable to the traditional stable-platform single-axis gravimeters. The challenge has been to control the long term drift of the IMU sensors, propagating into the long-wavelengths of the gravity estimates. This has made the stable-platform approach the preferred method for geodetic applications. In the summer of 2016, during a large airborne survey in Malaysia, a SIMU system was flown alongside a traditional LaCoste & Romberg (LCR) gravimeter. The SIMU observations were combined with GNSS observations using the commercial software product "Inertial Explorer" from NovAtel’s Waypoint software suite, and it is shown how gravity estimates can be derived from these results. A statistical analysis of the crossover differences yields an RMS error of 2.5 mGal, which is comparable to the results obtained from the LCR gravimeter. The properties of the SIMU and LCR systems are compared and a merging of the two is performed. A statistical analysis of the crossover differences of the merged product yields an RMS error of 1.3 mGal. These results indicate that the properties of the two units are complementary and that a combination of the two can result in improved gravity estimates.

Strapdown Airborne Gravimetry Using a Combination of Commercial Software and Stable-Platform Gravity Estimates

STROBE-X: X-Ray Timing and Spectroscopy on Dynamical Timescales from Microseconds to Years

The Spectroscopic Time-Resolving Observatory for Broadband Energy X-rays (STROBE-X) probes strong gravity for stellar mass to supermassive black holes and ultradense matter with unprecedented effective area, high time-resolution, and good spectral resolution, while providing a powerful time-domain X-ray observatory.
Temperature trends with reduced impact of ocean air temperature

Temperature data 1900-2010 from meteorological stations across the world have been analysed and it has been found that all areas generally have two different valid temperature trends. Coastal stations and hill stations facing dominant ocean winds are normally more warm-trended than the valley stations which are sheltered from dominant oceans winds. Thus in any area with some variation in the topography, we can divide the stations into the more warm trended OAA (Ocean Air Affected) stations, and the more cold trended OAS (Ocean Air Sheltered) stations. We therefore find that the distinction between Ocean Air Affected and Ocean Air Sheltered stations can be used to identify the influence of the oceans on land surface temperatures and also as a tool to better study climate variability on the land surface without the moderating effects of the ocean.
The analysis of initial Juno magnetometer data using a sparse magnetic field representation

The Juno spacecraft, now in polar orbit about Jupiter, passes much closer to Jupiter's surface than any previous spacecraft, presenting a unique opportunity to study the largest and most accessible planetary dynamo in the solar system. Here we present an analysis of magnetometer observations from Juno's first perijove pass (PJ1; to within 1.06 RJ of Jupiter's center). We calculate the residuals between the vector magnetic field observations and that calculated using the VIP4 spherical harmonic model and fit these residuals using an elastic net regression. The resulting model demonstrates how effective Juno's near-surface observations are in improving the spatial resolution of the magnetic field within the immediate vicinity of the orbit track. We identify two features resulting from our analyses: the presence of strong, oppositely signed pairs of flux patches near the equator and weak, possibly reversed-polarity patches of magnetic field over the polar regions. Additional orbits will be required to assess how robust these intriguing features are.

General information

State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems, Harvard University, NASA Goddard Space Flight Center
Authors: Moore, K. M. (Ekstern), Bloxham, J. (Ekstern), Connerney, J. E. P. (Ekstern), Jørgensen, J. L. (Intern), Merayo, J. M. (Intern)
Pages: 4687–4693
Publication date: 2017
Main Research Area: Technical/natural sciences
The work on the definition and technological preparation of the ATHENA (Advanced Telescope for High ENergy Astrophysics) mission continues to progress. In parallel to the study of the accommodation of the telescope, many aspects of the X-ray optics are being evolved further. The optics technology chosen for ATHENA is the Silicon Pore Optics (SPO), which hinges on technology spin-in from the semiconductor industry, and uses a modular approach to produce large effective area lightweight telescope optics with a good angular resolution. Both system studies and the technology developments are guided by ESA and implemented in industry, with participation of institutional partners. In this paper an overview of the current status of the telescope optics accommodation and technology development activities is provided.
The CHAOS-X Model and Uncertainty Values for Magnetic Directional Surveying

The Earth’s magnetic field provides a unique natural source of orientation information that is particularly useful for subsurface magnetic measurement-while-drilling (MWD) navigation. In order to utilize the MWD magnetic field measurements for calculating the orientation of the bottom hole assembly (BHA), an accurate geomagnetic reference model is needed for comparison. In this paper we present the CHAOS-X model, a new geomagnetic reference model that provides global vector field estimates of Earth’s magnetic field, with high resolution in both space and time, for precision magnetic directional surveying applications.

The model is derived from more than one million satellite and ground-based observatory magnetic measurements and consists of modules representing internal sources (in the Earth’s core and crust), magnetospheric sources, and ionospheric sources. Compared with previous reference models, the CHAOS-X model is particularly designed for better characterization of the time variations in the geomagnetic field. In this paper, we describe the model and present benchmark comparisons with magnetic observatory data to establish the uncertainty values required in models of wellbore positional errors in magnetic directional surveying applications. The discrepancy between geomagnetic measurements and reference models are typically dominated by spatial variations caused by local geology. In applications requiring high accuracy, these variations can be taken into account by using a dedicated local model. In such cases, when the errors associated with local geology is small, our results show that the CHAOS-X reference model may yield a significant improvement compared with existing reference models. This result holds both when the model is used predictively and retrospectively. We also argue that using a model with an accurate description of the time variations improves recent magnetic surveys while drilling, since the description of the rapid time variations can be updated near real-time.

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The coastal mean dynamic topography in Norway observed by CryoSat-2 and GOCE
New-generation synthetic aperture radar altimetry, as implemented on CryoSat-2, observes sea surface heights in coastal areas that were previously not monitored by conventional altimetry. Therefore, CryoSat-2 is expected to improve the coastal mean dynamic topography (MDT). However, the MDT remains highly reliant on the geoid. Using new regional geoid models as well as CryoSat-2 data, we determine three geodetic coastal MDT models in Norway and validate them against independent tide-gauge observations and the operational coastal ocean model NorKyst800. The CryoSat-2 MDTs agree on the ~3–5 cm level with both tide-gauge geodetic and ocean MDTs along the Norwegian coast. In addition, we compute geostrophic surface currents to help identifying errors in the geoid models. We find that even though the regional geoid models are all based on the latest satellite gravity data as provided by GOCE, the resulting circulation patterns differ. We demonstrate that some of these differences are due to erroneous or lack of marine gravity data. This suggests that there is significant MDT signal at spatial scales beyond GOCE, and that the geodetic approach to MDT determination benefits from the additional terrestrial gravity information provided by the regional geoid model. We also find that the border of the geographical mode mask of CryoSat-2 coincides with the Norwegian Coastal Current, making it challenging to distinguish between artifacts in the CryoSat-2 observations during mode switch and ocean signal.

General information
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Organisations: National Space Institute, Geodesy, Norwegian University of Life Sciences
Authors: Idžanović, M. (Ekstern), Ophaug, V. (Ekstern), Andersen, O. B. (Intern)
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.429 SJR 2.657
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.35 SJR 2.819 SNIP 1.495
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.24 SNIP 1.728 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.122 SNIP 1.577 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
e-ASTROGAM mission: Exploring the extreme Universe with gamma rays in the MeV – GeV range

e-ASTROGAM (‘enhanced ASTROGAM’) is a breakthrough Observatory space mission, with a detector composed by a Silicon tracker, a calorimeter, and an anticoincidence system, dedicated to the study of the non-thermal Universe in the photon energy range from 0.3 MeV to 3 GeV – the lower energy limit can be pushed to energies as low as 150 keV, albeit with rapidly degrading angular resolution, for the tracker, and to 30 keV for calorimetric detection. The mission is based on an advanced space-proven detector technology, with unprecedented sensitivity, angular and energy resolution, combined with polarimetric capability. Thanks to its performance in the MeV-GeV domain, substantially improving its predecessors, e-ASTROGAM will open a new window on the non-thermal Universe, making pioneering observations of the most powerful Galactic and extragalactic sources, elucidating the nature of their relativistic outflows and their effects on the surroundings. With a line sensitivity in the MeV energy range one to two orders of magnitude better than previous generation instruments, e-ASTROGAM will determine the origin of key isotopes fundamental for the understanding of supernova explosion and the chemical evolution of our Galaxy. The mission will provide unique data of significant interest to a broad astronomical community, complementary to powerful observatories such as LIGO-Virgo-GEO600-KAGRA, SKA, ALMA, E-ELT, TMT, LSST, JWST, Athena, CTA, IceCube, KM3NeT, and the promise of eLISA.

Bibliographical note

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The e-ASTROGAM mission: Exploring the extreme Universe with gamma rays in the MeV – GeV range

e-ASTROGAM (‘enhanced ASTROGAM’) is a breakthrough Observatory space mission, with a detector composed by a Silicon tracker, a calorimeter, and an anticoincidence system, dedicated to the study of the non-thermal Universe in the photon energy range from 0.3 MeV to 3 GeV – the lower energy limit can be pushed to energies as low as 150 keV, albeit with rapidly degrading angular resolution, for the tracker, and to 30 keV for calorimetric detection. The mission is based on an advanced space-proven detector technology, with unprecedented sensitivity, angular and energy resolution, combined with polarimetric capability. Thanks to its performance in the MeV-GeV domain, substantially improving its predecessors, e-ASTROGAM will open a new window on the non-thermal Universe, making pioneering observations of the most powerful Galactic and extragalactic sources, elucidating the nature of their relativistic outflows and their effects on the surroundings. With a line sensitivity in the MeV energy range one to two orders of magnitude better than previous generation instruments, e-ASTROGAM will determine the origin of key isotopes fundamental for the understanding of supernova explosion and the chemical evolution of our Galaxy. The mission will provide unique data of significant interest to a broad astronomical community, complementary to powerful observatories such as LIGO-Virgo-GEO600-KAGRA, SKA, ALMA, E-ELT, TMT, LSST, JWST, Athena, CTA, IceCube, KM3NeT, and the promise of eLISA.
The effect of signal leakage and glacial isostatic rebound on GRACE-derived ice mass changes in Iceland

Monthly gravity field models from the GRACE satellite mission are widely used to determine ice mass changes of large ice sheets as well as smaller glaciers and ice caps. Here, we investigate in detail the ice mass changes of the Icelandic ice caps as derived from GRACE data. The small size of the Icelandic ice caps, their location close to other rapidly changing ice covered areas and the low viscosity of the mantle below Iceland make this especially challenging. The mass balance of the ice caps is well constrained by field mass balance measurements, making this area ideal for such investigations. We find that the ice mass changes of the Icelandic ice caps derived from GRACE gravity field models are influenced by both the large gravity change signal resulting from ice mass loss in southeast Greenland and the mass redistribution within the Earth mantle due to glacial isostatic adjustment since the Little Ice Age (~ 1890 AD). To minimize the signal that leaks towards Iceland from Greenland, we employ an independent mass change estimate of the Greenland Ice Sheet derived from satellite laser altimetry. We also estimate the effect of post Little Ice Age glacial isostatic adjustment, from knowledge of the ice history and GPS network constrained crustal deformation data. We find that both the leakage from Greenland and the post Little Ice Age glacial isostatic adjustment are important to take into account, in order to correctly determine Iceland ice mass changes from GRACE, and when applying these an average mass balance of the Icelandic ice caps of -11.4 +/- 2.2 Gt yr^-1 for the period 2003-2010 is found. This number corresponds well with available mass balance measurements.

General information
State: Published
Organisations: National Space Institute, Geodynamics, University of Iceland
Authors: Sørensen, L. S. (Intern), Jarosch, A. H. (Ekstern), Adalgeirsdottir, G. (Ekstern), Barletta, V. R. (Intern), Forsberg, R. (Intern), Pálsson, F. (Ekstern), Bjornsson, H. (Ekstern), Johannesson, T. (Ekstern)
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The influence of bremsstrahlung on electric discharge streamers in N₂, O₂ gas mixtures

Streamers are ionization filaments of electric gas discharges. Negative polarity streamers propagate primarily through electron impact ionization, whereas positive streamers in air develop through ionization of oxygen by UV photons emitted by excited nitrogen; however, experiments show that positive streamers may develop even for low oxygen concentrations.
Here we explore if bremsstrahlung ionization facilitates positive streamer propagation. To discriminate between effects of UV and bremsstrahlung ionization, we simulate the formation of a double headed streamer at three different oxygen concentrations: no oxygen, 1 ppm O₂ and 20% O₂, as in air. At these oxygen levels, UV-relative to bremsstrahlung ionization is zero, small, and large. The simulations are conducted with a particle-in-cell code in a cylindrically symmetric configuration at ambient electric field magnitudes three times the conventional breakdown field. We find that bremsstrahlung induced ionization in air, contrary to expectations, reduces the propagation velocity of both positive and negative streamers by about 15%. At low oxygen levels, positive streamers stall; however, bremsstrahlung creates branching sub-streamers emerging from the streamer front that allow propagation of the streamer. Negative streamers propagate more readily forming branching sub-streamers. These results are in agreement with experiments. At both polarities, ionization patches are created ahead of the streamer front. Electrons with the highest energies are in the sub-streamer tips and the patches.

General information
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Authors: Köhn, C. (Intern), Chanrion, O. (Intern), Neubert, T. (Intern)
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Scopus rating (2016): CiteScore 1.93 SJR 1.016 SNIP 1.276
Web of Science (2016): Indexed yes
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.007 SNIP 1.453 CiteScore 1.98
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Scopus rating (2011): SJR 1.134 SNIP 1.787 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 1.274 SNIP 1.67
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Scopus rating (2009): SJR 1.106 SNIP 1.395
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Scopus rating (2008): SJR 1.402 SNIP 1.998
Scopus rating (2007): SJR 1.081 SNIP 1.453
Scopus rating (2006): SJR 1.285 SNIP 1.961
Scopus rating (2005): SJR 1.099 SNIP 1.592
The Juno Magnetic Field Investigation

The Juno Magnetic Field investigation (MAG) characterizes Jupiter’s planetary magnetic field and magnetosphere, providing the first globally distributed and proximate measurements of the magnetic field of Jupiter. The magnetic field instrumentation consists of two independent magnetometer sensor suites, each consisting of a tri-axial Fluxgate Magnetometer (FGM) sensor and a pair of co-located imaging sensors mounted on an ultra-stable optical bench. The imaging system sensors are part of a subsystem that provides accurate attitude information (to ~20 arcsec on a spinning spacecraft) near the point of measurement of the magnetic field. The two sensor suites are accommodated at 10 and 12 m from the body of the spacecraft on a 4 m long magnetometer boom affixed to the outer end of one of three solar array assemblies. The magnetometer sensors are controlled by independent and functionally identical electronics boards within the magnetometer electronics package mounted inside Juno’s massive radiation shielded vault. The imaging sensors are controlled by a fully hardware redundant electronics package also mounted within the radiation vault. Each magnetometer sensor measures the vector magnetic field with 100 ppm absolute vector accuracy over a wide dynamic range (to 16 Gauss = 1.6 \times 10^6 \text{ per axis}) with a resolution of \sim 0.05 \text{nT in the most sensitive dynamic range (\pm 1600 \text{nT per axis}). Both magnetometers sample the magnetic field simultaneously at an intrinsic sample rate of 64 vector samples per second. The magnetic field instrumentation may be reconfigured in flight to meet unanticipated needs and is fully hardware redundant. The attitude determination system compares images with an on-board star catalog to provide attitude solutions (quaternions) at a rate of up to 4 solutions per second, and may be configured to acquire images of selected targets for science and engineering analysis. The system tracks and catalogs objects that pass through the imager field of view and also provides a continuous record of radiation exposure. A spacecraft magnetic control program was implemented to provide a magnetically clean environment for the magnetic sensors, and residual spacecraft fields and/or sensor offsets are monitored in flight taking advantage of Juno’s spin (nominally 2 rpm) to separate environmental fields from those that rotate with the spacecraft.

General information

State: Published
Authors: Connerney, J. E. P. (Ekstern), Benn, M. (Intern), Bjarnø, J. B. (Intern), Denver, T. (Intern), Espley, J. (Ekstern), Jørgensen, J. L. (Intern), Jørgensen, P. S. (Intern), Lawton, P. (Ekstern), Malinnikova Bang, A. (Intern), Merayo, J. M. (Intern), Murphy, S. (Ekstern), Odom, J. (Ekstern), Oliversen, R. (Ekstern), Schnurr, R. (Ekstern), Sheppard, D. (Ekstern), Smith, E. J. (Ekstern)
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ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 2.223 SNIP 1.724
Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 2.176 SNIP 1.758
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.739 SNIP 1.313
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Scopus rating (2006): SJR 2.306 SNIP 1.394
Scopus rating (2005): SJR 1.76 SNIP 1.297
Scopus rating (2004): SJR 1.207 SNIP 0.944
Scopus rating (2003): SJR 1.397 SNIP 1.341
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.967 SNIP 0.903
Scopus rating (2001): SJR 1.285 SNIP 1.026
Scopus rating (2000): SJR 1.083 SNIP 0.779
Web of Science (2000): Indexed yes
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The Juno Radiation Monitoring (RM) Investigation
The Radiation Monitoring Investigation of the Juno Mission will actively retrieve and analyze the noise signatures from penetrating radiation in the images of Juno’s star cameras and science instruments at Jupiter. The investigation’s objective is to profile Jupiter’s > 10-MeV electron environment in regions of the Jovian magnetosphere which today are still largely unexplored. This paper discusses the primary instruments on Juno which contribute to the investigation’s data
suite, the measurements of camera noise from penetrating particles, spectral sensitivities and measurement ranges of the instruments, calibrations performed prior to Juno’s first science orbit, and how the measurements may be used to infer the external relativistic electron environment.

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                    - Scopus rating (2005): SJR 1.76 SNIP 1.297
                    - Scopus rating (2004): SJR 1.207 SNIP 0.944
                    - Scopus rating (2003): SJR 1.397 SNIP 1.341
The NuSTAR Hard X-Ray Survey of the Norma Arm Region

We present a catalog of hard X-ray sources in a square-degree region surveyed by the Nuclear Spectroscopic Telescope Array (NuSTAR) in the direction of the Norma spiral arm. This survey has a total exposure time of 1.7 Ms, and the typical and maximum exposure depths are 50 ks and 1 Ms, respectively. In the area of deepest coverage, sensitivity limits of $5 \times 10^{-14}$ and $4 \times 10^{-14}$ erg s$^{-1}$ cm$^{-2}$ in the 3–10 and 10–20 keV bands, respectively, are reached. Twenty-eight sources are firmly detected, and 10 are detected with low significance; 8 of the 38 sources are expected to be active galactic nuclei. The three brightest sources were previously identified as a low-mass X-ray binary, high-mass X-ray binary, and pulsar wind nebula. Based on their X-ray properties and multiwavelength counterparts, we identify the likely nature of the other sources as two colliding wind binaries, three pulsar wind nebulae, a black hole binary, and a plurality of cataclysmic variables (CVs). The CV candidates in the Norma region have plasma temperatures of ≈10–20 keV, consistent with the Galactic ridge X-ray emission spectrum but lower than the temperatures of CVs near the Galactic center. This temperature difference may indicate that the Norma region has a lower fraction of intermediate polars relative to other types of CVs compared to the Galactic center. The NuSTAR logN–logS distribution in the 10–20 keV band is consistent with the distribution measured by Chandra at 2–10 keV if the average source spectrum is assumed to be a thermal model with kT ≈ 15 keV, as observed for the CV candidates.

General information

State: Published

Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Universite de Toulouse, University of California at Berkeley, Harvard-Smithsonian Center for Astrophysics, Columbia University, Pontificia Universidad Catolica de Chile, European Southern Observatory, California Institute of Technology, Georgia College and State University, Durham University, Lawrence Livermore National Laboratory, ASI Science Data Center, Hiroshima University, SLAC National Accelerator Laboratory, National Institute for Astrophysics, NASA Goddard Space Flight Center


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The NuSTAR serendipitous survey: the 40-month catalog and the properties of the distant high-energy X-ray source population

We present the first full catalog and science results for the Nuclear Spectroscopic Telescope Array (NuSTAR) serendipitous survey. The catalog incorporates data taken during the first 40 months of NuSTAR operation, which provide ≈20 Ms of effective exposure time over 331 fields, with an areal coverage of 13 deg², and 497 sources detected in total over the 3–24 keV energy range. There are 276 sources with spectroscopic redshifts and classifications, largely resulting from our extensive campaign of ground-based spectroscopic follow-up. We characterize the overall sample in terms of the X-ray, optical, and infrared source properties. The sample is primarily composed of active galactic nuclei (AGNs), detected over a large range in redshift from z = 0.002 to 3.4 (median of ), but also includes 16 spectroscopically confirmed Galactic sources. There is a large range in X-ray flux, from to −11, and in rest-frame 10–40 keV luminosity, from to 46, with a median of 44.1. Approximately 79% of the NuSTAR sources have lower-energy (<10 keV) X-ray counterparts from XMM-Newton, Chandra, and Swift XRT. The mid-infrared (MIR) analysis, using WISE all-sky survey data, shows that MIR AGN color selections miss a large fraction of the NuSTAR-selected AGN population, from ≈15% at the highest luminosities ( erg s⁻¹) to ≈80% at the lowest luminosities ( erg s⁻¹). Our optical spectroscopic analysis finds that the observed fraction of optically obscured AGNs (i.e., the type 2 fraction) is , for a well-defined subset of the 8–24 keV selected sample. This is higher, albeit at a low significance level, than the type 2 fraction measured for redshift- and luminosity-matched AGNs selected by <10 keV X-ray missions.
The performance and potentials of the CryoSat-2 SAR and SARIn modes for lake level estimation

Over the last few decades, satellite altimetry has proven to be valuable for monitoring lake levels. With the new generation of altimetry missions, CryoSat-2 and Sentinel-3, which operate in Synthetic Aperture Radar (SAR) and SAR Interferometric (SARIn) modes, the footprint size is reduced to approximately 300 m in the along-track direction. Here, the performance of these new modes is investigated in terms of uncertainty of the estimated water level from CryoSat-2 data and the agreement with in situ data. The data quality is compared to conventional low resolution mode (LRM) altimetry products from Envisat, and the performance as a function of the lake area is tested. Based on a sample of 145 lakes with areas ranging from a few to several thousand km², the CryoSat-2 results show an overall superior performance. For lakes with an area below 100 km², the uncertainty of the lake levels is only half of that of the Envisat results. Generally, the CryoSat-2 lake levels also show a better agreement with the in situ data. The lower uncertainty of the CryoSat-2 results entails a more detailed description of water level variations.

General information
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Organisations: National Space Institute, Geodesy
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 0.53 SNIP 1.057 CiteScore 1.96
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 0.518 SNIP 0.96 CiteScore 1.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
The Phoenix galaxy as seen by NuSTAR

Aims. We study the long-term variability of the well-known Seyfert 2 galaxy Mrk 1210 (also known as UGC 4203, or the Phoenix galaxy). Methods. The source was observed by many X-ray facilities in the last 20 yr. Here we present a NuSTAR observation and put the results in the context of previously published observations. Results. NuSTAR observed Mrk 1210 in 2012 for 15.4 ks. The source showed Compton-thin obscuration similar to that observed by Chandra, Suzaku, BeppoSAX and XMM-Newton over the past two decades, but different from the first observation by ASCA in 1995, in which the active nucleus was caught in a low flux state or was obscured by Compton-thick matter with a reflection-dominated spectrum. Thanks to the high-quality hard X-ray spectrum obtained with NuSTAR and exploiting the long-term spectral coverage spanning 16.9 yr, we can precisely disentangle the transmission and reflection components and put constraints on both the intrinsic long-term variability and hidden nucleus scenarios. In the former case, the distance between the reflector and the source must be at least ~2 pc, while in the latter the eclipsing cloud may be identified with a water maser-emitting clump.
The Planck Length and the Constancy of the Speed of Light in Five Dimensional Spacetime Parametrized with Two Time Coordinates

In relativity and quantum field theory, the vacuum speed of light is assumed to be constant; the range of validity of general relativity is determined by the Planck length. However, there has been no convincing theory explaining the constancy of the light speed. In this paper, we assume a five dimensional spacetime with three spatial dimensions and two local time
coordinates giving us a hint about the constancy of the speed of light. By decomposing the five dimensional spacetime vector into four-dimensional vectors for each time dimension and by minimizing the resulting action, for a certain class of additional time dimensions, we observe the existence of a minimal length scale, which we identify as the Planck scale. We derive an expression for the speed of light as a function of space and time and observe the constancy of the vacuum speed of light in the observable universe.

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Authors: Köhn, C. (Intern)
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The role of charged ice hydrometeors in lightning initiation
In connection with the lightning initiation problem, we consider positive streamer formation around charged, needle-shaped ice hydrometeors in an external electric field. We present results of numerical simulations of the streamer discharges that include the ice dielectric polarization and conductivity, and determine the external field intensity, at which stable streamer development is possible for different hydrometeor sizes and charge magnitudes. We find that the required charge is within the range of measured precipitation charges while the required external field is higher than observed in thunderclouds. We conclude, therefore, that a second mechanism for amplification of thundercloud fields is required for the streamer inception.

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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.39 SJR 0.749 SNIP 0.845
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.913 SNIP 0.947 CiteScore 1.48
THESEUS is a space mission concept aimed at exploiting Gamma-Ray Bursts for investigating the early Universe and at providing a substantial advancement of multi-messenger and time-domain astrophysics. These goals will be achieved through a unique combination of instruments allowing GRBs and X-ray transients detection over a broad FOV (more than 1sr) with 0.5-1 arcmin localization, an energy band extending from several MeVs down to 0.3 keV and high sensitivity to transient sources in the soft X-ray domain, as well as on-board prompt (few minutes) follow-up with a 0.7 m class IR telescope with both imaging and spectroscopic capabilities. THESEUS will be perfectly suited for addressing the main open issues in cosmology such as, e.g., star formation rate and metallicity evolution of the inter-stellar and intra-galactic medium up to redshift ~10, signatures of Pop III stars, sources and physics of re-ionization, and the faint end of the galaxy luminosity function. In addition, it will provide unprecedented capability to monitor the X-ray variable sky, thus detecting, localizing, and identifying the electromagnetic counterparts to sources of gravitational radiation, which may be routinely detected in the late '20s / early '30s by next generation facilities like aLIGO/ aVirgo, eLISA, KAGRA, and Einstein Telescope. THESEUS will also provide powerful synergies with the next generation of multi-wavelength observatories (e.g., LSST, ELT, SKA, CTA, ATHENA).
The weak neutral Fe fluorescence line and long-term X-ray evolution of the Compton-thick AGN in NGC 7674

We present NuSTAR X-ray observations of the active galactic nucleus (AGN) in NGC 7674. The source shows a flat X-ray spectrum, suggesting that it is obscured by Compton-thick gas columns. Based upon long-term flux dimming, previous work suggested the alternate possibility that the source is a recently switched-off AGN with the observed X-rays being the lagged echo from the torus. Our high-quality data show the source to be reflection-dominated in hard X-rays, but with a relatively weak neutral Fe Kα emission line (equivalent width [EW] of ≈ 0.4 keV) and a strong Fe XXVI ionised line (EW = 0.2 keV). We construct an X-ray light curve of NGC 7674 spanning 37 years and find that the observed 2-10 keV X-ray flux has remained constant for the past ≈ 20 years. Light travel time arguments constrain the minimum radius of the reflector to be ∼3.2pc under the switched-off AGN scenario, ≈30 times larger than the expected dust sublimation radius, rendering this possibility unlikely. A combination of intrinsic fading and patchy obscuration cannot be ruled out. A Compton-thick AGN (CTAGN) solution requires a minimum line-of-sight column density (NH) of 3 × 10^{24} cm\(^{-2}\) and yields an intrinsic 2-10 keV luminosity of (3-5) × 10^{43} erg s\(^{-1}\). Realistic uncertainties span the range of (1-13) × 10^{43} erg s\(^{-1}\).

The source has one of the weakest fluorescence lines amongst bona fide CTAGN, and potentially a local analogue of bolometrically luminous systems showing complex neutral and ionised Fe emission. It exemplifies the difficulty of identification and proper characterisation of distant CTAGN based on the strength of the neutral Fe Kα line.
The X-Ray Reflection Spectrum of the Radio-loud Quasar 4C 74.26

The relativistic jets created by some active galactic nuclei are important agents of AGN feedback. In spite of this, our understanding of what produces these jets is still incomplete. X-ray observations, which can probe the processes operating in the central regions in the immediate vicinity of the supermassive black hole, the presumed jet launching point, are potentially particularly valuable in illuminating the jet formation process. Here, we present the hard X-ray NuSTAR observations of the radio-loud quasar 4C 74.26 in a joint analysis with quasi-simultaneous, soft X-ray Swift observations. Our spectral analysis reveals a high-energy cutoff of $E_{\text{cut}} = 2.5 \pm 0.3$ keV and confirms the presence of ionized reflection in the source. From the average spectrum we detect that the accretion disk is mildly recessed, with an inner radius of $R_{\text{in}} = 4 - 18 R_g$. However, no significant evolution of the inner radius is seen during the three months covered by our NuSTAR campaign. This lack of variation could mean that the jet formation in this radio-loud quasar differs from what is observed in broad-line radio galaxies.
Three Decades of Volume Change of a Small Greenlandic Glacier Using Ground Penetrating Radar, Structure from Motion, and Aerial Photogrammetry

Glaciers in the Arctic are losing mass at an increasing rate. Here we use surface topography derived from Structure from Motion (SfM) and ice volume from ground penetrating radar (GPR) to describe the 2014 state of Aqqutikitsoq glacier (2.85 km) on Greenland's west coast. A photogrammetrically derived 1985 digital elevation model (DEM) was subtracted from a 2014 DEM obtained using land-based SfM to calculate geodetic glacier mass balance. Furthermore, a detailed 2014 ground penetrating radar survey was performed to assess ice volume. From 1985 to 2014, the glacier has lost 49.8 ± 9.4 10 m of ice, corresponding to roughly a quarter of its 1985 volume (148.6 ± 47.6 10 m) and a thinning rate of 0.60 ± 0.11 m a. The computations are challenged by a relatively large fraction of the 1985 DEM (~50% of the glacier surface) being deemed unreliable owing to low contrast (snow cover) in the 1985 aerial photography. To address this issue, surface elevation in low contrast areas was measured manually at point locations and interpolated using a universal kriging approach. We conclude that ground-based SfM is well suited to establish high-quality DEMs of smaller glaciers. Provided favorable topography, the approach constitutes a viable alternative where the use of drones is not possible. Our investigations constitute the first glacier on Greenland's west coast where ice volume was determined and volume change calculated. The glacier's thinning rate is comparable to, for example, the Swiss Alps and underlines that arctic glaciers are subject to fast changes.

General information
State: Published
Organisations: Department of Environmental Engineering, Department of Civil Engineering, National Space Institute, Geodesy, Section for Geotechnics and Geology, Arctic Technology Centre, Technical University of Denmark, Natural History Museum of Denmark
Authors: Marcer, M. (Ekstern), Stentoft, P. A. (Intern), Bjerre, E. (Intern), Cimoli, E. (Ekstern), Bjørk, A. A. (Ekstern), Stenseng, L. (Intern), Machguth, H. (Intern)
Time Lens based Optical Fourier Transformation for All-Optical Signal Processing of Spectrally-Efficient Data

We review recent progress in the use of time lens based optical Fourier transformation for advanced all-optical signal processing. A novel time lens based complete optical Fourier transformation (OFT) technique is introduced. This complete OFT is based on two quadratic phase-modulation stages using four-wave mixing (FWM), separated by a dispersive medium, which enables time-to-frequency and frequency-to-time conversions simultaneously, thus performing an exchange between the temporal and spectral profiles of the input signal. Using the proposed complete OFT, several advanced all-optical signal processing schemes for spectrally-efficient systems and networks have been achieved, including all-optical generation, detection and format conversion of spectrally-efficient signals. The spectrally-efficient signals in this paper mainly refer to efficiently multiplexed signals with a high symbol rate per Hz, such as orthogonal frequency division multiplexing (OFDM), Nyquist wavelength-division multiplexing (Nyquist-WDM) and Nyquist optical time division multiplexing (Nyquist-OTDM) signals.
Towards a Regional Assessment of Coastal Flood Risk: A review of Methods Applied in Norway, Sweden, Finland, Denmark, and Germany

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State: Published
Organisations: National Space Institute, Geodesy, Nansen Environmental and Remote Sensing Center, University of Siegen, Swedish Meteorological and Hydrological Institute, Finnish Meteorological Institute, Danish Meteorological Institute, The Norwegian Mapping Authority, Danish Coastal Authority
Authors: Nilsen, J. E. Ø. (Ekstern), Sørensen, C. S. (Intern), Dangendorf, S. (Ekstern), Andersson, H. (Ekstern), Arns, A. (Ekstern), Jensen, J. (Ekstern), Jönsson, A. (Ekstern), Knudsen, P. (Intern), Leiula, U. (Ekstern), Madsen, K. S. (Ekstern), Nerheim, S. (Ekstern), Pellikka, H. (Ekstern), Ravnadal, O. (Ekstern), Sande, H. (Ekstern), Simpson, M. J. R. (Ekstern), Sørensen, P. (Ekstern)
Number of pages: 1
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Towards_a_Regional_Assessment_of_Coastal_Flood_Risk.pdf
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Transcending sectors – pooling visions and surging ahead

Novel cross-sectorial and transdisciplinary work on climate impacts has led to a shared, local knowledge and visions’ platform for adaptation and planning. A regional center for coastal water sector related research and innovation on climate change adaptation is becoming reality: the ‘Climatorium’.

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Organisations: National Space Institute, Geodesy, Lemvig Water and Wastewater, Lemvig municipality, Port of Thyborøn, Danish Agency for Data Supply and Efficiency, Rambøll Danmark A/S, GEO, Energi, Forsynings- og Klimaministeriet, Danish Coastal Authority, Danish Geodata Agency
Authors: Sørensen, C. S. (Intern), N. Holmegaard, L. (Ekstern), Damgaard, T. (Ekstern), Vrist, C. (Ekstern), Molgaard, M. R. (Ekstern), Schow, C. (Ekstern), Hviid, B. (Ekstern), Jensen, A. (Ekstern), Sørensen, T. (Ekstern), Broge, N. (Ekstern), Levinsen, F. (Ekstern), Sørensen, P. (Ekstern), Thomsen, M. (Ekstern), Jensen, J. (Ekstern), Frambøl, C. (Ekstern), Mogree, P. (Ekstern), Harbo, K. (Ekstern), Andersen, F. (Ekstern), Katborg, K. (Ekstern), Nielsen, J. (Ekstern), B. Andersen, T. (Ekstern), Knudsen, P. (Intern), Vognsen, K. (Ekstern)
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Transient variations in glacial mass near Upernavik Isstrøm (west Greenland) detected by the combined use of GPS and GRACE data: Greenland Upernavik Transient Changes

The continuously operating Global Positioning System (GPS) sites mounted on bedrock around the coast of Greenland provide important geodetic datasets to quantify the solid Earth’s response to historical and present-day ice mass variations. The presence of colored noise and irregular seasonal signals makes it difficult to detect transient changes in GPS time series. Here we apply the Multichannel Singular Spectral Analysis to the combination of GPS data and Gravity Recovery and Climate Experiment (GRACE) data so that we can identify and fully utilize the spatial correlations from...
these two independent datasets. Using the GPS and GRACE data near Upernavik Isstrøm in West Greenland as an example, we demonstrate that this method successfully detects two transient signals in ice mass variations during 2008 and 2014. Our forward modeling of loading displacements due to changes in surface mass balance (SMB) and ice dynamics suggests that the transient change starting in mid-2008 was due to the combined contributions from dynamically-induced mass loss and SMB. The transient change starting in mid-2011 was mainly due to ablation. Specifically, the ice melted more in 2012 and less in 2013 with little contribution from anomalies in accumulation.

General information
State: Published
Organisations: National Space Institute, Geodesy, Chinese University of Hong Kong, Wuhan University, University of Luxembourg
Authors: Zhang, B. (Ekstern), Liu, L. (Ekstern), Khan, S. A. (Intern), van Dam, T. (Ekstern), Zhang, E. (Ekstern), Yao, Y. (Ekstern)
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  Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
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  Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
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  BFI (2009): BFI-level 2
  Scopus rating (2009): SJR 2.85 SNIP 1.738
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  BFI (2008): BFI-level 2
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Ultra-Tightly Coupled GNSS/INS for small UAVs

This paper describes an ultra-tight integration of a Global Navigation Satellite System (GNSS) receiver and an Inertial Navigation System (INS) for small Unmanned Aerial Vehicles (UAVs). The system is based on a low-cost and low-weight GNSS Intermediate Frequency (IF) sampler which has been fitted onto a small UAV. The storage of IF samples together with measurements from an Inertial Measurement Unit (IMU) has allowed the authors to process an Ultra-Tightly Coupled (U.T.C.) GNSS/INS solution from real data collected with a small UAV. The focus of this paper has been to investigate the potential benefits in signal tracking during flights below dense foliage and tree canopies by using the developed U.T.C. system. The obtained results have been compared to a scalar GNSS receiver and a high-grade commercial reference receiver and have showed significant improvements in tracking capabilities.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Olesen, D. (Intern), Jakobsen, J. (Intern), Knudsen, P. (Intern)
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Uplift and tilting of the Shackleton Range in East Antarctica driven by glacial erosion and normal faulting

Unravelling the long-term evolution of the subglacial landscape of Antarctica is vital for understanding past ice sheet dynamics and stability, particularly in marine-based sectors of the ice sheet. Here we model the evolution of the bedrock topography beneath the Recovery catchment, a sector of the East Antarctic Ice Sheet characterized by fast-flowing ice streams that occupy overdeepened subglacial troughs. We use 3-D flexural models to quantify the effect of erosional unloading and mechanical unloading associated with motion on border faults in driving isostatic bedrock uplift of the Shackleton Range and Theron Mountains, which are flanked by the Recovery, Slessor, and Bailey ice streams. Inverse spectral (free-air admittance) and forward modeling of topography and gravity anomaly data allow us to constrain the effective elastic thickness of the lithosphere (T-e) in the Shackleton Range region to similar to 20km. Our models indicate...
that glacial erosion, and the associated isostatic rebound, has driven 40-50% of total peak uplift in the Shackleton Range and Theron Mountains. A further 40-50% can be attributed to motion on normal fault systems of inferred Jurassic and Cretaceous age. Our results indicate that the flexural effects of glacial erosion play a key role in mountain uplift along the East Antarctic margin, augmenting previous findings in the Transantarctic Mountains. The results suggest that at 34Ma, the mountains were lower and the bounding valley floors were close to sea level, which implies that the early ice sheet in this region may have been relatively stable.

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Web of Science (2015): Indexed yes
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Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.85 SNIP 1.738
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Scopus rating (2008): SJR 2.826 SNIP 1.529
Web of Science (2008): Indexed yes
An airborne gravity campaign was carried out at the Dome-C survey area in East Antarctica between the 17th and 22nd of January 2013, in order to provide data for an experiment to validate GOCE satellite gravity gradients. After typical filtering for airborne gravity data, the cross-over error statistics for the few crossing points are 11.3 mGal root mean square (rms) error, corresponding to an rms line error of 8.0 mGal. This number is relatively large due to the rough flight conditions, short lines and field handling procedures used. Comparison of the airborne gravity data with GOCE RL4 spherical harmonic models confirmed the quality of the airborne data and that they contain more high-frequency signal than the global models. First, the airborne gravity data were upward continued to GOCE altitude to predict gravity gradients in the local North-East-Up reference frame. In this step, the least squares collocation using the ITGGRACE2010S field to degree and order 90 as reference field, which is subtracted from both the airborne gravity and GOCE gravity gradients, was applied. Then, the predicted gradients were rotated to the gradiometer reference frame using level 1 attitude quaternion data. The validation with the airborne gravity data was limited to the accurate gradient anomalies (TXX, TYY, TZZ and TXZ) where the long-wavelength information of the GOCE gradients has been replaced with GOCO03s signal to avoid contamination with GOCE gradient errors at these wavelengths. The comparison shows standard deviations between the predicted and GOCE gradient anomalies TXX, TYY, TZZ and TXZ of 9.9, 11.5, 11.6 and 10.4 mE, respectively. A more precise airborne gravity survey of the southern polar gap which is not observed by GOCE would thus provide gradient predictions at a better accuracy, complementing the GOCE coverage in this region.
Visualization of and Software for Omnibus Test Based Change Detected in a Time Series of Polarimetric SAR Data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution and a factorization of this test statistic with associated p-values, change analysis in a time series of multilook polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic
and its factorization detect if and when change occurs. Using airborne EMISAR and spaceborne RADARSAT-2 data this paper focuses on change detection based on the p-values, on visualization of change at pixel as well as segment level, and on computer software.

**General information**

**State:** Published

**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, Research Center Jülich GmbH

**Authors:** Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern), Canty, M. J. (Ekstern)

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- ISI indexed (2011): ISI indexed no
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- Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.832 SNIP 1.563
- Scopus rating (2001): SJR 0.549 SNIP 0.905
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Africas droner overhaler os indenom
Donorblod sendes nu ud med droner i Rwanda – Danmark bør prioritere den nye teknologi højt

Afrikanerne flytter nu tilbage til det indirekte område, hvor droner tætter i kædelig forbindelse med de lokale naboländer.

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Authors: Pedersen, J. O. P. (Intern)
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Source: PublicationPreSubmission
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Selvførsøkende
Klima. En undersøgelse af klimafølsomheden i Jordens geologiske fortid viser, at når temperaturen er høj, forstærkes den globale opvarmning.

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Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Stop en halv. Kvantefysikken kan ikke befri os fra det mekaniske verdensbillede

Dårlig timing

Dårlig timing
**Fysik for fodgængere**

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Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2016

"Darwinismen gjør ikke Religionen Afbræk"
y bog svarer på 50 af de mest umulige spørgsmål, som nysgerrige børn kan finde på at stille

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Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
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**3D geomarketing segmentation: A higher spatial dimension planning perspective**
Geomarketing is a discipline which uses geographic information in the process of planning and implementation of marketing activities. It can be used in any aspect of the marketing such as price, promotion or geo targeting. The analysis of geomarketing data use a huge data pool such as location residential areas, topography, it also analyzes demographic information such as age, genre, annual income and lifestyle. This information can help users to develop successful promotional campaigns in order to achieve marketing goals. One of the common activities in geomarketing is market segmentation. The segmentation clusters the data into several groups based on its geographic criteria. To refine the search operation during analysis, we proposed an approach to cluster the data using a clustering algorithm. However, with the huge data pool, overlap among clusters may happen and leads to inefficient analysis. Moreover, geomarketing is usually active in urban areas and requires clusters to be organized in a three-dimensional (3D) way (i.e. multi-level shop lots, residential apartments). This is a constraint with the current Geographic Information System (GIS) framework. To avoid this issue, we proposed a combination of market segmentation based on geographic criteria and clustering algorithm for 3D geomarketing data management. The proposed approach is capable in minimizing the overlap region during market segmentation. In this paper, geomarketing in urban area is used as a case study. Based on the case study, several locations of customers and stores in 3D are used in the test. The experiments demonstrated in this paper substantiated that the proposed approach is capable of minimizing overlapping segmentation and reducing repetitive data entries. The structure is also tested for retrieving the spatial records from the database. For marketing purposes, certain radius of point is used to analyzing marketing targets. Based on the presented tests in this paper, we strongly believe that the structure is capable in handling and managing huge pool of geomarketing data. For future outlook, this paper also discusses the possibilities of expanding the structure.
Nowadays, municipalities intend to have 3D city models for facility management, disaster management and architectural planning. Indoor models can be reconstructed from construction plans but sometimes, they are not available or very often, they differ from 'as-built' plans. In this case, the buildings and their rooms must be surveyed. One of the most utilized methods of indoor surveying is laser scanning. The laser scanning method allows taking accurate and detailed measurements. However, Terrestrial Laser Scanner is costly and time consuming. In this paper, several techniques for indoor 3D building data acquisition have been investigated. For reducing the time and cost of indoor building data acquisition process, the Trimble LaserAce 1000 range finder is used. The proposed approach uses relatively cheap equipment: a light Laser Rangefinder which appears to be feasible, but it needs to be tested to see if the observation accuracy is sufficient for the 3D building modelling. The accuracy of the rangefinder is evaluated and a simple spatial model is reconstructed from real data. This technique is rapid (it requires a shorter time as compared to others), but the results show inconsistencies in horizontal angles for short distances in indoor environments. The range finder horizontal angle sensor was calibrated using a least square adjustment algorithm, a polynomial kernel, interval analysis and homotopy continuation.
3D Nearest Neighbour Search Using a Clustered Hierarchical Tree Structure

Locating and analysing the location of new stores or outlets is one of the common issues facing retailers and franchisers. This is due to ensure that new opening stores are at their strategic location to attract the highest possible number of customers. Spatial information is used to manage, maintain and analyse these store locations. However, since the business of franchising and chain stores in urban areas runs within high rise multi-level buildings, a three-dimensional (3D) method is prominently required in order to locate and identify the surrounding information such as at which level of the franchise unit will be located or is the franchise unit located is at the best level for visibility purposes. One of the common used analyses used for retrieving the surrounding information is Nearest Neighbour (NN) analysis. It uses a point location and identifies the surrounding neighbours. However, with the immense number of urban datasets, the retrieval and analysis of nearest neighbour information and their efficiency will become more complex and crucial. In this paper, we present a technique to retrieve nearest neighbour information in 3D space using a clustered hierarchical tree structure. Based on our findings, the proposed approach substantially showed an improvement of response time analysis compared to existing approaches of spatial access methods in databases. The query performance was tested using a dataset consisting of 500,000 point locations building and franchising unit. The results are presented in this paper. Another advantage of this structure is that it also offers a minimal overlap and coverage among nodes which can reduce repetitive data entry.

A Backscattering and Propagation Model for Radar Sounding of Ice Sheets

In this paper the electromagnetic properties of the continental ice sheets are modeled with the aim of assessing the feasibility of space-based radar ice sounding at P-band. The paper focuses on the model itself, as distinct from the estimation of model parameters and the exploitation of the model. The scattering and propagation properties of the icesheets are characterized using an empirical approach. The model comprises surface scattering from the air/ice interface and the ice/bed interface as well as volume scattering from the firm and the ice. Also specular reflection from the internal layers is modeled. In combination with simple models of the ice sounding radar and the geometry, the electromagnetic model estimates the return waveform and its constituents, such that sensitivity and clutter masking issues can be assessed.
Accurately measuring sea level change from space: an ESA Climate Change Initiative for MSL closure budget studies

Sea level is a very sensitive index of climate change and variability. Sea level integrates the ocean warming, mountain glaciers and ice sheet melting. Understanding the sea level variability and changes implies an accurate monitoring of the sea level variable at climate scales, in addition to understanding the ocean variability and the exchanges between ocean, land, cryosphere, and atmosphere. That is why Sea Level is one of the Essential Climate Variables (ECV) selected in the frame of the ESA Climate Change Initiative (CCI) program. It aims at providing long-term monitoring of the sea level ECV with regular updates, as required for climate studies.

After a first phase (2011-2013), the program has started in 2014 a second phase of 3 years. The objectives of this second phase are to involve the climate research community, to refine their needs and collect their feedbacks on product quality, to develop, test and select the best algorithms and standards to generate an updated climate time series and to produce and validate the Sea Level ECV product. This will better answer the climate user needs by improving the quality of the Sea Level products and maintain a sustain service for an up-to-date production. To this extent, the ECV time series has benefited from yearly extension and it now covers the period 1993-2014. A full reprocessing of the dataset will be available in 2016.

We will firstly present the main achievements of the ESA CCI Sea Level Project. On the one hand, the major steps required to produce the 21 years climate time series are briefly described: collect and refine the user requirements, development of adapted algorithms for climate applications and specification of the production system. On the other hand, the product characteristics are described as well as the results from product validation, performed by several groups of the ocean and climate modeling community. At last, the main improvements derived from the algorithms development dedicated to the 2016 full reprocessing of the dataset are described. Efforts have also focused on the improvement of the sea level estimation in the Arctic Ocean and in coastal areas for which preliminary results suggest that significant improvements can be achieved.
A Direct and Fast Methodology for Ship Recognition in Sentinel-2 Multispectral Imagery

The European Space Agency satellite Sentinel-2 provides multispectral images with pixel sizes down to 10 m. This high resolution allows for ship detection and recognition by determining a number of important ship parameters. We are able to show how a ship position, its heading, length and breadth can be determined down to a subpixel resolution. If the ship is moving, its velocity can also be determined from its Kelvin waves. The 13 spectrally different visual and infrared images taken using multispectral imagery (MSI) are “fingerprints” that allow for the recognition and identification of ships. Furthermore, the multispectral image profiles along the ship allow for discrimination between the ship, its turbulent wakes, and the Kelvin waves, such that the ship’s length and breadth can be determined more accurately even when sailing. The ship’s parameters are determined by using satellite imagery taken from several ships, which are then compared to known values from the automatic identification system. The agreement is on the order of the pixel resolution or better.

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Advancing Coastal Climate Adaptation in Denmark by Land Subsidence Mapping using Sentinel-1 Satellite Imagery

There are still large uncertainties in projections of climate change and sea level rise. Here, land subsidence is an additional factor that may adversely affect the vulnerability towards floods in low-lying coastal communities. The presented study performs an initial assessment of subsidence mapping using Sentinel-1 satellite imagery and leveling at two coastal locations in Denmark. Within both investigated areas current subsidence rates of 5-10 millimeters per year are found. This subsidence is related to the local geology, and challenges and potentials in bringing land subsidence mapping and
geology into climate adaptation are discussed in relation to perspectives of a national subsidence monitoring system partly based on the findings from the two coastal locations. The current lack of subsidence data and a fragmentation of geotechnical information are considered as hindrances to optimal adaptation in Denmark. A simple decision support system is suggested to gradually implement subsidence monitoring and to include geotechnical information in coastal climate adaptation to the benefit of municipalities and other stakeholders.

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Authors: Sørensen, C. S. (Intern), Broge, N. H. (Ekstern), Mølgaard, M. R. (Ekstern), Levinsen, J. (Ekstern), Okkels, N. (Ekstern), Knudsen, P. (Intern)
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**Advancing Coordination Between DRM and CCA in Integrated Flood Risk Management**

Flood hazards in coastal regions induce risks toward lives, property, economy and the environment. In need of sustainable and holistic actions to reduce risks, these should include innovative Disaster Risk Management (DRM) and Climate Change Adaptation (CCA) measures. While differing on important parameters such as political commitment, awareness and uncertainty of the hazard/risk, commonalities between DRM and CCA can also be identified that affect human settlement, institutional adaptation, and the economy. This supports coordination of mitigation and adaptation measures to create resilience and sustainable solutions that take into account present and future outcomes. Adaptation must be integrated in existing policy making and be a planning process priority to become effective, however. In relation to coastal hazards in Denmark, deficits are identified in how DRM is brought into effect, e.g. though lack of planning and awareness. This, we argue, may be the golden opportunity to improve the national DRM-CCA integration. Past coastal risk mitigation and adaptation in Denmark only focused on structural measures. Due to its long coastline this is neither a sustainable nor an economically feasible solution ahead, and emphasis on non-structural measures is crucial. From qualitative research, we show that for the Danish case this should include: new policies, legislative changes, a higher degree of preparedness, and an improved awareness among stakeholders and civil society. The shift towards nonstructural measures is hampered by lack in coordination that should be improved to agree e.g. on an acceptable risk definition and to avoid duplicating efforts. To advance awareness and coordination between DRM and CCA and to improve measures, a bottom-up approach could by initiated by civil society using recent flood events to exert pressure on the national government, and in a top-down approach the government could identify the needs among the civil society to include these in the decision-making process.

**General information**
Flood hazards in coastal regions induce risks toward lives, property, economy and the environment. In need of sustainable and holistic actions to reduce risks, these should include innovative Disaster Risk Management (DRM) and Climate Change Adaptation (CCA) measures. While differing on important parameters such as political commitment, awareness and uncertainty of the hazard/risk, commonalities between DRM and CCA can also be identified that affect human settlement, institutional adaptation, and the economy. This supports coordination of mitigation and adaptation measures to create resilience and sustainable solutions that take into account present and future outcomes. Adaptation must be integrated in existing policymaking and be a planning process priority to become effective, however. In relation to coastal hazards in Denmark, deficits are identified in how DRM is brought into effect, e.g., though lack of planning and awareness. This, we argue, may be the golden opportunity to improve the national DRM-CCA integration. Past coastal risk mitigation and adaptation in Denmark only focused on structural measures. Due to its long coastline this is neither a sustainable nor an economically feasible solution ahead, and emphasis on non-structural measures is crucial. From qualitative research, we show that for the Danish case this should include: new policies, legislative changes, a higher degree of preparedness, and an improved awareness among stakeholders and civil society. The shift towards non-structural measures is hampered by lack in coordination that should be improved to agree e.g. on an acceptable risk definition and to avoid duplicating efforts. To advance awareness and coordination between DRM and CCA and to improve measures, a bottom-up approach could by initiated by civil society using recent flood events to exert pressure on the national government, and in a top-down approach the government could identify the needs among the civil society to include these in the decision-making process.
A fiducial reference site for satellite altimetry in Crete, Greece

With the advent of diverse satellite altimeters and variant measuring techniques, it has become mature in the scientific community, that an absolute reference Cal/Val site is regularly maintained to define, monitor, control the responses of any altimetric system. This work sets the ground for the establishment of a Fiducial Reference Site for ESA satellite altimetry in Gavdos and West Crete, Greece. It will consistently and reliably determine (a) absolute altimeter biases and their drifts; (b) relative bias among diverse missions; but also (c) continuously and independently connect different missions, on a common and reliable reference and also to SI-traceable measurements. Results from this fiducial reference site will be based on historic Cal/Val site measurement records, and will be the yardstick for building up capacity for monitoring climate change. This will be achieved by defining and assessing any satellite altimeter measurements to known, controlled and absolute reference signals with different techniques, processes and instrumentation.

A global high-resolution data set of ice sheet topography, cavity geometry and ocean bathymetry

The ocean plays an important role in modulating the mass balance of the polar ice sheets by interacting with the ice shelves in Antarctica and with the marine-terminating outlet glaciers in Greenland. Given that the flux of warm water onto the continental shelf and into the sub-ice cavities is steered by complex bathymetry, a detailed topography data set is an essential ingredient for models that address ice-ocean interaction. We followed the spirit of the global RTopo-1 data set and compiled consistent maps of global ocean bathymetry, upper and lower ice surface topographies, and global surface height on a spherical grid with now 30 arcsec grid spacing. For this new data set, called RTopo-2, we used the General Bathymetric Chart of the Oceans (GEBCO_2014) as the backbone and added the International Bathymetric Chart of the Arctic Ocean version 3 (IBCAOv3) and the International Bathymetric Chart of the Southern Ocean (IBCSO) version 1. While RTopo-1 primarily aimed at a good and consistent representation of the Antarctic ice sheet, ice shelves, and sub-ice cavities, RTopo-2 now also contains ice topographies of the Greenland ice sheet and outlet glaciers. In particular, we aimed at a good representation of the fjord and shelf bathymetry surrounding the Greenland continent. We modified data from earlier gridded products in the areas of Petermann Glacier, Hagen Brae, and Sermeq Fjord, assuming that sub-ice and fjord bathymetries roughly follow plausible Last Glacial Maximum ice flow patterns. For the continental shelf off Northeast Greenland and the floating ice tongue of Nigoghalvfjerdsfjorden Glacier at about 79 N, we incorporated a high-resolution digital bathymetry model considering original multibeam survey data for the region. Radar data for surface topographies of the floating ice tongues of Nigoghalvfjerdsfjorden Glacier and Zachariae Isstrend have been obtained from the data centres of Technical University of Denmark (DTU), Operation Icebridge (NASA/NSF), and Alfred Wegener Institute (AWI). For the Antarctic ice sheet/ice shelves, RTopo-2 largely relies on the Bedmap-2 product but applies corrections for the geometry of Getz, Abbot, and Fimbul ice shelf cavities. The data set is available in full and in regional subsets in NetCDF format from the PANGAEA database at doi:10.1594/PANGAEA.856844.
A Hard X-Ray Study of the Normal Star-Forming Galaxy M83 with NuSTAR

We present the results from sensitive, multi-epoch NuSTAR observations of the late-type star-forming galaxy M83 (d = 4.6 Mpc). This is the first investigation to spatially resolve the hard (E > 10 keV) X-ray emission of this galaxy. The nuclear region and similar to 20 off-nuclear point sources, including a previously discovered ultraluminous X-ray source, are detected in our NuSTAR observations. The X-ray hardnesses and luminosities of the majority of the point sources are consistent with hard X-ray sources resolved in the starburst galaxy NGC 253. We infer that the hard X-ray emission is most likely dominated by intermediate accretion state black hole binaries and neutron star low-mass X-ray binaries (Z-sources). We construct the X-ray binary luminosity function (XLF) in the NuSTAR band for an extragalactic environment for the first time. The M83 XLF has a steeper XLF than the X-ray binary XLF in NGC 253, which is consistent with previous measurements by Chandra at softer X-ray energies. The NuSTAR integrated galaxy spectrum of M83 drops quickly above 10 keV, which is also seen in the starburst galaxies NGC 253, NGC 3310, and NGC 3256. The NuSTAR observations constrain any active galactic nucleus (AGN) to be either highly obscured or to have an extremely low luminosity of less than or similar to 10^{38} erg s^{-1} (10-30 keV), implying that it is emitting at a very low Eddington ratio. An X-ray point source that is consistent with the location of the nuclear star cluster with an X-ray luminosity of a few times 10^{38} erg s^{-1} may be a low-luminosity AGN but is more consistent with being an X-ray binary.
A NuSTAR observation of the reflection spectrum of the low-mass X-ray binary 4U 1728-34

We report on a simultaneous NuSTAR and Swift observation of the neutron star low-mass X-ray binary 4U 1728-34. We identified and removed four Type I X-ray bursts during the observation in order to study the persistent emission. The continuum spectrum is hard and described well by a blackbody with $kT = 1.5$ keV and a cutoff power law with $\Gamma = 1.5$, and a cutoff temperature of 25 keV. Residuals between 6 and 8 keV provide strong evidence of a broad Fe Kα line. By modeling the spectrum with a relativistically blurred reflection model, we find an upper limit for the inner disk radius of $R_{\text{in}} \lesssim 2R_{\text{ISCO}}$. Consequently, we find that $R_{\text{NS}} \lesssim 23$ km, assuming $M = 1.4 M_\odot$ and $a = 0.15$. We also find an upper limit on the magnetic field of $B \lesssim 2 \times 10^8$ G.
Airborne gravity field Measurements - status and developments

English Abstract: DTU-Space has since 1996 carried out large area airborne surveys over both polar, tropical and temperate regions, especially for geoid determination and global geopotential models. Recently we have started flying two gravimeters (LCR and Chekan-AM or inertial navigation systems) side by side for increased reliability and redundancy. Typical gravity results are at the 2 mGal rms level, translating into 5-10 cm accuracy in geoid. However, in rough mountainous areas results can be noisier, mainly due to long-period mountain waves and turbulence. In the paper we outline results of aerogravity surveys and examples of recent geoid determinations in Indonesia, the Philippines and Tanzania, based on DTU-Space aerogravity and satellite data (GOCE/GRACE).

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Authors: Olesen, A. V. (Intern), Forsberg, R. (Intern)
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Airborne observations of changes of ice sheet and sea ice in the Arctic using CryoVEx campaign data

DTU Space have collected surface elevation observations of the Arctic sea ice and land ice since 1998 using laser scanning and radar altimetry from a small fixed-wing Twin-Otter aircraft. The observations provide unique datasets for studying ongoing changes, and support the analysis of satellite measurements of ice sheet changes. The majority of the campaigns have been sponsored by the European Space Agency, ESA, as part of the CryoSat Validation Experiments – CryoVEx. These have been internationally coordinated efforts to collect coincident space-borne, airborne, and in-situ data for pre- and post-launch validation studies, with several aircraft and international in-situ ground teams participating, both in Greenland, Arctic Canada, and Svalbard.

The methods and campaigns are outlined together with examples of results. The campaigns focused on five main validation sites: Devon ice cap (Canada), Austfonna ice cap (Svalbard), the EGIG line crossing the Greenland Ice Sheet, as well as the sea ice north of Alert and sea ice around Svalbard in the Fram Strait. Selected tracks were planned to match CryoSat-2 passes and a few of them were flown in formation flight with the Alfred Wegener Institute (AWI) Polar-5 carrying an EM-bird. The poster will outline the methods and campaigns, as well as show examples of the results.
Algorithms for the mitigation of space weather threats at low latitudes, contributing to the extension of EGNOS over Africa

GNSS is already a technology that pervades modern lifestyles and over the last decade has become integral to many of our transport systems. One of the major barriers to the development of GNSS for safety-critical services such as aviation comes from the unknown threats from Space Weather. In order to overcome the intrinsic limitation posed by space weather, regional systems called Satellite Based Augmentation Systems (SBAS) have been developed. The European region has a system called EGNOS. The idea behind these systems is to ensure that integrity information is provided to the GNSS user. Part of the function of an SBAS system is to map the ionised regions of the upper atmosphere (the ionosphere) to enable specialist aviation GNSS receivers to make corrections for the ionospheric delay and hence to achieve a more accurate position. This is very important but more critical still is the capability to know how accurate a position is at a given time and this is also an important function of SBAS. However, the SBAS systems still have significant limitations that prevent the extension of the EGNOS system into new geographical regions and this project addresses these limitations. Within the framework of the EC-funded project, algorithms to mitigate against space weather vulnerabilities (i.e. ionisation gradients and scintillation) at both receiver and system level are investigated and prepared. From the point of view of ionization gradients, worst-case scenarios characterized through diverse datasets were prepared and used to simulate EGNOS performance at low latitudes in Africa. Furthermore, alternative methods to calculate grid corrections and errors were investigated and evaluated against the state of the art (Figure 1). From the point of view of scintillation, two dedicated GISO monitoring stations were installed in San Pedro and Brazzaville with the purpose to assess the impact of scintillation on EGNOS availability maps as well as on the performance of the receiver in the presence of scintillation (Figure 2). Algorithms capable of minimizing the impact of scintillation will be illustrated and discussed.

Altimetry for inland water

With the globally decreasing amount of in-situ stations, satellite altimetry based water levels are an important supplement to obtain continuous time series of the worlds inland water. In this study we demonstrate two new services, that are related to inland water and altimetry. The first is Altimetry for inland water (AltWater), which is a new open service, that provides altimetry based time series for inland water. Currently, the service includes data from cryoSat-2, but we intend to add other missions in future versions. The second, tsHydro, is a software package, that is implemented in the open source environment "R". The package enables the user to easily construct water level time series for lakes and rivers based on along-track altimetry data.
A model of Earth's magnetic field derived from 2 years of Swarm satellite constellation data

More than 2 years of magnetic field data taken by the three-satellite constellation mission Swarm are used to derive a model of Earth's magnetic field and its time variation. This model is called SIFMplus. In addition to the magnetic field observations provided by each of the three Swarm satellites, explicit advantage is taken of the constellation aspect of Swarm by including East–West magnetic intensity and vector field gradient information from the lower satellite pair. Along-track differences of the magnetic intensity as well as of the vector components provide further information concerning the North–South gradient. The SIFMplus model provides a description of the static lithospheric field that is very similar to models determined from CHAMP data, up to at least spherical harmonic degree n=75. Also the core field part of SIFMplus, with a quadratic time dependence for n≤6 and a linear time dependence for n=7–15, demonstrates the possibility to determine high-quality field models from only 2 years of Swarm data, thanks to the unique constellation aspect of Swarm. To account for the magnetic signature caused by ionospheric electric currents at polar latitudes we co-estimate, together with the model of the core, lithospheric and large-scale magnetospheric fields, a magnetic potential that depends on quasi-dipole latitude and magnetic local time.
A Model of the Earth's Magnetic Field From Two Year of Swarm Satellite Constellation Data

More than two year of data from ESA's Swarm constellation mission are used to derive a model of the Earth's magnetic field and its time variation (secular variation). The model describes contributions from the core and lithosphere as well as large-scale contributions from the magnetosphere (and its Earth-induced counterpart). We use data from geomagnetic quiet times and co-estimate the Euler angles describing the rotation between the vector magnetometer instrument frame and the North-East-Center (NEC) frame. In addition to the magnetic field observations provided by each of the three
Swarm satellites and alongtrack first differences we include the East-west magnetic gradient information provided by the lower Swarm satellite pair, thereby explicitly taking advantage of the constellation aspect of Swarm. We assess the spatial and temporal model resolution that can be obtained from two years of Swarm satellite data by comparison with other recent models that also include non-Swarm magnetic observations.

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**An accelerating high-latitude jet in Earth's core**
Observations of the change in Earth’s magnetic field—the secular variation—provide information about the motion of liquid metal within the core that is responsible for the magnetic field’s generation. High-resolution observations from the European Space Agency’s Swarm satellite mission show intense field change at high latitude, localized in a distinctive circular daisy-chain configuration centred on the north geographic pole. Here we show that this feature can be explained by a localized, non-axisymmetric, westward jet of 420 km width on the tangent cylinder, the cylinder of fluid within the core that is aligned with the rotation axis and tangent to the solid inner core. We find that the jet has increased in magnitude by a factor of three over the period 2000–2016 to about 40 km yr⁻¹, and is now much stronger than typical large-scale flows inferred for the core. We suggest that the current accelerating phase may be part of a longer-term fluctuation of the jet causing both eastward and westward movement of magnetic features over historical periods, and may contribute to recent changes in torsional-wave activity and the rotation direction of the inner core.

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Analysis of High-Latitude Ionospheric Processes During HSS and CME-Induced Geomagnetic Storms

For the first time we compared ionospheric effects of HSS and CME-driven storms at high-latitudes. There were similarities and also differences observed in the development of the storms. (1) Both type of storms exhibited clear negative phase, which resulted in an increase of TOI-breaking-down into patches and a decrease in patch formation in general throughout the Greenland sector. The negative phase developed as the PCN-index started to increase indicated energy input into the polarcap. (2) The rate of PCN increase was clearly different for the two types of storms. (3) The impact of the physical processes responsible for the negative phase have less pronounced impact on the diurnal TEC variations than on patch formation. We also investigated and assessed storm influences on airborne navigation at high-latitudes in order to determine the possible cause of the radio communication disturbances. This effort may lead us to a better understanding of the phenomenon and might help develop communication hardware that is more resistant to such effects.

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Analyzing x-ray emissions from meter-scale negative discharges in ambient air

When voltage pulses of 1 MV drive meter long air discharges, short and intense bursts of x-rays are measured. Here we develop a model for electron acceleration and subsequent photon generation within this discharge to understand these bursts. We start from the observation that the encounter of two streamers of opposite polarity launches the electrons, that they are further accelerated in the discharge field and then lose their energy, e.g., by photon emission through Bremsstrahlung. We model electron and photon dynamics in space and energy with a Monte Carlo model. Also the detector response to incoming photons is modelled in detail. The model justifies the approximation that the x-ray bursts are isotropic in space; this assumption is used to conclude that x-ray bursts near the high-voltage electrode with 6x10^4 photons and characteristic energies of 160 keV closely reproduce the measured spectra and attenuation curves. The nanosecond duration of the bursts as well as their energy spectrum is consistent with model calculations.
A new 25 years Arctic Sea level record from ESA satellites

The Arctic is an extremely challenging region for the use of remote sensing for ocean studies. One is the fact that despite 25 years of altimetry only very limited sea level observations exists in the interior of the Arctic Ocean. However, with Cryosat-2 SAR altimetry the situation is changing and through development of tailored retrackers dealing with presence of sea ice within the radar footprint, we can now develop sea surface height and its variation in most of the Arctic Ocean. We have processed 5 years of Cryosat-2 data quantified as either Lead or Ocean data within the Cryosat-2 SAR mask in the Arctic Ocean. By carefully reprocessing and reedited conventional altimetry from ERS-1/ERS-2 and Envisat we have now been able to derive a 25 year time series (1991-2016) using far more remote sensing data in the interior of the Arctic Ocean than ever before. Along with gradiometer observations from the ESA GOCE mission we are now able to derive a mean dynamic topography of the Arctic Ocean with unprecedented accuracy to constrain the ocean circulation. We present both a new estimation of the mean ocean circulation and new estimates of large scale sea level changes based on satellite data and perform an estimation of the freshwater storage increase over the last decade using temporal gravity changes from the GRACE satellite.

A new high resolution tidal model in the arctic ocean

The Arctic Ocean is a challenging region for tidal modeling, because of its complex and not well-documented bathymetry, together combined with the intermittent presence of sea ice and the fact that the in situ tidal observations are rather scarce at such high latitudes. As a consequence, the accuracy of the global tidal models decreases by several centimeters in the Polar Regions. In particular, it has a large impact on the quality of the satellite altimeter sea surface heights in these regions (ERS1/2, Envisat, CryoSat-2, SARAL/Altika and the future Sentinel-3 mission). Better knowledge of the tides improves the quality of the high latitudes altimeter sea surface heights and of all derived products, such as the altimetry-derived geostrophic currents, the mean sea surface and the mean dynamic topography. In addition, accurate tidal models are highly strategic information for ever-growing maritime and industrial activities in this region.

NOVELTIS and DTU Space have developed a regional, high-resolution tidal atlas in the Arctic Ocean, in the framework of the CryoSat Plus for Ocean (CP4O) ESA project. In particular, this atlas benefits from the assimilation of the most complete satellite altimetry dataset ever used in this region, including Envisat data up to 82°N and the CryoSat-2 reprocessed data between 82°N and 88°N. The combination of all these satellites gives the best possible coverage of altimetry-derived tidal constituents. The available tide gauge data were also used for assimilation and validation. This paper presents the performances of this new regional tidal model in the Arctic Ocean, compared to the existing global tidal models.
An Extreme Event as a Game Changer in Coastal Erosion Management

The construction of hard protection measures along the northeast coast of Sealand, Denmark, has gradually led to profile steepening, loss of beaches, and increased storm erosion. Although the problem has been addressed for decades no common solutions have been implemented yet. However, the impact of cyclone Xaver in December 2013 with severe coastal erosion led to collaboration between the involved municipalities to work on a coherent solution for the entire coastline that involves sand nourishments, renovation and optimization of hard protection structures, and the restoration of recreational values. We present a concept of 'erosion pressure' as a simple method to estimate potential chronic (longshore) and acute (cross-shore) erosion on protected coasts. The erosion pressure estimates are reliable at the investigated coast and the concept has proved useful for dissemination to stakeholders about coastal dynamics.

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Organisations: National Space Institute, Geodesy, DHI Denmark, University of Siegen, Danish Coastal Authority
Authors: Sørensen, C. S. (Intern), Drønen, N. K. (Ekstern), Knudsen, P. (Intern), Jensen, J. (Ekstern), Sorensen, P. (Ekstern)
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Web of Science (2017): Indexed Yes
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Scopus rating (2016): CiteScore 1.19 SJR 0.584 SNIP 0.826
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.661 SNIP 0.781 CiteScore 0.98
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Scopus rating (2014): SJR 0.597 SNIP 0.66 CiteScore 0.77
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.528 SNIP 0.871 CiteScore 1.04
ISI indexed (2013): ISI indexed yes
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ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.565 SNIP 0.537
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.486 SNIP 0.911
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.554 SNIP 0.742
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.625 SNIP 1.011
Scopus rating (2006): SJR 0.59 SNIP 0.823
Scopus rating (2005): SJR 0.467 SNIP 0.929
Scopus rating (2004): SJR 0.613 SNIP 1.062
An omnibus likelihood test statistic and its factorization for change detection in time series of polarimetric SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a short sequence of multilook, polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change(s) occur. The technique is demonstrated on airborne EMISAR L-band data but may be applied to Sentinel-1, Cosmo-SkyMed, TerraSAR-X, ALOS and RadarSat-2 or other dual- and quad/full-pol, and even single-pol data also.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern)
Pages: 316-319
Publication date: 2016

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Conference: Conference on Big Data from Space (BiDS'16), Santa Cruz de Tenerife, Spain, 15/03/2016 - 15/03/2016
Electronic versions:
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

An optimal estimation algorithm to derive Ice and Ocean parameters from AMSR Microwave radiometer observations

Global multispectral microwave radiometer measurements have been available for several decades. However, most current sea ice concentration algorithms still only takes advantage of a very limited subset of the available channels. Here we present a method that allows utilization of all available channels as well as the combination of data from multiple sources such as microwave radiometry, scatterometry and numerical weather prediction.

Optimal estimation is data assimilation without a numerical model for retrieving physical parameters from remote sensing using a multitude of available information. The methodology is observation driven and model innovation is limited to the translation between observation space and physical parameter space.

Over open water we use a semi-empirical radiative transfer model developed by Meissner & Wentz that estimates the multispectral AMSR brightness temperatures, i.e. horizontal and vertical polarization at channels between 6 and 89 GHz as a function of a limited set of physical parameters, i.e. atmospheric water vapor, cloud liquid water, wind speed, surface and air temperature. This type of model is ideal for optimal estimation applications because of its limited set of free variables. The atmosphere/open water model is adapted to simulate the atmosphere over sea ice and to work over intermediate ice concentrations by linear scaling of the surface emissivity and surface effective temperature.

The simulation of the surface brightness temperature of sea ice requires a separate forward model. Important physical parameters include snow layering, scattering in the snow and sea ice, effective temperature and ice concentration. Here
we are testing and evaluating different models. Ice emissivity model development and validation is based on time series of data from Ice Mass Balance Buoys which is co-located with AMSR data and ERA Interim data.

A priori knowledge of each of the physical parameters is used to constrain the solution and improve the retrieval. We test two different a priori options: 1) climatology and 2) numerical weather prediction.

The retrievals are compared to the ESA CCI round robin reference dataset to verify improvements.

A prescribed co-variance matrix both for the a priori set of parameters and for the suite of AMSR brightness temperatures are used in addition to constrain the retrieval. These matrices are derived from an analysis of the ESA CCI round robin reference dataset. Over open water the reference data is a co-location of satellite SST, ERA Interim re-analysis data and observed brightness temperatures. Over ice the reference data is a co-location of ERA Interim re-analysis data, and observed AMSR microwave brightness temperatures.

Due to the nonlinearity of the radiative transfer equation we need an iterative approach to obtain the optimal estimate.

The paper will demonstrate results of retrievals of SST and Sea Ice Concentration.

## General information

**State:** Published

**Organisations:** National Space Institute, Microwaves and Remote Sensing, Danish Meteorological Institute

**Authors:** Pedersen, L. T. (Ekstern), Tonboe, R. T. (Ekstern), Høyer, J. (Ekstern), Saldo, R. (Intern)

**Number of pages:** 1

**Publication date:** 2016

**Event:** Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.

**Main Research Area:** Technical/natural sciences

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http://lps16.esa.int/page_session185.php#2383p

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### An update on the Axion Helioscopes front: Current activities at CAST and the IAXO project

Although they have not yet been detected, axions and axion-like particles (ALPs) continue to maintain the interest (even increasingly so) of the rare-event searches community as viable candidates for the Dark Matter of the Universe but also as a solution for several other puzzles of astrophysics. Their property of coupling to photons has inspired different experimental methods for their detection, one of which is the helioscope technique. The CERN Axion Solar Telescope (CAST) is the most sensitive helioscope built up to date and has recently published part of the latest data taken with the magnet bores gradually filled with 3He, probing the mass range up to 1.17 eV. The International AXion Observatory (IAXO) is being proposed as a facility where different axion studies can be performed, with the primary goal to study axions coming from the Sun. Designed to maximize sensitivity, it will improve the levels reached by CAST by almost 5 orders of magnitude in signal detection, that is more than one order of magnitude in terms of sensitivity. Here we will summarize the most important aspects of the helioscopes, and focus mainly on IAXO, based on the recent papers [1, 2].

## General information

**State:** Published

**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, University of Zaragoza, Dogus University, IRFU, University of South Carolina, Russian Academy of Sciences, Max-Planck Institut für Extraterrestrische Physik, CERN

**Authors:** Dafni, T. (Ekstern), Arik, M. (Ekstern), Armengaud, E. (Ekstern), Aune, S. (Ekstern), Avignone, F. T. (Ekstern), Barth, K. (Ekstern), Belov, A. (Ekstern), Betz, M. (Ekstern), Bräuninger, H. (Ekstern), Brax, P. (Ekstern), Christensen, F. E. (Intern), Jakobsen, A. C. (Intern)

**Pages:** 244-249

**Publication date:** 2016

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**Main Research Area:** Technical/natural sciences

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Web of Science (2017): Indexed Yes

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Scopus rating (2016): CiteScore 0.38 SJR 2.211 SNIP 1.505

Scopus rating (2015): SJR 2.099 SNIP 1.359
Approach to the condensation-coagulation equation of aerosols

We present analytical solutions to the steady state nucleation-condensation-coagulation equation of aerosols in the atmosphere. These solutions are appropriate under different limits but more general than previously derived analytical solutions. For example, we provide an analytic solution to the coagulation limit plus a condensation correction. Our solutions are then compared with numerical results. We show that the solutions can be used to estimate the sensitivity of the cloud condensation nuclei number density to the nucleation rate of small condensation nuclei and to changes in the formation rate of sulfuric acid.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Hebrew University of Jerusalem
Authors: Smith, N. R. (Ekstern), Shaviv, N. J. (Ekstern), Svensmark, H. (Intern)
Pages: 578-590
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Aerosol Science and Technology
Volume: 50
Issue number: 6
ISSN (Print): 0278-6826
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Are there low-cost and low-weight options for GNSS IF storage?

General information
State: Published
Organisations: National Space Institute, Geodesy, University of Calgary
Authors: Petovello, M. (Ekstern), Olesen, D. H. (Intern), Jakobsen, J. (Intern), Knudsen, P. (Intern)
Pages: 40-45
Publication date: 2016
Main Research Area: Technical/natural sciences
Are We Drowning? Urban Land Subsidence in Thyborøn, Denmark, From Ers-2 and Sentinel-1 Imagery and Precision Leveling

We assess the potential in information on rates of vertical land deformation, which is useful for, e.g., climate change adaptation. The optimal results are obtained from observations with a high spatial coverage, such as those from Sentinel-1 Synthetic Aperture Radar Interferometry (InSAR) data. However, challenges exist in creating an awareness of the data and ensuring that end-users at a local level can accurately interpret and efficiently implement them into their respective businesses. We address these challenges via a case study over the low-lying Danish coastal town Thyborøn. This is situated on a sandy coastal barrier on the high-energy North Sea coast by the entrance to the Limfjord. Deformation rates are obtained from time series of precision leveling and GPS measurements as well as ERS-2 and Sentinel-1 InSAR data. The study points to a potential solution for obtaining a public awareness and use of deformation maps.

A soft X-ray spectral episode for the Clocked Burster, GS 1826-24 as measured by Swift and NuSTAR

We report on NuSTAR and Swift observations of a soft state of the neutron star low-mass X-ray binary GS 1826–24, commonly known as the "clocked" burster. The transition to the soft state was recorded in 2014 June through an increase of the 2–20 keV source intensity measured by MAXI, simultaneous with a decrease of the 15–50 keV intensity measured by Swift/BAT. The episode lasted approximately two months, after which the source returned to its usual hard state. We analyze the broadband spectrum measured by Swift/XRT and NuSTAR and estimate the accretion rate during the soft episode to be \( \approx 13\% \dot{m}_{\text{edd}} \) within the range of previous observations. However, the best-fit spectral model, adopting the double Comptonization used previously, exhibits significantly softer components. We detect seven type-I X-ray bursts, all significantly weaker (and with shorter rise and decay times) than observed previously. The burst profiles and recurrence times vary significantly, ruling out the regular bursts that are typical for this source. One burst exhibited photospheric radius expansion and we estimate the source distance as \((5.7 \pm 0.2) \xi_{b}^{-1/2} \text{kpc}\), where \(\xi_{b}\) parameterizes the possible anisotropy of the burst emission. The observed soft state may most likely be interpreted as a change in accretion geometry at about similar bolometric luminosity as in the hard state. The different burst behavior can therefore be attributed to this change in accretion flow geometry, but the fundamental cause and process for this effect remain unclear.
Assessing Future Flood Hazards for Adaptation Planning in a Northern European Coastal Community

From a transdisciplinary approach in the town of Thyboron, Denmark, we investigate couplings between sea state (i.e., mean and extreme) and flooding hazards today and ahead. This includes analyses of change and variability in the groundwater table, precipitation, land motion, geotechnical ground properties, sewerage systems and other infrastructure to outline a more complete platform for the integration of knowledge into climate adaptation schemes at this highly vulnerable coastal location. It involves the engagement of the main stakeholders who, although having different responsibilities, interests, needs of knowledge and data, and different timeframes for investment and planning, must join in a common appraisal of the challenges faced ahead to provide for better adaptation measures. Apart from obvious adverse effects from future storm surge events, knowledge about the coupled effects of the abovementioned parameters needs to be taken into account to reach optimal mitigation and adaptation measures. Through stakeholder interviews it becomes clear that an enhanced focus on transdisciplinary research is a viable way forward to develop such measures: it will bring in more knowledge, a broader scope, and it will provide for more holistic solutions that both serve to protect the town and allow for business development and better municipal planning ahead.

General information
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Organisations: National Space Institute, Geodesy, GEO, Rambøll Danmark A/S, Danish Geodata Agency
Authors: Sørensen, C. S. (Intern), Broge, N. H. (Ekstern), Molgaard, M. R. (Ekstern), Schow, C. (Ekstern), Thomson, P. (Ekstern), Vognsen, K. (Ekstern), Knudsen, P. (Intern)
Number of pages: 24
Publication date: 2016
Main Research Area: Technical/natural sciences

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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 1.425 SNIP 1.095
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.126 SNIP 0.812
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
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Assessing GOCE Gravity Models using Altimetry and Drifters

The improved gravity models provided by the GOCE mission have enhanced the resolution and sharpened the boundaries of those features and the associated geostrophic surface currents reveal improvements for all of the ocean's current systems. There are still important signals to be recovered and issues related to errors in the models have been identified. In this study, a series of newer gravity models including observations from GRACE and GOCE are compared with the DTU15MSS mean sea surface to analyse resolution capacities and to identify issues caused by errors in the models. The comparisons are carried out in regional analyses using Fourier techniques to derive the spectral characteristics as well as anisotropic patterns to identify differences and to quantify quality measures associated with the models. In addition, regional analyses are carried out using in-situ observations of the geostrophic surface currents from drifters. This is done to analyse correlations and to derive resolution capacities associated with the ocean circulation and to derive requirements to future gravity missions.

A surface elevation changes of the Greenland ice sheet from SARAL/AltiKa satellite radar altimeter

Radar altimeter measurements from ERS, Envisat and CryoSat-2 ESA's satellites have been used for study of the ice sheet elevation changes for more than two decades. The follow-on SARAL ISRO/CNES mission with the radar altimeter AltiKa on board was launched in February 2013 on the same orbit as Envisat. However, in contrast to the previous Ku-band radar altimeters, AltiKa operates in Ka-band (36.8 GHz) resulting in smaller footprint, better vertical resolution and decreased penetration of the signal in the snowpack. This work presents Greenland ice sheet surface elevation changes (SEC) derived from the first years of SARAL/AltiKa operation as part of the ESA's Climate Change Initiative program, which addresses the GrIS as one of the Essential Climate Variables. Seasonal changes in elevation and radar altimeter waveform parameters are estimated using crossover and stacking methods and compared with those derived from ERS, Envisat and CryoSat data.

Atomic scattering factor of the ASTRO-H (Hitomi) SXT reflector around the gold's L edges

The atomic scattering factor in the energy range of 11.2-15.4 keV for the ASTRO-H Soft X-ray Telescope (SXT) is reported. The large effective area of the SXT makes use of photon spectra above 10 keV viable, unlike most other X-ray satellites with total-reflection mirror optics. Presence of gold's L-edges in the energy band is a major issue, as it complicates the function of the effective area. In order to model the area, the reflectivity measurements in the 11.2-15.4 keV band with the energy pitch of 0.4-0.7 eV were made in the synchrotron beamline Spring-8 BL01B1. We obtained atomic scattering factors f1 and f2 by the curve fitting to the reflectivities of our witness sample. The edges associated with the L-I, II, and III transitions are identified, of which the depths are found to be roughly 60% shallower than those expected from the Henke's atomic scattering factor.
Automated Photogrammetric Image Matching with Sift Algorithm and Delaunay Triangulation

An algorithm for image matching of multi-sensor and multi-temporal satellite images is developed. The method is based on the SIFT feature detector proposed by Lowe in (Lowe, 1999). First, SIFT feature points are detected independently in two images (reference and sensed image). The features detected are invariant to image rotations, translations, scaling and also to changes in illumination, brightness and 3-dimensional viewpoint. Afterwards, each feature of the reference image is matched with one in the sensed image if, and only if, the distance between them multiplied by a threshold is shorter than the distances between the point and all the other points in the sensed image. Then, the matched features are used to compute the parameters of the homography that transforms the coordinate system of the sensed image to the coordinate system of the reference image. The Delaunay triangulations of each feature set for each image are computed. The isomorphism of the Delaunay triangulations is determined to guarantee the quality of the image matching. The algorithm is implemented in Matlab and tested on World-View 2, SPOT6 and TerraSAR-X image patches.

A Validation Dataset for CryoSat Sea Ice Investigators

Since its launch in April 2010 Cryosat has been collecting valuable sea ice data over the Arctic region. Over the same period ESA's CryoVEx and NASA IceBridge validation campaigns have been collecting a unique set of coincident airborne measurements in the Arctic. The CryoVal-SI project has collated the campaign data and selected the CryoSat ground tracks which have the best coverage by coincident campaign data to produce a list of "Golden Days". The campaign data were processed and resampled to coincident CryoSat footprints to make them easier to utilise. The resulting validation dataset provides an independent metric that can be used to objectively evaluate any experimental
changes or refinements to the CryoSat data processing that a user may wish to test. This valuable resource is in itself an output of the CryoVal-SI project which is made openly and freely available to the scientific community. In this talk we will describe the composition of the validation dataset, summarising how it was processed and how to understand the content and format of the data. We will also explain how to access the data and the supporting documentation.

**General information**

State: Published  
Organisations: National Space Institute, Geodynamics, University College London, University of Maryland, Norwegian Polar Institute, University of Bremen, York University, University of Alberta, European Space Agency, Alfred Wegener Institute  
Authors: Julia G. (Ekstern), Baker, S. (Ekstern), Haas, C. (Ekstern), Beckers, J. (Ekstern), Davidson, M. (Ekstern), Farrell, S. (Ekstern), Forsberg, R. (Intern), Gerland, S. (Ekstern), Hendricks, S. (Ekstern), Hvidegaard, S. M. (Intern), King, J. (Ekstern), Ricker, R. (Ekstern), Skourup, H. (Intern), Gunnar, S. (Ekstern)  
Number of pages: 1  
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Links:  
http://lps16.esa.int/page_session185.php#1927p  

**Block-sparse beamforming for spatially extended sources in a Bayesian formulation**

Direction-of-arrival (DOA) estimation refers to the localization of sound sources on an angular grid from noisy measurements of the associated wavefield with an array of sensors. For accurate localization, the number of angular look-directions is much larger than the number of sensors, hence, the problem is underdetermined and requires regularization. Traditional methods use an L2-norm regularizer, which promotes minimum-power (smooth) solutions, while regularizing with L1-norm promotes sparsity. Sparse signal reconstruction improves the resolution in DOA estimation in the presence of a few point sources, but cannot capture spatially extended sources. The DOA estimation problem is formulated in a Bayesian framework where regularization is imposed through prior information on the source spatial distribution which is then reconstructed as the maximum a posteriori estimate. A composite prior is introduced, which simultaneously promotes a piecewise constant profile and sparsity in the solution. Simulations and experimental measurements show that this choice of regularization provides high-resolution DOA estimation in a general framework, i.e., in the presence of spatially extended sources.

**General information**

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Organisations: Center for Energy Resources Engineering, Department of Applied Mathematics and Computer Science, National Space Institute, Department of Informatics and Mathematical Modeling, Department of Electrical Engineering, Acoustic Technology, University of California, San Diego  
Authors: Xenaki, A. (Intern), Fernandez Grande, E. (Intern), Gerstoft, P. (Ekstern)  
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Scopus rating (2017): SJR 0.695 SNIP 1.224  
Web of Science (2017): Indexed yes  
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Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77  
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.56 SNIP 1.306
Original language: English
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Can the Paris Agreement stop global warming?

At the COP21 meeting in Paris world leaders agreed to keep the Earth’s temperature well below 2 degrees Celsius and preferably limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels. To achieve this they decided to reduce the predicted emission of greenhouse gases in the year 2030 of about 55 Gt Carbon to 40 Gt Carbon. This can be compared to an approximate emission of 35 Gt in 2014 and thus means that a global rise in emission of only 5 Gt Carbon is allowed over the next 15 years. Using the Danish Center for Earth System Science (DCESS) model [1] we have investigated how large an emission reduction is necessary to keep the global temperatures below these targets. The DCESS model is a low order Earth system box model which includes atmosphere, ocean, ocean sediment, land biosphere and lithosphere components, and using the year 1765 as the pre-industrial level. We have examined different emission scenarios and the national commitments and find that even if the Paris Agreement is fulfilled, global temperatures will have increased by 1.5 degree C in 2030, and then only a yearly percentage reduction of 5% or more will be sufficient to keep temperatures below 2 degree C in 2100.

Challenges for Greenland-wide mass balance from Cryosat-2 radar-altimetry

As the Greenland ice sheet warms, a change in the structure of the upper snow/firn occurs. This change further induces changes in the reflective properties of the firm seen from satellite radar altimetry. If not identified as changes in the reflective properties of the firm, these may be interpreted as actual surface elevation changes seen from the satellite radar altimetry (Nilsson et al., 2015). Here, we investigate how to correct the elevation change observed from the ESA Cryosat-2 radar altimetry mission to derive elevation change of the air/snow interface of the Greenland ice sheet. The elevation change of this “real” physical surface is crucial, if the goal is to derive Greenland mass balance as done for LiDAR missions. The investigations look into waveform parameters to correct for the observed bias between Radar and LiDAR observations when using Cryosat-2 level-2 data. Based on the knowledge gained by analyzing the elevation change derived from the inclusion of various waveform parameters, we pinpoint the challenges associated with the using Cryosat-2 observation in mass balance studies. As for mass balance studies utilizing LiDAR observation (ICESat), a strong firm-modeling component is needed; here the information gained from running such models may also provide input for the correction of radar elevation in to surface elevation.

Change detection in a short time sequence of polarimetric C-band SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution and a factorization of this test statistic with associated p-values, change analysis in a time series of multilook, polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change(s) occur. The technique is demonstrated on airborne EMISAR C-band data but may be applied to ALOS, COSMO-SkyMed, RadarSat-2 Sentinel-1, TerraSAR-X, and Yaogan data also.
Change detection in a time series of polarimetric SAR data by an omnibus test statistic and its factorization

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a short sequence of multilook, polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change(s) occur. The technique is demonstrated on airborne EMISAR L-band data but may be applied to Sentinel-1, Cosmo-SkyMed, TerraSAR-X, ALOS and RadarSat-2 or other dual- and quad/full-pol, and even single-pol data also.

General information

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Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern)
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Changes in Earth's core-generated magnetic field, as observed by Swarm

By far the largest part of the Earth's magnetic field is generated by motions taking place within our planet's liquid metal outer core. Variations of this core-generated field thus provide us with a unique means of probing the dynamics taking place in the deepest reaches of the Earth. In this contribution, we will present the core-generated magnetic field, and its recent time changes, as seen by ESA's Earth explorer mission Swarm.

We will present a new time-dependent geomagnetic field model, called CHAOS-6, derived from satellite data collected by the Swarm constellation, as well as data from the previous missions CHAMP and Oersted together with ground observatory data. Advantage is taken of the constellation aspect of the Swarm mission by ingesting field differences along track and across track between the lower pair of Swarm satellites. Evaluating the global field model at the outer boundary of the source region, the core-mantle boundary, we present maps of the detailed structure of the geodynamo, and how this
is presently evolving. Both the trend (secular variation) and accelerations in the field changes since the launch of the Swarm mission will be presented.

Assuming that field changes are primarily a result of advective processes, thanks to the high electrical conductivity of the core, and that the responsible core flows are essentially columnar, due to the organizing influence of the Coriolis force, we derive maps of the underlying core flow. The structure of this core flow, its changes over recent years, and implications for our understanding of the geodynamo process will be discussed.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, University of Grenoble
Authors: Finlay, C. (Intern), Olsen, N. (Intern), Gillet, N. (Ekstern), Kotsiaros, S. (Intern), Tøffner-Clausen, L. (Intern), Hammer, M. D. (Intern)
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Characterizing X-Ray and Radio Emission in the Black Hole X-Ray Binary V404 Cygni During Quiescence
We present results from multi-wavelength simultaneous X-ray and radio observations of the black hole X-ray binary V404 Cyg in quiescence. Our coverage with NuSTAR provides the very first opportunity to study the X-ray spectrum of V404 Cyg at energies above 10 keV. The unabsorbed broadband (0.3–30 keV) quiescent luminosity of the source is $8.9 \times 10^{32}$ erg s$^{-1}$ for a distance of 2.4 kpc. The source shows clear variability on short timescales (an hour to a couple of hours) in the radio, soft X-ray, and hard X-ray bands in the form of multiple flares. The broadband X-ray spectra obtained from XMM-Newton and NuSTAR can be characterized with a power-law model having a photon index of $\Gamma = 2.12 \pm 0.07$ (90% confidence errors); however, residuals at high energies indicate spectral curvature significant at a 3σ confidence level with the e-folding energy of the cutoff as $20^{\pm 7/20}$ keV. Such curvature can be explained using synchrotron emission from the base of a jet outflow. Radio observations using the VLA reveal that the spectral index evolves on very fast timescales (as short as 10 minutes), switching between optically thick and thin synchrotron emission, possibly due to instabilities in the compact jet or stochastic instabilities in the accretion rate. We explore different scenarios to explain this very fast variability.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Universite de Toulouse, California Institute of Technology, University Paris Diderot - Paris 7, University of Orleans, University of California at Berkeley, Massachusetts Institute of Technology, Durham University, Columbia University, Harvard University, NASA Goddard Space Flight Center
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Classified and Clustered Data Constellation: An Efficient Approach of 3D Urban Data Management

The growth of urban areas has resulted in massive urban datasets and difficulties handling and managing issues related to urban areas. Huge and massive datasets can degrade data retrieval and information analysis performance. In addition, the urban environment is very difficult to manage because it involves various types of data, such as multiple types of zoning themes in the case of urban mixed-use development. Thus, a special technique for efficient handling and management of urban data is necessary. This paper proposes a structure called Classified and Clustered Data Constellation (CCDC) for urban data management. CCDC operates on the basis of two filters: classification and clustering. To boost up the performance of information retrieval, CCDC offers a minimal percentage of overlap among nodes and coverage area to avoid repetitive data entry and multipath query. The results of tests conducted on several urban mixed-use development datasets using CCDC verify that it efficiently retrieves their semantic and spatial information. Further, comparisons conducted between CCDC and existing clustering and data constellation techniques, from the aspect of preservation of minimal overlap and coverage, confirm that the proposed structure is capable of preserving the minimum overlap and coverage area among nodes. Our overall results indicate that CCDC is efficient in handling and managing urban data, especially urban mixed-use development applications.
Coastal community resilience in climate adaptation and risk reduction

Storm surge impacts on the Limfjord coasts of Denmark are exacerbated by the expansion of the Thyboron Channel that causes increased water transport into the fjord from the North Sea. This, in combination with sea level rise, jeopardizes the strength of existing flood protection and challenges the local municipalities to implement additional measures. For the fjord towns of Thyboron (pop. 2100, located towards the North Sea by the Thyboron Channel) and Legster (pop. 4000, located approximately 80 km east from the North Sea) flood hazard, vulnerability, and risk assessments and mapping are combined with community resilience studies to provide the corresponding municipalities with a more elaborate knowledge platform for climate adaptation and disaster risk reduction. Community resilience is investigated in four dimensions (information & communication, community competence, social capital, and institutional capacity) from +25 semi-structured interviews conducted with local citizens, municipal level employees as well as national government officials. Despite facing the same flood hazards, the two communities have different histories, social structures, and previous flood experiences and, accordingly, have different resilience strengths and limitations inherent. Thyboron emerged over the past century as a fisheries town protected from the North Sea by large sea dikes constructed by the national government. Life in a harsh physical environment and no significant flood accounts in decades, means that neither the community nor the municipality perceives floods as any immediate threat. Municipal adaptation planning is slowly forming but hitherto without engaging the local community, and the town has no formal emergency preparedness plan. In contrast, the medieval town of Legster last experienced severe floods in 1981 and 2005 which led to the construction of a sea wall, community involvement, and detailed emergency management setup. The Thyboron community has a reputation of ‘acting on their own’ and the citizens do not –neither individually nor collectively, ask e.g., the municipality for assistance. They do possess the ability to muster volunteers in large numbers when needed, however. Here, the current lack of information from the municipality is noticeable and community involvement, to go along with current scientific investigations for climate adaptation, will increase community resilience and allow for better and more integrated solutions. The Legster community resilience is strong as the locals are knowledgeable about the flood risk, have good work relations with the municipality, and have detailed disaster preparedness plans. The plans are not flexible which may limit the community resilience, however. In addition, amenity – or the attractiveness of the town to tourists and residents, is a strong factor to both the locals and the municipality and is weighed at almost equal level to safety and risk reduction in adaptation planning. More specifically this means that the heights of existing sea walls are a compromise between safety against floods and sea view. Thus, although the community is well prepared for the next extreme event and has the ability to recover, the level of protection indicates that floods may occur at unnecessary high frequencies thereby degrading the community resilience to an undesired extent. In conclusion, the study points to the potential in combining and merging natural and social science approaches for climate adaptation and disaster risk management to strengthen municipal decision-making, allow for better planning measures, and to strengthen community resilience.

General information
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Organisations: National Space Institute, Geodesy, Danish Coastal Authority
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Main Research Area: Technical/natural sciences
Community resilience, Coastal floods, Storm surges, Emergency response, Impact mitigation

Coastal Erosion and Flooding Hazards on the North Sea Coast at Thyboron, Denmark

Since a breach of the coastal barrier in 1862, the Thyboron Channel connecting the North Sea and the Lim Fiord has been artificially maintained by construction of breakwaters and groins on the North Sea coast and inside the channel, respectively. Sand nourishment schemes have since the 1980s counteracted the natural erosion in the upper profile on the North Sea coast where the alongshore sediment transport converges towards the channel and deposits up to 1 million m3/y on the flood tidal delta inside the fiord, Figure 1.

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State: Published
Organisations: National Space Institute, Geodesy, University of Queensland, Danish Coastal Authority
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Number of pages: 1
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Event: Poster session presented at International Coastal Symposium 2016, Sydney, Australia.
Coastal Hazards and Integration of Impacts in Local Adaptation Planning

Data on sea and groundwater levels, precipitation, land subsidence, geology, and geotechnical soil properties are combined with information on flood and erosion protection measures to analyze water-related impacts from climate change at an exposed coastal location. Future sea extremes will have a large impact but several coupled effects in the hydrological system need to be considered as well to provide for optimal protection and mitigation efforts. For instance, the investment and maintenance costs of securing functional water and wastewater pipes are significantly reduced by incorporating knowledge about climate change. The translation of regional sea level rise evidence and projections to concrete impact measures should take into account the potentially affected stakeholders who must collaborate on common and shared adaptation solutions. Here, knowledge integration across levels of governance and between research, private and public institutions, and the local communities provides: understanding of the immediate and potential future challenges; appreciation of different stakeholder motives, business agendas, legislative constraints etc., and a common focus on how to cost-efficiently adapt to and manage impacts of climate change. By construction of a common working platform that is updated with additional data and knowledge, e.g. from future regional models or extreme events, advances in sea level research can more readily be translated into concrete and local impact measures in a way that handles uncertainties in the future climate and urban development as well as suiting the varying stakeholder needs.

General information

State: Published
Organisations: National Space Institute, Geodesy, Danish Ministry of Energy, Utilities and Climate, GEO
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Main Research Area: Technical/natural sciences

Coastal sea-level in Norway from CryoSat-2 SAR altimetry

Conventional spaceborne altimeters determine the sea surface height with an accuracy of a few centimeters. Although satellite altimetry may be regarded as a mature technology, altimeter observations collected over coastal regions suffer from numerous effects which degrade their quality. For example, land and bright targets contaminate the radar footprint, and the range and geophysical corrections (wet troposphere, tides, and high-frequency atmospheric and ocean signals) are notoriously difficult to model in the coastal zone. The Norwegian coast adds further complications, due to the many islands, mountains, and deep, narrow fjords.

As the first of its kind, the European Space Agency’s CryoSat-2 satellite carries a Synthetic aperture Interferometric Radar Altimeter (SIRAL) which can operate in Synthetic Aperture Radar (SAR), SAR Interferometric (SARIn), as well as conventional Low Rate (LR) modes. When operating in SARIn mode, the altimeter measures the phase difference of the backscattered signal at two antennas, from which the position of any backscattered point may be derived. Thus, the SARIn mode may help discriminating and mitigating land contamination signals from off-nadir land targets (e.g., steep cliffs) over coastal regions.

Conventional altimetry (Envisat, Jason-2) and specific coastal products (CTOH, PISTACH) have recently been tested along the Norwegian coast, where it was concluded that the coastal products did not offer an improvement over the conventional products they are based on. We therefore investigate the potential for CryoSat-2 data to provide improved ocean measurements in the Norwegian coastal zone. In particular, we make use of CryoSat-2’s SAR and SARIn modes and determine coastal sea surface heights in specific coastal regions, and compare results with independent sea-level observations.

General information

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Combining Envisat and CryoSat-2 altimetry to inform hydrodynamic models

Decreasing availability of in-situ river monitoring data can be met with increasing availability and quality of satellite altimetry data over rivers. CryoSat-2 is an altimeter mission launched in 2010 by the European Space Agency (ESA). With its unique drifting orbit, common procedures of working with satellite altimetry data over rivers cannot be easily applied. This work presents a way of informing a hydrologic-hydrodynamic model of the Brahmaputra River with CryoSat-2 altimetry. For one, CryoSat-2 data with its high spatial resolution was used to calibrate water levels in the 1D hydrodynamic model. For the other, a data assimilation framework was developed and applied, showing promising results for assimilation experiments with real and synthetic CryoSat-2 data.

General information
State: Published
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Combining Envisat and CryoSat-2 altimetry to inform hydrodynamic models
Remote sensing provides valuable data for parameterization and updating of hydrological models, for example water level measurements of inland water bodies from satellite radar altimeters. Many studies have used satellite altimetry data from repeat-orbit missions such as Envisat, ERS or Jason, or synthetic wide-swath altimetry data as expected from the SWOT mission. This study is one of the first hydrologic applications of altimetry data from a drifting orbit satellite mission, namely CryoSat-2. CryoSat-2 is equipped with the SIRAL instrument, a new type of radar altimeter similar to SRAL on Sentinel-3. CryoSat-2 SARIn level 2 data is used to improve a 1D hydrodynamic model of the Brahmaputra river basin in South Asia set up in the DHI MIKE 11 software. CryoSat-2 water levels were extracted over river masks derived from Landsat imagery. After discharge calibration, simulated water levels were fitted to the CryoSat-2 data: In a first step, the average simulated water levels along the river were calibrated to the CryoSat-2 data by adapting the hydrodynamic cross section datums. Subsequently the simulated water level amplitudes were fitted to those obtained from Envisat virtual station time series by adapting the cross section shapes. The water level was only calibrated for the Brahmaputra in the Assam valley due to a lack of Envisat data further upstream. Despite the steep and rugged terrain in the upstream part of the Brahmaputra, the CryoSat-2 data was found usable after a Landsat river mask was applied. After calibration a hydrodynamic model with accurate spatio-temporal representation of water levels is obtained. This is a prerequisite for real-time model updating by assimilation of CryoSat-2 altimetry or multi-mission data in general. For this task, a data assimilation framework has been developed and linked with the MIKE 11 model, enabling the integration of any kind of water level measurements. It is a flexible framework that can assimilate water level data which are arbitrarily distributed in time and space. Different types of error models and data assimilation methods can easily be used and tested. Furthermore, it is not only possible to update the water level of the hydrodynamic model, but also the states of the rainfall-runoff models providing the forcing of the hydrodynamic model. The setup has been used to assimilate CryoSat-2 observations over the Assam valley for the years 2010 to 2013, testing different data assimilation methods and model error representations. Performance improvement in terms of discharge forecast due to the assimilation of satellite altimetry data was then evaluated.
Combining SAMOSA-3 and empirical retrackers for inland water height determination

Here we present a new system for retracking of SAR waveforms over rivers and lakes. Satellite altimetry offers frequent and global sampling across borders, which can be used to validate and calibrate hydrological models in remote areas where in situ measurements are scarce. The system was developed using CryoSat-2 20Hz SAR data, but due to the similarities between the Sentinel-3 SRAL altimeter and the SIRAL altimeter on-board CryoSat-2 an adaption of the method will be straightforward. The SAMOSA-3 retracker has previously demonstrated to perform better than other existing SAR retrackers over water surfaces and has therefore been chosen as the primary retracker whenever applicable. To find the waveforms for which the SAMOSA-3 retracker is appropriate, a classification is performed using first the k-means for clustering sample waveforms into classes and then the Naïve Bayes classifiers supported by training classes from the k-means for determining classes of all waveforms. The waveforms that are found suitable for the SAMOSA-3 retracker are isolated; these are the ocean-like and the highly specular waveforms. If the SAMOSA-3 retracker is found unsuitable or if the obtained result from this retracker is unsatisfactory, the waveform is retracked using the newly developed Multiple Waveform Persistent Peak (MWaPP) sub-waveform retracker, which studies adjacent waveforms to reveal the sub-waveform most likely to represent the echo from nadir. The method has been validated against lake and river gauges around the world to ensure that the system works for multiple types of inland water, and reveals that the combined method performs very well, but does not obtain significantly higher precisions compared to the MWaPP retracker. The results also show the MWaPP retracker provides height estimates with precisions very similar to those of the SAMOSA-3 retracker.

CryoSat-2 radar altimetry for monitoring surface water in China

Surface water bodies (lakes, reservoirs and rivers) are key components of the water cycle and are important water sources. Water level and storage vary greatly under the impacts of climate change and human activities. A national-scale surface water monitoring dataset for China is not available. The spatio-temporal pattern of surface water dynamics is poorly known due to insufficient in situ monitoring capabilities and restricted access to monitoring data. In comparison with other satellites, the 369 day repeat orbit enables CryoSat-2 to monitor smaller water bodies than other satellites and the SIRAL sensor has higher precise than conventional altimeters. We investigated water level variations for large lakes, reservoirs and rivers during the period of 2010 - 2015 using CryoSat-2 altimetry data. Water storage changes for 759 water bodies were estimated, and the contribution of surface water storage (SWS) changes to terrestrial water storage (TWS) was evaluated in combination with results from the Gravity Recovery and Climate Experiment (GRACE). Moreover, water level dynamics in the Yangtze and Yellow Rivers were mapped. Results show that 1) surface water levels change significantly at regional scale, i.e. declining in Junggar Basin, Huai River Basin and Hubei Province while rising in North Tibetan Plateau and Songnen Plain; 2) SWS change affects TWS variation greatly, especially in Tibetan Plateau; 3) TWS in Songhua River basin has been fluctuating strongly over the past decade and the North China Plain maintained a consistently decreasing trend in TWS (~ 20 mm/yr); 4) Change observed in Songnen Plain is also seen from SongLiao Water Resources Bulletin.
CryoSat Land Ice Product Validation within the CryoVal-LI project

The main objective of the ESA funded CryoVal-LI project has been to identify and quantify the error sources for the CryoSat-2 mission over land ice. This has been undertaken through the careful documentation of the possible error sources, the identification of suitable validation sites and the creation of a public database containing validation data for these areas from recent ground and airborne field campaigns. These sites also offer considerable potential as sites on which to focus future validation efforts.

Through the utilization of these observational datasets, an extensive comparative analysis has been carried out in which Cryosat-2 data has been evaluated against airborne and in-situ data. A number of different Cryosat-2 data sets have been included in this analysis with the goal of testing the performance of different processing and retracking algorithms. A similar, but smaller validation analysis has also been carried out for ICESat data.

Here, we present the results of these analyses and outline the conclusions reached. Based on the findings from the project, a set of recommendations for the design of future land-ice/satellite validation campaigns will be given. Furthermore, the outcome of the re-tracker inter-comparison will be used to advocate a set of optimal re-tracking algorithms for Cryosat-2 in the next generation of L2 products.

Danish risk management plans of the EU Floods Directive

We evaluate the impact and effect of the EU Flood’s Directive (2007/60/EC) in Denmark and the flood risk management plans that are the result of the national implementation. In a qualitative research approach, the flood risk management plans published by 22 Danish municipalities are reviewed and analyzed regarding main objectives and structural and non-structural mitigation measures. From the analyses conclusions are drawn on the non-structural risk management measures still to be improved to obtain the full benefits from the Directive. Conclusions point to the need of introducing better decision support systems, a need to define acceptable risks, and a need to enhance coordination between municipal and cross-sectorial actors as well as an increased effort to involve civil society is necessary. In general, the implementation of the Directive has significantly advanced the national scientific and cross-sectorial working platform for dealing with risks from floods.
Decadal period external magnetic field variations determined via eigenanalysis

We perform a reanalysis of hourly mean magnetic data from ground-based observatories spanning 1997-2009 inclusive, in order to isolate (after removal of core and crustal field estimates) the spatiotemporal morphology of the external fields important to mantle induction, on (long) periods of months to a full solar cycle. Our analysis focuses on geomagnetically quiet days and middle to low latitudes. We use the climatological eigenanalysis technique called empirical orthogonal functions (EOFs), which allows us to identify discrete spatiotemporal patterns with no a priori specification of their geometry—the form of the decomposition is controlled by the data. We apply a spherical harmonic analysis to the EOF outputs in a joint inversion for internal and external coefficients. The results justify our assumption that the EOF procedure responds primarily to the long-period external inducing field contributions. Though we cannot determine uniquely the contributory source regions of these inducing fields, we find that they have distinct temporal characteristics which enable some inference of sources. An identified annual-period pattern appears to stem from a north-south seasonal motion of the background mean external field distribution. Separate patterns of semiannual and solar-cycle-length periods appear to stem from the amplitude modulations of spatially fixed background fields.

General information
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Decadal variability in core surface flows deduced from geomagnetic observatory monthly means

Monthly means of the magnetic field measurements at ground observatories are a key data source for studying temporal changes of the core magnetic field. However, when they are calculated in the usual way, contributions of external
(magnetospheric and ionospheric) origin may remain, which make them less favourable for studying the field generated by
dynamo action in the core. We remove external field predictions, including a new way of characterising the
magnetospheric ring current, from the data and then calculate revised monthly means using robust methods. The
geomagnetic secular variation (SV) is calculated as the first annual differences of these monthly means, which also
removes the static crustal field. SV time series based on revised monthly means are much less scattered than those
calculated from ordinary monthly means, and their variances and correlations between components are smaller. On the
annual to decadal timescale, the SV is generated primarily by advection in the fluid outer core. We demonstrate the utility
of the revised monthly means by calculating models of the core surface advective flow between 1997 and 2013 directly
from the SV data. One set of models assumes flow that is constant over three months; such models exhibit large and rapid
temporal variations. For models of this type, less complex flows achieve the same fit to the SV derived from revised
monthly means than those from ordinary monthly means. However, those obtained from ordinary monthly means are able
to follow excursions in SV that are likely to be external field contamination rather than core signals. Having established
that we can find models that fit the data adequately, we then assess how much temporal variability is required. Previous
studies have suggested that the flow is consistent with torsional oscillations (TO), solid body-like oscillations of fluid on
concentric cylinders with axes aligned along the Earth's rotation axis. TO have been proposed to explain decadal
timescale changes in the length-of-day. We invert for flow models where the only temporal changes are consistent with
TO, but such models have an unacceptably large data misfit. However, if we relax the TO constraint to allow a little more
temporal variability, we can fit the data as well as with flows assumed constant over three months, demonstrating that
rapid SV changes can be reproduced by rather small flow changes. Although the flow itself changes slowly, its time
derivative can be locally (temporally and spatially) large, in particular when and where core surface secular acceleration
peaks. Spherical harmonic expansion coefficients of the flows are not well resolved, and many of them are strongly
correlated. Averaging functions, a measure of our ability to determine the flow at a given location from the data distribution
available, are poor approximations to the ideal, even when centred on points of the core surface below areas of high
observatory density. Both resolution and averaging functions are noticeably worse for the toroidal flow component, which
dominates the flow, than the poloidal flow component, except around the magnetic equator where averaging functions for
both components are poor.

General information
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Organisations: National Space Institute, Geomagnetism, University of Edinburgh
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.796 SNIP 1.354 CiteScore 2.46
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.901 SNIP 1.473 CiteScore 2.63
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.376 SNIP 1.677 CiteScore 3.15
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.367 SNIP 1.43 CiteScore 2.78
Deep time evidence for climate sensitivity increase with warming: Climate Sensitivity Rise With Warming

Future global warming from anthropogenic greenhouse gas emissions will depend on climate feedbacks, the effect of which is expressed by climate sensitivity, the warming for a doubling of atmospheric CO₂ content. It is not clear how feedbacks, sensitivity, and temperature will evolve in our warming world, but past warming events may provide insight. Here we employ paleoreconstructions and new climate-carbon model simulations in a novel framework to explore a wide scenario range for the Paleocene-Eocene Thermal Maximum (PETM) carbon release and global warming event 55.8Ma ago, a possible future warming analogue. We obtain constrained estimates of CO₂ and climate sensitivity before and during the PETM and of the PETM carbon input amount and nature. Sensitivity increased from 3.3-5.6 to 3.7-6.5K (Kelvin) into the PETM. When taken together with Last Glacial Maximum and modern estimates, this result indicates climate sensitivity increase with global warming.

General information
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Organisations: National Space Institute, Innovation and Research-based consultancy, University of Copenhagen, Purdue University, University of Chile
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Pages: 6538-6545
Publication date: 2016
Demonstrating the likely neutron star nature of five M31 globular cluster sources with Swift-NuSTAR spectroscopy

We present the results of a joint Swift-NuSTAR spectroscopy campaign on M31. We focus on the five brightest globular cluster X-ray sources in our fields. Two of these had previously been argued to be black hole candidates on the basis of apparent hard-state spectra at luminosities above those for which neutron stars are in hard states. We show that these two sources are likely to be Z-sources (i.e. low magnetic field neutron stars accreting near their Eddington limits), or perhaps bright atoll sources (low magnetic field neutron stars which are just a bit fainter than this level) on the basis of simultaneous Swift and NuSTAR spectra which cover a broader range of energies. These new observations reveal spectral curvature above 6-8 keV that would be hard to detect without the broader energy coverage the NuSTAR data provide relative to Chandra and XMM-Newton. We show that the other three sources are also likely to be bright neutron star X-ray binaries, rather than black hole X-ray binaries. We discuss why it should already have been realized that it was unlikely that these objects were black holes on the basis of their being persistent sources, and we re-examine past work which suggested that tidal capture products would be persistently bright X-ray emitters. We discuss how this problem is likely due to neglecting disc winds in older work that predict which systems will be persistent and which will be transient.

General information

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Scopus rating (2017): SJR 2.346 SNIP 0.904
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.09 SJR 2.388 SNIP 1.134
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.701 SNIP 1.165 CiteScore 4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Deriving the DTU15 Global high resolution marine gravity field from satellite altimetry

Data from the Cryosat-2 (369 days repeat mission) as well as Jason-1 end-of-life mission are the first new “geodetic mission” data sets released in nearly 2 decades since the ERS-1 and Geosat geodetic missions were conducted in the early 90'th and late 80'th. Besides providing high quality sea surface height observations, the Cryosat-2 has now completed its fifth cycle of 369 days. This opens for new ways of using “pseudo” repeat Geodetic mission data, by averaging or other means of analysis. One further advantage of the Cryosat-2 is its ability of provide new accurate sea surface height information for gravity field determination in the northernmost part of the Arctic Ocean upto 88N where no altimeters have measured before. The first evaluation of the DTU15 global marine gravity field is presented here. The
DTU15 is based on five years of retracked altimetry from Cryosat-2 as well as data from the Jason-2 EOL geodetic missions. It is shown how the older geodetic missions (ERS-1 and GEOSAT) only contribute valuable information in very limited regions of the world. In the Arctic Ocean are testing an new combined empirical/physical retracking system that uses physical retracking of the LRM data using a reduced parameter system in combination with empirical retracking of the SAR and SAR-In data in particularly high latitude regions.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Andersen, O. B. (Intern), Knudsen, P. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Links:
http://lps16.esa.int/page_session189.php#1558p
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Detailed Analysis of Solar Data Related to Historical Extreme Geomagnetic Storms: 1868 – 2010
An analysis of historical Sun–Earth connection events in the context of the most extreme space weather events of the last ~ 150 years is presented. To identify the key factors leading to these extreme events, a sample of the most important geomagnetic storms was selected based mainly on the well-known aa index and on geomagnetic parameters described in the accompanying paper (Vennerstrøm et al., Solar Phys. in this issue, 2016, hereafter Paper I). This part of the analysis focuses on associating and characterizing the active regions (sunspot groups) that are most likely linked to these major geomagnetic storms. For this purpose, we used detailed sunspot catalogs as well as solar images and drawings from 1868 to 2010. We have systematically collected the most pertinent sunspot parameters back to 1868, gathering and digitizing solar drawings from different sources such as the Greenwich archives, and extracting the missing sunspot parameters. We present a detailed statistical analysis of the active region parameters (sunspots, flares) relative to the geomagnetic parameters developed in Paper I. In accordance with previous studies, but focusing on a much larger statistical sample, we find that the level of the geomagnetic storm is highly correlated to the size of the active regions at the time of the flare and correlated with the size of the flare itself. We also show that the origin at the Sun is most often a complex active region that is also most of the time close to the central meridian when the event is identified at the Sun. Because we are dealing with extremely severe storms, and not the usual severe storm sample, there is also a strong correlation between the size of the linked active region, the estimated transit speed, and the level of the geomagnetic event. In addition, we confirm that the geomagnetic events studied here and the associated events at the Sun present a low probability of occurring at low sunspot number value and are associated mainly with the maximum and descending part of the solar cycle.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Royal Observatory of Belgium, University of Zagreb, Leibniz Institute for Astrophysics Potsdam, The Royal Belgian Institute for Space Aeronomy
Authors: Lefèvre, L. (Ekstern), Vennerstrøm, S. (Intern), Dumbović, M. (Ekstern), Vršnak, B. (Ekstern), Sudar, D. (Ekstern), Arlt, R. (Ekstern), Clette, F. (Ekstern), Crosby, N. (Ekstern)
Pages: 1483-1531
Publication date: 2016
Main Research Area: Technical/natural sciences
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Journal: Solar Physics
Volume: 291
Issue number: 5
ISSN (Print): 0038-0938
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.135 SJR 1.517
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.62 SJR 1.352 SNIP 1.247
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Detection of Very Low-Frequency Quasi-Periodic Oscillations in the 2015 Outburst of V404 Cygni

In June 2015, the black hole X-ray binary (BHXRB) V404 Cygni went into outburst for the first time since 1989. Here, we present a comprehensive search for quasi-periodic oscillations (QPOs) of V404 Cygni during its recent outburst, utilizing data from six instruments on board five different X-ray missions: Swift/XRT, Fermi/GBM, Chandra/ACIS, INTEGRAL’s IBIS/ISGRI and JEM-X, and NuSTAR. We report the detection of a QPO at 18 mHz simultaneously with both Fermi/GBM and Swift/XRT, another example of a rare but slowly growing new class of mHz-QPOs in BHXRBs linked to sources with a high orbital inclination. Additionally, we find a duo of QPOs in a Chandra/ACIS observation at 73 mHz and 1.03 Hz, as well as a QPO at 136 mHz in a single Swift/XRT observation that can be interpreted as standard Type-C QPOs. Aside from the detected QPOs, there is significant structure in the broadband power, with a strong feature observable in the Chandra observations between 0.1 and 1 Hz. We discuss our results in the context of current models for QPO formation.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, New York University, George Washington University, University of Amsterdam, Sabanci University, National Institute for Astrophysics, European Space Astronomy Centre, University of Oxford, Open University of Israel, NASA Goddard Space Flight Center, University of California at Berkeley, California Institute of Technology
Authors: Huppenkothen, D. (Ekstern), Younes, G. (Ekstern), Ingram, A. (Ekstern), Kouveliotou, C. (Ekstern), Göğüş, E. (Ekstern), Bachetti, M. (Ekstern), Sánchez-Fernández, C. (Ekstern), Chenevez, J. (Intern), Motta, S. (Ekstern), van der Klis, M. (Ekstern), Granot, J. (Ekstern), Gehrels, N. (Ekstern), Kuulkers, E. (Ekstern), Tomsick, J. A. (Ekstern), Walton, D. J. (Ekstern)
Number of pages: 17
Determining polar ionospheric electrojet currents from Swarm satellite constellation magnetic data

We determine the strength and location of the ionospheric currents responsible for the polar electrojets from magnetic data collected by the Swarm satellite constellation on an orbit-by-orbit basis. The ionospheric currents are modelled using a simple, yet robust, method by a series of line currents at 110 km altitude (corresponding to the ionospheric E-layer) perpendicular to the satellite orbit, separated by 1° (about 113 km). We assess the reliability of our method, with the aim of a possible near-real-time application. A study of the effect of different regularization methods is therefore carried out. An L1 model regularization of the second-order spatial differences, and robust treatment of the data (to account for non-Gaussian error distributions), yields the most encouraging results. We apply our approach to two three-weekly data periods in March 2014 (geomagnetic quiet conditions) and March 2015 (more disturbed conditions), respectively. Our orbit-by-orbit approach also allows the temporal evolution of the polar electrojets to be investigated. We find remarkable agreement of the ionospheric activity in Northern and Southern polar regions, with correlation exceeding 0.9 for periods longer than two days. Reliability of the approach is shown by three key results: (1) a common regularization parameter for all orbits with enough data coverage, (2) 0.95 squared coherence with the Auroral Electrojet index, and (3) 0.97 squared coherence is found between the side-by-side flying satellites, Alpha and Charlie, indicating a method invariant to small changes in data input. All these results indicate a possible automated near-real-time application.

General information
State: Published
Organisations: National Space Institute, Geomagnetism
Authors: Aakjær, C. D. (Intern), Olsen, N. (Intern), Finlay, C. (Intern)
Number of pages: 14
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Earth, Planets and Space
Volume: 68
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Article number: 140
ISSN (Print): 1343-8832
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.146 SJR 1.289
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.981 SNIP 0.89 CiteScore 1.79
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.969 SNIP 0.966 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.493 SNIP 1.081 CiteScore 2.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.063 SNIP 1.231 CiteScore 2.65
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.322 SNIP 0.987 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.677 SNIP 0.746 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.909 SNIP 0.73
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Determining the Points of Change in Time Series of Polarimetric SAR Data

We present the likelihood ratio test statistic for the homogeneity of several complex variance–covariance matrices that may be used in order to assess whether at least one change has taken place in a time series of SAR data. Furthermore, we give a factorization of this test statistic into a product of test statistics that each tests simpler hypotheses of homogeneity up to a certain point and that are independent if the hypothesis of total homogeneity is true. This factorization is used in determining the (pixelwise) time points of change in a series of six L-band EMISAR polarimetric SAR data. The pixelwise analyses are applied on homogeneous subareas covered with different vegetation types using the distribution of the observed p-values.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Conradsen, K. (Intern), Nielsen, A. A. (Intern), Skriver, H. (Intern)
Pages: 3007-3024
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Volume: 54
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ISSN (Print): 0196-2892
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Complex covariance matrix test statistic, Complex Wishart distribution, Dual polarization, EMISAR, Full polarization, Multitemporal synthetic aperture radar (SAR) data, Omnibus test statistic, Quad polarization, Remote sensing change detection
Development and production of a multilayer-coated X-ray reflecting stack for the Athena mission

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Cosine Science and Computing B.V., Physikalisch-Technische Bundesanstalt, European Space Agency
Authors: Massahi, S. (Intern), Della Monica Ferreira, D. (Intern), Christensen, F. E. (Intern), Shortt, B. (Ekstern), Girou, D. (Ekstern), Collon, M. (Ekstern), Landgraf, B. (Ekstern), Barriere, N. (Ekstern), Krumrey, M. (Ekstern), Cibik, L. (Ekstern), Schreiber, S. (Ekstern)
Number of pages: 10
Publication date: 2016

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Title of host publication: Proceedings of Space Telescopes and Instrumentation 2016: Ultraviolet to Gamma Ray
Volume: 9905
Publisher: SPIE - International Society for Optical Engineering
Editors: den Herder, J. A., Takahashi, T., Bautz, M.
Article number: 99055P
Main Research Area: Technical/natural sciences
Conference: Space Telescopes and Instrumentation 2016, Edinburgh, United Kingdom, 26/06/2016 - 26/06/2016
Athena, Silicon pore optics (SPO), AFM, Surface Roughness, Photolithography Process, Plasma Cleaning, Multilayer Deposition, DC Magnetron Sputtering, Lift-off Process, Stacking, XRR, X-ray Optics
DOIs:
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Digital-beamforming array antenna technologies for future ocean-observing satellite missions

Existing passive microwave radiometers that are used for ocean observations are limited in spatial resolution and geographic coverage, due to the limitations of traditional antenna technologies using mechanically-scanning reflectors and horn-type feeds. Future ocean observation missions call for new solutions, such as digitally-beamforming array feeds (DBAFs) as well as stationary and more complex reflectors. Our studies demonstrate that DBAFs can overcome the physically fundamental limitations of traditional horn feeds, and are capable of meeting all the challenging requirements for the next-generation instruments.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Chalmers University of Technology, TICRA
Authors: Iupikov, O. A. (Ekstern), Ivashina, M. V. (Ekstern), Cappellin, C. (Ekstern), Skou, N. (Intern)
Pages: 1377-1378
Publication date: 2016

Host publication information
Title of host publication: Proceedings of IEEE International Symposium on Antennas and Propagation (APSURSI 2016)
Publisher: IEEE
Main Research Area: Technical/natural sciences
DOIs:
10.1109/APS.2016.7696395
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
Digital elevation model and orthophotographs of Greenland based on aerial photographs from 1978-1987

Digital Elevation Models (DEMs) play a prominent role in glaciological studies for the mass balance of glaciers and ice sheets. By providing a time snapshot of glacier geometry, DEMs are crucial for most glacier evolution modelling studies, but are also important for cryospheric modelling in general. We present a historical medium-resolution DEM and orthophotographs that consistently cover the entire surroundings and margins of the Greenland Ice Sheet 1978-1987. About 3,500 aerial photographs of Greenland are combined with field surveyed geodetic ground control to produce a 25 m gridded DEM and a 2 m black-and-white digital orthophograph. Supporting data consist of a reliability mask and a photo footprint coverage with recording dates. Through one internal and two external validation tests, this DEM shows an accuracy better than 10 m horizontally and 6 m vertically while the precision is better than 4 m. This dataset proved successful for topographical mapping and geodetic mass balance. Other uses include control and calibration of remotely sensed data such as imagery or InSAR velocity maps.

General information
State: Published
Organisations: National Space Institute, Geodesy, University of Copenhagen, University of Oslo
Authors: Korsgaard, N. J. (Ekstern), Nuth, C. (Ekstern), Khan, S. A. (Intern), Kjeldsen, K. K. (Ekstern), Bjørk, A. A. (Ekstern), Schomacker, A. (Ekstern), Kjær, K. H. (Ekstern)
Number of pages: 15
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Scientific Data
Volume: 3
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Scopus rating (2017): SNIP 2.291 SJR 3.026
Scopus rating (2016): CiteScore 4.8 SJR 3.261 SNIP 2.059
Scopus rating (2015): SNIP 1.373 SJR 2.187
Original language: English
Cryospheric science, Geomorphology, Climate and Earth system modelling
Electronic versions:
DOIs:
10.1038/sdata.2016.32
Source: FindIt
Source-ID: 2304130533
Publication: Research - peer-review › Journal article – Annual report year: 2016

Disk-Wind Connection During the Heartbeats of GRS 1915+105
Disk and wind signatures are seen in the soft state of Galactic black holes, while the jet is seen in the hard state. Here we study the disk–wind connection in the ρ class of variability in GRS 1915+105 using a joint NuSTAR–Chandra observation. The source shows 50 s limit cycle oscillations. By including new information provided by the reflection spectrum and using phase-resolved spectroscopy, we find that the change in the inner disk inferred from the blackbody emission is not matched by reflection measurements. The latter is almost constant, independent of the continuum model. The two radii are comparable only if the disk temperature color correction factor changes, an effect that could be due to the changing opacity of the disk caused by changes in metal abundances. The disk inclination is similar to that inferred from the jet axis, and oscillates by ~10°. The simultaneous Chandra data show the presence of two wind components with velocities between 500 and 5000 km s⁻¹, and possibly two more with velocities reaching 20,000 km s⁻¹ (~0.06 c). The column densities are ~5 × 10²² cm⁻². An upper limit to the wind response time of 2 s is measured, implying a launch radius of ~6 × 10¹⁰ cm. The changes in wind velocity and absorbed flux require the geometry of the wind to change during the oscillations, constraining the wind to be launched from a distance of 290–1300 r_g from the black hole. Both data sets support fundamental model predictions in which a bulge originates in the inner disk and moves outward as the instability progresses.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, NASA Goddard Space Flight Center, University of Michigan, Stanford University, University of Nevada, University of Cambridge, California Institute of Technology, University of California at Berkeley, Columbia University, Utrecht University, University of Maryland
Authors: Zoghbi, A. (Ekstern), Miller, M. C. (Ekstern), King, A. L. (Ekstern), Proga, D. (Ekstern), Kallman, T. (Ekstern), Fabian, A. C. (Ekstern), Harrison, F. A. (Ekstern), Kaastra, J. (Ekstern), Raymond, J. (Ekstern), Reynolds, C. S. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. (Ekstern), Hailey, C. J. (Ekstern), Stern, D. (Ekstern), Zhang,
Doing Forensic on DTUsat-2 Using the Beacon Counter

DTUsat-2 was launched into a Polar LEO on a Dnepr rocket out of Yasny on 19th June 2014. After the first few days of beacon recording and precise orbit determination it became apparent that all was not nominal. One notable thing was the relatively low beacon count number. The beacon count reflects how many times the communication system has generated and transmitted a beacon. When nominal the number will reach 32767 in about 22.5 days before rolling over. Not only did we observe a low beacon count number but most surprisingly the counter seemed to restart right before AOS when the satellite rises from the south. That observation is in direct conflict with our model for DTUsat-2 attitude. The electrical power subsystem became the primary suspect in the search for a cause for the frequent resets. However a fault in the power subsystem could not explain why the resets would occur just before AOS were the satellite should have maximum power. A thorough investigation using modelling and beacon count mapping has been conducted in order to understand why the satellite does not operate nominally and why the beacon counter maps out contradictory to our initial understandings.

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
Pages: 4079-4083
Publication date: 2016

DTUsat the Ideal CDIO project

The CDIO concept was conceived by MIT, KTH, Linköping and Chalmers University to meet the changing demands of industries employing engineers. In real life engineering a theoretical model or a design is only half the picture, actual implementation and operation of a given design or technical solution is likewise challenging. The conceiving, designing, implementation and operation phases in the CDIO education aims to bring the student through a scenario simulating real life engineering. A satellite mission constitutes an ideal case for a CDIO project. Designing, building, launching and operating a satellite is not possible for any single individual nor for any single institute of expertise. Not only is interdisciplinary collaboration mandatory, but a tight control of system interfaces all the way from the conceptual phase to the operational phase is paramount. This calls for substantial documentation throughout the project that could drain valuable man-power resources from a student satellite project yielding the actual satellite construction impossible. From the very onset of the DTUsat-2 project we acknowledged this dilemma and adopted a strategy in which we simplified and standardized both documentation and knowledge management. The engineering education brings the student skills within mathematics, physics, specific engineering disciplines and the ability to dissolve and analyze any technical challenge. This however is only half the picture of a real life engineering job. The other half, inter-disciplinary collaboration and all the devils buried in the details of realizing any theoretical project is barely touched upon. The CDIO approach aims to simulate this and thereby prepare the students to meet the challenges of an engineering job. Whereas the standard student project at DTU involves one to three students and ends with a report or more rarely a prototype the DTUsat project involved +90 students over 9 years, achieving more than 1100 ECTS and ended with an orbiting satellite. In this paper I will go through the challenges faced and our solutions to the creation of the DTUsat-2 project.

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
Pages: 9650-9653
Publication date: 2016

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Title of host publication: Proceedings of the International Astronautical Congress
Publisher: International Astronautical Federation
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Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
En rumbaseret infrastruktur i Arktis - Satellitter og droner kan hjælpe de arktiske samfund
Hvor det tidligere kunne tage mange år at bygge en stor satellit, har den teknologiske udvikling gjort det muligt at producere mindre satellitsystemer, som indeholder mere automatik, vejer mindre og bygges af stærkere materialer. En ny satellit kan samles på få måneder og både omkostninger til produktion og opsendelse er faldende. Det kan blive en game-changer for samfundene i Arktis.

General information
State: Published
Organisations: National Space Institute, Innovation and Research-based consultancy
Authors: Pedersen, J. O. P. (Intern)
Pages: 17-19
Publication date: 2016
Main Research Area: Technical/natural sciences

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Volume: 2016
Issue number: 3
ISSN (Print): 0903-2266
Ratings:
ISI indexed (2013): ISI indexed no
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ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
Satellitter_og_droner_i_Arktis_effektivitet.pdf
Links:

Bibliographical note
Source: PublicationPreSubmission
Source-ID: 126411829
Publication: Communication › Journal article – Annual report year: 2016

Etos og det absoluttle

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 5
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Weekendavisen
Issue number: 21. April
ISSN (Print): 0106-4142
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
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Original language: English

Bibliographical note
Weekendavisen Ideer # 16 21. april 2016, side 5
Source: PublicationPreSubmission
Euclid Near Infrared Spectrometer and Photometer instrument concept and first test results obtained for different breadboards models at the end of phase C

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Support functions, Centre National d'Etudes Spatiales, Max-Planck-Institut fur Astronomie, Institut de Physique Nucleaire de Lyon, Institut d'astrophysique de Paris, University of Copenhagen, Aix Marseille Universite


**Number of pages:** 18

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**Host publication information**

**Title of host publication:** Space Telescopes and Instrumentation 2016: Optical, Infrared, and Millimeter Wave

**Volume:** 9904

**Publisher:** SPIE - International Society for Optical Engineering

**Editors:** MacEwen, H. A., G. Fazio, G., Lystrup, M.

**Article number:** 99040T

**ISBN (Print):** 9781510601871

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**Main Research Area:** Technical/natural sciences

**Conference:** Space Telescopes and Instrumentation 2016, Edinburgh, United Kingdom, 26/06/2016 - 26/06/2016

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**Electronic versions:**

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**DOIs:**

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**Bibliographical note**

For full list of authors, see the publication: http://dx.doi.org/10.1117/12.2232941

**Publication:** Research - peer-review » Article in proceedings – Annual report year: 2016

**Evaluation of the ESA Sea Ice CCI (SICCI) project sea ice concentration data set**

During phase 1 of the European Space Agency’s (ESA) climate change initiative (CCI) sea ice project (SICCI project) a sea ice concentration (SIC) data product was produced by employing a hybrid SIC retrieval algorithm comprising the Bristol and the Comiso-Bootstrap algorithm in frequency mode. SIC was computed from brightness temperatures (TB) measured at 19.4 GHz [18.7 GHz] and 37.0 GHz [36.5 GHz] by the space-borne microwave radiometer Special Sensor Microwave / Imager (SSM/I) [Advanced Microwave Scanning Radiometer aboard EOS (AMSR-E)] in both polar hemispheres. The product has daily temporal and 25 km x 25 km grid resolution and is available for the period 1992-2008 (SSM/I) and 2002-2011 (AMSR-E) from, e.g., http://icdc.zmaw.de.

Each data file contains a limited (to the range 0% … 100%) and an unlimited (see below) SIC, SIC retrieval uncertainty, SIC smearing uncertainty from the gridding process, and SIC total uncertainty. A flag layer allows to identify where SIC may be less reliable. The unlimited SIC contains the full range of SIC values retrieved. The natural variability of the measured TBs around the typical TBs at 0% and 100% SIC (the so-called tie points) causes SIC to spread around these two SIC values; consequently SIC can be negative or above 100%. In order to fully evaluate SICCI SIC this natural variability needs to be taken into account. In contrast to most other SIC retrieval algorithms the SICCI algorithm does not filter spurious sea ice over open water with a weather filter because by doing so often substantial portions of the sea ice cover along the ice edge are discarded.

**General information**

**State:** Published

**Organisations:** National Space Institute, Microwaves and Remote Sensing, University of Hamburg, Nansen Environmental and Remote Sensing Center, Max Planck Institute for Meteorology

**Authors:** Kern, S. (Ekstern), Bell, L. (Ekstern), Ivanova, N. (Ekstern), Beitsch, A. (Ekstern), Pedersen, L. T. (Intern), Saldo, R. (Intern), Sandven, S. (Ekstern)

**Number of pages:** 1

**Publication date:** 2016
Evidence for Intermediate Polars as the Origin of the Galactic Center Hard X-ray Emission

Recently, unresolved hard (20-40 keV) X-ray emission has been discovered within the central 10 pc of the Galaxy, possibly indicating a large population of intermediate polars (IPs). Chandra and XMM-Newton measurements in the surrounding ~50 pc imply a much lighter population of IPs with $\langle M_{\text{WD}} \rangle = 0.5 \text{H}_\odot$. Here we use broadband NuSTAR observations of two IPs: TV Columbae, which has a fairly typical but widely varying reported mass of $M_{\text{WD}} \approx 0.5-1.0 \text{M}_\odot$, and IGR J17303-0601, with a heavy reported mass of $M_{\text{WD}} \approx 1.0-1.2 \text{M}_\odot$. We investigate how varying spectral models and observed energy ranges influences estimated white dwarf mass. Observations of the inner 10 pc can be accounted for by IPs with $\langle M_{\text{WD}} \rangle = 0.9 \text{M}_\odot$, consistent with that of the CV population in general and the X-ray observed field IPs in particular. The lower mass derived by Chandra and XMM-Newton appears to be an artifact of narrow energy-band fitting. To explain the (unresolved) central hard X-ray emission (CHXE) by IPs requires an X-ray (2-8 keV) luminosity function (XLF) extending down to at least $5 \times 10^{31} \text{ erg s}^{-1}$. The CHXE XLF, if extended to the surrounding ~50 pc observed by Chandra and XMM-Newton, requires that at least ~20%-40% of the ~9000 point sources are IPs. If the XLF extends just a factor of a few lower in luminosity, then the vast majority of these sources are IPs. This is in contrast to recent observations of the Galactic ridge, where the bulk of the 2-8 keV emission is ascribed to non-magnetic CVs.
Excess B-modes extracted from the Planck polarization maps

One of the main obstacles for extracting the Cosmic Microwave Background (CMB) from mm/submm observations is the pollution from the main Galactic components: synchrotron, free-free and thermal dust emission. The feasibility of using simple neural networks to extract CMB has been demonstrated on both temperature and polarization data obtained by the WMAP satellite. The main goal of this paper is to demonstrate the feasibility of neural networks for extracting the CMB signal from the Planck polarization data with high precision. Both auto-correlation and cross-correlation power spectra within a mask covering about 63 % of the sky have been used together with a “high pass filter” in order to minimize the influence of the remaining systematic errors in the Planck Q and U maps. Using the Planck 2015 released polarization maps, a BB power spectrum have been extracted by Multilayer Perceptron neural networks. This spectrum contains a bright feature with signal to noise ratios 4.5 within 200 ≪ l ≪ 250. The spectrum is significantly brighter than the BICEP2 2015 spectrum, with a spectral behaviour quite different from the “canonical” models (weak lensing plus B-modes spectra with different tensor to scalar ratios). The feasibility of the neural network to remove the residual systematics from the available Planck polarization data to a high level has been demonstrated. (© 2016 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)
**General information**

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**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Chinese Academy of Sciences, Tsinghua University, Max-Planck-Institute for Extraterrestrial Physics, Tongji University, University of Geneva, National Institute for Astrophysics

**Authors:** Zhang, S. (Ekstern), Feroci, M. (Ekstern), Santangelo, A. (Ekstern), Dong, Y. (Ekstern), Feng, H. (Ekstern), Lu, F. (Ekstern), Nandra, K. (Ekstern), Wang, Z. (Ekstern), Zhang, S. (Ekstern), Bozzo, E. (Ekstern), Brandt, S. (Intern), Budtz-Jørgensen, C. (Intern), Lund, N. (Intern)

**eXTP: enhanced X-ray Timing and Polarimetry Mission**
Extracting Ocean-Generated Tidal Magnetic Signals from Swarm Data through Satellite Gradiometry

Ocean-generated magnetic field models of the Principal Lunar, $M_2$, and the Larger Lunar elliptic, $N_2$, semi-diurnal tidal constituents were estimated through a “Comprehensive Inversion” of the first 20.5 months of magnetic measurements from ESA’s Swarm satellite constellation mission. While the constellation provides important north-south along-track gradiometry information, it is the unique low spacecraft pair that allows for east-west cross-track gradiometry. This latter type is crucial in delivering an $M_2$ estimate of similar quality with that derived from over 10 yrs of CHAMP satellite data, but over a shorter interval, at higher altitude, and during more magnetically disturbed conditions. Recovered $N_2$ contains non-oceanic signal, but is highly correlated with theoretical models in regions of maximum oceanic amplitude. Thus, satellite magnetic gradiometry may eventually enable the monitoring of ocean electrodynamic properties at temporal resolutions of one to two years, which may have important implications for the inference of ocean temperature and salinity.
Extreme Geomagnetic Storms – 1868–2010

We present the first large statistical study of extreme geomagnetic storms based on historical data from the time period 1868 – 2010. This article is the first of two companion papers. Here we describe how the storms were selected and focus on their near-Earth characteristics. The second article presents our investigation of the corresponding solar events and their characteristics. The storms were selected based on their intensity in the aa index, which constitutes the longest existing continuous series of geomagnetic activity. They are analyzed statistically in the context of more well-known geomagnetic indices, such as the Kp and Dcx/Dst index. This reveals that neither Kp nor Dcx/Dst provide a comprehensive geomagnetic measure of the extreme storms. We rank the storms by including long series of single magnetic observatory data. The top storms on the rank list are the New York Railroad storm occurring in May 1921 and the Quebec storm from March 1989. We identify key characteristics of the storms by combining several different available data sources, listsof storm sudden...
commencements (SSCs) signifying occurrence of interplanetary shocks, solar wind in-situ measurements, neutron monitor data, and associated identifications of Forbush decreases as well as satellite measurements of energetic proton fluxes in the near-Earth space environment. From this we find, among other results, that the extreme storms are very strongly correlated with the occurrence of interplanetary shocks (91 – 100 %), Forbush decreases (100 %), and energetic solar proton events (70 %). A quantitative comparison of these associations relative to less intense storms is also presented. Most notably, we find that most often the extreme storms are characterized by a complexity that is associated with multiple, often interacting, solar wind disturbances and that they frequently occur when the geomagnetic activity is already elevated. We also investigate the semiannual variation in storm occurrence and confirm previous findings that geomagnetic storms tend to occur less frequently near solstices and that this tendency increases with storm intensity. However, we find that the semiannual variation depends on both the solar wind source and the storm level. Storms associated with weak SSC do not show any semiannual variation, in contrast to weak storms without SSC.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Royal Observatory of Belgium, University of Zagreb, The Royal Belgian Institute for Space Aeronomy, National Observatory of Athens, University of Graz, National Science Foundation
Authors: Vennerstrøm, S. (Intern), Lefèvre, L. (Ekstern), Dumbović, M. (Ekstern), Crosby, N. (Ekstern), Malandraki, O. (Ekstern), Patsou, I. (Ekstern), Clette, F. (Ekstern), Veronig, A. (Ekstern), Vršnak, B. (Ekstern), Leer, K. (Intern), Moretto, T. (Ekstern)
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Extreme sea levels and the assessment of future coastal flood risk

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Authors: Nilsen, J. E. Ø. (Ekstern), Sørensen, C. S. (Intern), Dangendore, S. (Ekstern), Andersson, H. (Ekstern), Arns, A. (Ekstern), Jensen, J. (Ekstern), Jönsson, A. (Ekstern), Nerheim, S. (Ekstern), Ravndal, O. (Ekstern), Sande, H. (Ekstern), Simpson, M. J. R. (Ekstern), Sørensen, P. (Ekstern)
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Extremes of the jet-accretion power relation of blazars, as explored by NuSTAR

Hard X-ray observations are crucial to study the non-thermal jet emission from high-redshift, powerful blazars. We observed two bright z > 2 flat-spectrum radio quasars (FSRQs) in hard X-rays to explore the details of their relativistic jets and their possible variability. SS 0014+81 (at z = 3.366) and B0222+185 (at z = 2.690) have been observed twice by the Nuclear Spectroscopic Telescope Array (NuSTAR) simultaneously with Swift/X-ray Telescope, showing different variability behaviours. We found that NuSTAR is instrumental to explore the variability of powerful high-redshift blazars, even when no γ-ray emission is detected. The two sources have proven to have respectively the most luminous accretion disc and the most powerful jet among known blazars. Thanks to these properties, they are located at the extreme end of the jet-accretion disc relation previously found for γ-ray detected blazars, to which they are consistent.

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Authors: Sbarrato, T. (Ekstern), Ghisellini, G. (Ekstern), Tagliaferri, G. (Ekstern), Perri, M. (Ekstern), Madejski, G. M. (Ekstern), Stern, D. (Ekstern), Boggis, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Zhang, W. W. (Ekstern)
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First NuSTAR Observations of the Bl Lac-Type Blazar Pks 2155-304: Constraints on the Jet Content and Distribution of Radiating Particles

We report the first hard X-ray observations with NuSTAR of the BL Lac-type blazar PKS 2155-304, augmented with soft X-ray data from XMM-Newton and γ-ray data from the Fermi Large Area Telescope, obtained in 2013 April when the source was in a very low flux state. A joint NuSTAR and XMM spectrum, covering the energy range 0.5–60 keV, is best described by a model consisting of a log-parabola component with curvature β = 0.3 ± 0.1 and a (local) photon index 3.04 ± 0.15 at photon energy of 2 keV, and a hard power-law tail with photon index 2.2 ± 0.4. The hard X-ray tail can be smoothly joined to the quasi-simultaneous γ-ray spectrum by a synchrotron self-Compton component produced by an electron distribution with index ρ = 2.2. Assuming that the power-law electron distribution extends down to γ min = 1 and that there is one proton per electron, an unrealistically high total jet power of Lp ~ 10^{47} erg s^{−1} is inferred. This can be reduced by two orders of magnitude either by considering a significant presence of electron–positron pairs with lepton-to-proton ratio n_{e^+ e^-}/n_p ~ 30, or by introducing an additional, low-energy break in the electron energy distribution at the electron Lorentz factor γ_{br1} ~ 100. In either case, the jet composition is expected to be strongly matter-dominated.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Durham University, Universite de Toulouse, California Institute of Technology, Max-Planck-Institut fur Physik (Werner-Heisenberg-Institut) Munchen, Yale University, Polish Academy of Sciences, Clemson University, Stanford University, Universite de Savoie, Ecole Polytechnique, University of California at Berkeley, ASI Science Data Center, Columbia University, RIKEN, National Institute for Astrophysics, NASA Goddard Space Flight Center, University of Tokyo
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Five years of coastal sea level monitoring in the Bay of Bengal with CryoSat-2

A continuous monitoring of sea level is particularly necessary along the coastal zones as these areas are the most exposed to flooding and storm surges that dramatically affect local economy and society. The aim of this project is to study the annual sea level variability in the Bay of Bengal exploiting five years of CryoSat-2 data. The work is focused on the analysis of CryoSat’s performances over coastal areas with using 20Hz SAR data from SARvatore online processing toolbox. This research is also an opportunity for comparing SIRAL’s LRM and SAR modes, which have covered the same area for different time frames: LRM from 2010 to October 2012 and SAR from October 2012 to present. Finally, SARvatore is compared with independent datasets like the ESA CCI product, AVISO and RADS.

Galaxy clusters as probes for cosmology and dark matter

In recent years, significant progress has been made in building new galaxy clusters samples, at low and high redshifts, from wide-area surveys, particularly exploiting the Sunyaev-Zel'dovich (SZ) effect. A large effort is underway to identify and characterize these new systems with optical/NIR and X-ray facilities, thus opening new avenues to constraint
cosmological models using structure growth and geometrical tests. A census of galaxy clusters sets constraints on reionization mechanisms and epochs, which need to be reconciled with recent limits on the reionization optical depth from cosmic microwave background (CMB) experiments. Future advances in SZ effect measurements will include the possibility to (unambiguously) measure directly the kinematic SZ effect, to build an even larger catalogue of galaxy clusters able to study the high redshift universe, and to make (spatially-)resolved galaxy cluster maps with even spectral capability to (spectrally-)resolve the relativistic corrections of the SZ effect.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, La Sapienza - Università di Roma, National Institute for Astrophysics, Dubna International University of Nature, Society, and Man , The Institute of Astronomy, Geophysics and Atmospheric Sciences, independent-research.org, Universite Pierre et Marie Curie, Università degli Studi di Milano
Authors: Battistelli, E. S. (Ekstern), Burigana, C. (Ekstern), De Bernardis, P. (Ekstern), Kirillov, A. A. (Ekstern), Neto, G. B. L. (Ekstern), Masi, S. (Ekstern), Nørgaard-Nielsen, H. U. (Intern), Ostermann, P. (Ekstern), Roman, M. (Ekstern), Rosati, P. (Ekstern), Rossetti, M. (Ekstern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
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BFI (2013): BFI-level 1
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 0.756 SNIP 0.518 CiteScore 1.08
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.641 SNIP 0.45 CiteScore 0.97
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.638 SNIP 0.503
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.995 SNIP 0.68
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.068 SNIP 0.807
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.208 SNIP 0.855
Scopus rating (2006): SJR 0.955 SNIP 0.659
This work presents and compares the latest altimeter calibration results for the Sentinel-3, Jason series, as well as the SARAL/AltiKa and the Chinese HY-2 missions, conducted at the Gavdos/Crete calibration/validation facilities. At first, the Jason altimeter calibration values will be given for the ascending Pass No.109 and the descending Pass No.18, based on the the GDR-E (Jason-1) and GDR-D (Jason-2) products. Secondly, these values will be cross-examined against the altimeter bias for the SARAL/AltiKa (GDR-T) satellite at Gavdos Cal/Val using its reference ascending orbit No. 571. The Chinese HY-2 satellite altimeter bias will be presented using the CRS1 permanent site in south west Crete for the descending HY-2 Pass No. 280, at 20 Hz based on SGDR data products. Finally, values will be compared against the Sentinel-3 altimeter. Additionally, altimeter biases as determined by locally developed Mean Sea Surface model will be presented and compared with the conventional sea-surface calibration methodology.

**GAVDOS/west crete cal-val site: Over a decade calibrations for Jason series, SARAL/AltiKa, cryoSat-2, Sentinel-3 and HY-2 altimeter satellites**

This work presents and compares the latest altimeter calibration results for the Sentinel-3, Jason series, as well as the SARAL/AltiKa and the Chinese HY-2 missions, conducted at the Gavdos/Crete calibration/validation facilities. At first, the Jason altimeter calibration values will be given for the ascending Pass No.109 and the descending Pass No.18, based on the the GDR-E (Jason-1) and GDR-D (Jason-2) products. Secondly, these values will be cross-examined against the altimeter bias for the SARAL/AltiKa (GDR-T) satellite at Gavdos Cal/Val using its reference ascending orbit No. 571. The Chinese HY-2 satellite altimeter bias will be presented using the CRS1 permanent site in south west Crete for the descending HY-2 Pass No. 280, at 20 Hz based on SGDR data products. Finally, values will be compared against the Sentinel-3 altimeter. Additionally, altimeter biases as determined by locally developed Mean Sea Surface model will be presented and compared with the conventional sea-surface calibration methodology.

**Geodetic measurements reveal similarities between post–Last Glacial Maximum and present-day mass loss from the Greenland ice sheet**

Accurate quantification of the millennial-scale mass balance of the Greenland ice sheet (GrIS) and its contribution to global sea-level rise remain challenging because of sparse in situ observations in key regions. Glacial isostatic adjustment (GIA) is the ongoing response of the solid Earth to ice and ocean load changes occurring since the Last Glacial Maximum (LGM; ~21 thousand years ago) and may be used to constrain the GrIS deglaciation history. We use data from the Greenland Global Positioning System network to directly measure GIA and estimate basinwide mass changes since the LGM. Unpredicted, large GIA uplift rates of +12 mm/year are found in southeast Greenland. These rates are due to low upper mantle viscosity in the region, from when Greenland passed over the Iceland hot spot about 40 million years ago. This region of concentrated soft rheology has a profound influence on reconstructing the deglaciation history of Greenland. We reevaluate the evolution of the GrIS since LGM and obtain a loss of 1.5-m sea-level equivalent from the northwest and southeast. These same sectors are dominating modern mass loss. We suggest that the present destabilization of these marine-based sectors may increase sea level for centuries to come. Our new deglaciation history and GIA uplift estimates
suggest that studies that use the Gravity Recovery and Climate Experiment satellite mission to infer present-day changes in the GrIS may have erroneously corrected for GIA and underestimated the mass loss by about 20 gigatons/year.

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**Organisations:** National Space Institute, Geodesy, Alfred Wegener Institute, University of Luxembourg, Ohio State University, University of Bristol, University of Colorado, Cornell University, University of Copenhagen, Utrecht University, University at Buffalo, German Research Centre for Geosciences, University of Alaska Fairbanks

**Authors:** Khan, S. A. (Intern), Sasgen, I. (Ekstern), Bevis, M. (Ekstern), Dam, T. V. (Ekstern), Bamber, J. L. (Ekstern), Wahr, J. (Ekstern), Willis, M. (Ekstern), Kjaer, K. H. (Ekstern), Wouters, B. (Ekstern), Helm, V. (Ekstern), Csatho, B. M. (Ekstern), Fleming, K. (Ekstern), Bjørk, A. A. (Ekstern), Aschwanden, A. (Ekstern), Knudsen, P. (Intern), Munneke, P. K. (Ekstern)

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**Geological Mapping of Sabah, Malaysia, Using Airborne Gravity Survey**

Airborne gravimetry is an effective tool for mapping local gravity fields using a combination of airborne sensors, aircraft and positioning systems. It is suitable for gravity surveys over difficult terrains and areas mixed with land and ocean. This paper describes the geological mapping of Sabah using airborne gravity surveys. Airborne gravity data over land areas of Sabah has been combined with the marine airborne gravity data to provide a seamless land-to-sea gravity field coverage in order to produce the geological mapping. Free-air and Bouguer anomaly maps (density 2.67 g/cm3) have been derived from the airborne data both as simple ad-hoc plots (at aircraft altitude), and as final plots from the downward continued airborne data, processed as part of the geoids determination. Data are gridded at 0.025 degree spacing which is about 2.7 km and the data resolution of the filtered airborne gravity data were 5-6 km. The airborne gravity survey database for landand marine areas has been compiled using ArcGIS geodatabase format in order to produce the update geological map of Sabah.

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**Organisations:** National Space Institute, Geodynamics, Jabatan Ukur dan Pemetaan Malaysia, Universiti Malaysia Sabah, Info-Geomatik Sdn. Bhd., Universiti Teknologi MARA

**Authors:** Fauzi Nordin, A. (Ekstern), Jamil, H. (Ekstern), Noor Isa, M. (Ekstern), Mohamed, A. (Ekstern), Hj. Tahir, S. (Ekstern), Musta, B. (Ekstern), Forsberg, R. (Intern), Olesen, A. V. (Intern), Nielsen, J. E. (Intern), Majid A. Kadir, A. (Ekstern), Fahmi Abd Majid, A. (Ekstern), Talib, K. (Ekstern), Aman Sulaiman, S. (Ekstern)

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Geospatial Big Data Handling Theory and Methods: A Review and Research Challenges

Big data has now become a strong focus of global interest that is increasingly attracting the attention of academia, industry, government and other organizations. Big data can be situated in the disciplinary area of traditional geospatial data handling theory and methods. The increasing volume and varying format of collected geospatial big data presents challenges in storing, managing, processing, analyzing, visualizing and verifying the quality of data. This has implications for the quality of decisions made with big data. Consequently, this position paper of the International Society for Photogrammetry and Remote Sensing (ISPRS) Technical Commission II (TC II) revisits the existing geospatial data handling methods and theories to determine if they are still capable of handling emerging geospatial big data. Further, the paper synthesises problems, major issues and challenges with current developments as well as recommending what needs to be developed further in the near future.

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Authors: Li, S. (Ekstern), Dragicevic, S. (Ekstern), Anton, F. (Intern), Sester, M. (Ekstern), Winter, S. (Ekstern), Coltekin, A. (Ekstern), Pettit, C. (Ekstern), Jiang, B. (Ekstern), Haworth, J. (Ekstern), Stein, A. (Ekstern), Cheng, T. (Ekstern)
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 2.371 SNIP 2.812 CiteScore 5.41
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.314 SNIP 2.924 CiteScore 4.56
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.257 SNIP 3.409 CiteScore 4.19
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.183 SNIP 3.304 CiteScore 4.16
ISI indexed (2011): ISI indexed yes
GEROS-ISS: GNSS Reflectometry, Radio Occultation and Scatterometry onboard the International Space Station

GEROS-ISS stands for GNSS Reflectometry, radio occultation, and scatterometry onboard the International Space Station (ISS). It is a scientific experiment, successfully proposed to the European Space Agency in 2011. The experiment as the name indicates will be conducted on the ISS. The main focus of GEROS-ISS is the dedicated use of signals from the currently available Global Navigation Satellite Systems (GNSS) in L-band for remote sensing of the Earth with a focus to study climate change. Prime mission objectives are the determination of the altimetric sea surface height of the oceans and of the ocean surface mean square slope, which is related to sea roughness and wind speed. These geophysical parameters are derived using reflected GNSS signals (GNSS reflectometry, GNSS-R). Secondary mission goals include atmosphere/ ionosphere sounding using refracted GNSS signals (radio occultation, GNSS-RO) and remote sensing of land surfaces using GNSS-R. The GEROS-ISS mission objectives and its design, the current status, and ongoing activities are reviewed and selected scientific and technical results of the GEROS-ISS preparation phase are described.

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Organisations: National Space Institute, Geodesy, DEIMOS Engenharia SA, Nansen Environmental and Remote Sensing Center, Institute of Space Sciences, IFREMER, European Space Agency, German Research Centre for Geosciences
Authors: Wickert, J. (Ekstern), Cardellach, E. (Ekstern), Bandeiras, J. (Ekstern), Bertino, L. (Ekstern), Andersen, O. B. (Intern), Camps, A. (Ekstern), Catarino, N. (Ekstern), Chapron, B. (Ekstern), Fabra, F. (Ekstern), Floury, N. (Ekstern), Heeg, P. (Intern)
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GEROS-ISS: Ocean Remote Sensing with GNSS Reflectometry from the International Space Station

In response to an European Space Agency (ESA) announcement of opportunity for climate change relevant science aboard the ISS, the GEROS-ISS (GEROS hereafter) proposal was submitted in 2011 and accepted by ESA to proceed to Phase A. GEROS-ISS is an innovative experiment primarily focused on exploiting reflected signals of opportunity from Global Navigation Satellite Systems (GNSS) at L-band to measure key parameters of ocean surfaces. GEROS will utilize the U.S. American GPS (Global Positioning System) and pioneer the exploitation of signals from Galileo and possibly other GNSS systems (GLONASS, QZSS, BeiDou), for reflectometry and occultation, thereby improving the accuracy as well as the spatio-temporal resolution of the derived geophysical properties.

The primary mission objectives of GEROS are: (1) to measure the altimetric sea surface height of the ocean using reflected GNSS signals to allow methodology demonstration, establishment of error budget and resolutions and comparison/synergy with results of satellite based nadir-pointing altimeters and (2) to retrieve scalar ocean surface mean square slope (MSS), which is related to sea roughness, wind speed and direction, with a GNSS spaceborne receiver to allow methodology testing, establishment of error budget and resolutions. Secondary objectives include the generation of the 2D MSS or directional MSS retrieval and the associated proof-of-concept scientific data product.

Secondary mission objectives, which increase the scientific value of the GEROS data, but are not driving the instrument developments, are: (1) to further explore the potential of GNSS radio occultation data (vertical profiles of atmospheric bending angle, refractivity, temperature, pressure, humidity and electron density), particularly in the Tropics, to detect changes in atmospheric temperature and climate relevant parameters (e.g., tropopause height) and to provide additional information for the analysis of the reflectometry data from GEROS and (2) to assess the potential of GNSS scatterometry for land applications and in particular to develop products such as soil moisture, vegetation biomass, and mid-latitudes snow/ice properties to better understand anthropogenic climate change.

A Science Advisory Group (SAG) was formed by ESA Mid 2013 and the initial definition of the GEROS mission and system requirements was completed end of 2013. Two industrial phase A studies were started end of 2014, complemented by the scientific study GARCA (GNSS-R – Assessment of Requirements and Consolidation of Retrieval Algorithms) to develop an End2End Simulator for the preparation of the GEROS-Mission and to perform Observing-
System Simulation Experiments (OSSE) to assess the oceanographic significance of the expected measurements and to demonstrate the usefulness of the GEROS concept. The presentation will give an overview on the current status of the GEROS experiment, review the science activities within the international GARCA study and related ESA-supported science activities.

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Organisations: National Space Institute, Geodesy, Ohio State University, Space Science and Technology Research Group, Helmholtz Centre Potsdam, IFREMER, Institute of Space Sciences, University of Southampton, European Space Agency, University of Bern, California Institute of Technology, Sapienza University of Rome, German Research Centre for Geosciences
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Publication date: 2016
Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences

GNSS Software Receiver for UAVs
This paper describes the current activities of GPS/GNSS Software receiver development at DTU Space. GNSS Software receivers have received a great deal of attention in the last two decades and numerous implementations have already been presented. DTU Space has just recently started development of our own GNSS software-receiver targeted for mini UAV applications, and we will in this paper present our current progress and briefly discuss the benefits of Software Receivers in relation to our research interests.

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State: Published
Organisations: National Space Institute, Geodesy
Authors: Olesen, D. M. (Intern), Jakobsen, J. (Intern), von Benzon, H. (Intern), Knudsen, P. (Intern)
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GOCE++ Dynamical Coastal Topography and tide gauge unification using altimetry and GOCE
ESA has recently released a study on the potential of ocean levelling as a novel approach to the study of height system unification taking the recent development in geoid accuracy trough GOCE data into account. The suggested investigation involves the use of measurements and modelling to estimate Mean Dynamic Topography (MDT) of the ocean along a coastline which contributes/requires reconciling altimetry, tide gauge and vertical land motion. The fundamental use of the MDT computed using altimetry, ocean models or through the use of tide gauges has values of between -2 and +1 meters at different points in the ocean. However, close to the coast the determination of the MDT is problematic due to i.e., the
The objective of this activity is to perform a consolidated and improved understanding and modelling of coastal processes and physics responsible for sea level changes on various temporal/spatial scales. The study runs from October 2015 to March 2017 and involves elements like: Develop an approach to estimate a consistent DT at tide gauges, coastal areas, and open ocean; Validate the approach in well-surveyed areas where DT can be determined at tide gauges; Determine a consistent MDT using GOCE with consistent error covariance fields; Connect measurements of a global set of tide gauges and investigate trends.

**General information**

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Organisations: National Space Institute, Geodesy, University of Liverpool, University of Bristol, Technical University of Darmstadt, European Space Agency

Authors: Andersen, O. B. (Intern), Knudsen, P. (Intern), Nielsen, K. (Intern), Hughes, C. (Ekstern), Woodworth, P. (Ekstern), Bingham, R. (Ekstern), WoppeLMann, G. (Ekstern), Mederic, M. (Ekstern), Fenoglio-Marc, L. (Ekstern), Becker, M. (Ekstern), Kern, M. (Ekstern)

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Main Research Area: Technical/natural sciences

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**Going down subsidence lane with Sentinel-1 imagery over Denmark**

**General information**

State: Published

Organisations: National Space Institute, Geodesy, Danish Agency for Data Supply and Efficiency, PPO.Labs, Energi, Forsynings- og Klimaministeriet, NORUT Information Technology, Danish Coastal Authority

Authors: Sørensen, C. S. (Intern), F. Levinsen, J. (Ekstern), Marinkovic, P. (Ekstern), Broge, N. (Ekstern), Larsen, Y. (Ekstern), Piontkowitz, T. (Ekstern), Knudsen, P. (Intern)

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**Bibliographical note**

Sustain Abstract S-1

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**GPS phase scintillation at high latitudes during the geomagnetic storm of 17-18 March 2015: GPS Scintillation at High Latitudes**

The geomagnetic storm of 17–18 March 2015 was caused by the impacts of a coronal mass ejection and a high-speed plasma stream from a coronal hole. The high-latitude ionosphere dynamics is studied using arrays of ground-based instruments including GPS receivers, HF radars, ionosondes, riometers, and magnetometers. The phase scintillation index is computed for signals sampled at a rate of up to 100 Hz by specialized GPS scintillation receivers supplemented by the phase scintillation proxy index obtained from geodetic-quality GPS data sampled at 1 Hz. In the context of solar wind coupling to the magnetosphere-ionosphere system, it is shown that GPS phase scintillation is primarily enhanced in the cusp, the tongue of ionization that is broken into patches drawn into the polar cap from the dayside storm-enhanced plasma density, and in the auroral oval. In this paper we examine the relation between the scintillation and auroral electrojet currents observed by arrays of ground-based magnetometers as well as energetic particle precipitation observed by the DMSP satellites. Equivalent ionospheric currents are obtained from ground magnetometer data using the spherical elementary currents systems technique that has been applied over the ground magnetometer networks in North America and North Europe. The GPS phase scintillation is mapped to the poleward side of strong westward electrojet and to the edge of the eastward electrojet region. Also, the scintillation was generally collocated with fluxes of energetic electron precipitation observed by DMSP satellites with the exception of a period of pulsating aurora when only very weak currents were observed.

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Organisations: National Space Institute, Geodesy, University of New Brunswick, Natural Resources Canada, University of California, Los Angeles, Finnish Meteorological Institute, Athabasca University, The Norwegian Mapping Authority, Virginia Polytechnic Institute and State University, University of Bergen, Johns Hopkins University, University of Calgary,
GPS phase scintillation during the geomagnetic storm of March 17, 2015: The relation to auroral electrojet currents

Ionospheric irregularities cause rapid fluctuations of radio wave amplitude and phase that can degrade GPS positional accuracy and affect performance of radio communication and navigation systems. The ionosphere becomes particularly disturbed during geomagnetic storms caused by impacts of coronal mass ejections compounded by high-speed plasma streams from coronal holes. Geomagnetic storm of March 17, 2015 was the largest in the current solar cycle. The high-latitude ionosphere dynamics is studied using arrays of ground-based instruments including GPS receivers, HF radars, ionosondes, riometers and magnetometers. GPS phase scintillation index is computed for L1 signal sampled at the rate of 50 Hz by specialized GPS scintillation receivers of the Expanded Canadian High Arctic Ionospheric Network (ECHAIN). To further extend the geographic coverage, the phasescintillation proxy index is obtained from geodetic-quality GPS data sampled at 1 Hz. In the context of solar wind coupling to the magnetosphere-ionosphere system, it has been demonstrated that GPS phase scintillation is primarily enhanced in the cusp, tongue of ionization (TOI) broken into patches drawn into the polar cap from the dayside storm-enhanced plasma density (SED) and in the auroral oval during energetic particle precipitation events, substorms and pseudo-breakups in particular. In this paper we examine the relation to auroral electrojet currents observed by arrays of ground-based magnetometers and energetic particle precipitation observed by DMSP satellites. Equivalent ionospheric currents (EICs) are obtained from ground magnetometer data using the spherical elementary currents systems (SECS) technique developed by Amm and Viljanen (1999) that has been applied over the entire North American ground magnetometer network by Weygand et al.(2011).

Gyre-driven decay of the Earth's magnetic dipole

Direct observations indicate that the magnitude of the Earth's magnetic axial dipole has decreased over the past 175 years; it is now 9% weaker than it was in 1840. Here we show how the rate of dipole decay may be controlled by a planetary-scale gyre in the liquid metal outer core. The gyre's meridional limbs on average transport normal polarity magnetic flux equatorward and reverse polarity flux poleward. Asymmetry in the geomagnetic field, due to the South Atlantic Anomaly, is essential to the proposed mechanism. We find that meridional flux advection accounts for the majority of the dipole decay since 1840, especially during times of rapid decline, with magnetic diffusion making an almost steady contribution generally of smaller magnitude. Based on the morphology of the present field, and the persistent nature of the gyre, the current episode of dipole decay looks set to continue, at least for the next few decades.
We present NuSTAR hard X-ray observations of Sh 2–104, a compact H ii region containing several young massive stellar clusters (YMSCs). We have detected distinct hard X-ray sources coincident with localized VERITAS TeV emission recently resolved from the giant gamma-ray complex MGRO J2019+37 in the Cygnus region. Fainter, diffuse X-rays coincident with the eastern YMSC in Sh2-104 likely result from the colliding winds of a component star. Just outside the radio shell of Sh 2–104 lies 3XMM J201744.7+365045 and a nearby nebula, NuSTAR J201744.3+364812, whose properties are most consistent with extragalactic objects. The combined XMM-Newton and NuSTAR spectrum of 3XMM
J201744.7+365045 is well-fit to an absorbed power-law model with cm$^{-2}$ and a photon index. Based on possible long-term flux variation and the lack of detected pulsations (≤43% modulation), this object is likely a background active galactic nucleus rather than a Galactic pulsar. The spectrum of the NuSTAR nebula shows evidence of an emission line at $E = 5.6$ keV, suggesting an optically obscured galaxy cluster at $z = 0.19 ± 0.02$ ($d = 800$ Mpc) and $L_X = 1.2 \times 10^{44}$ erg s$^{-1}$.

Follow-up Chandra observations of Sh 2–104 will help identify the nature of the X-ray sources and their relation to MGRO J2019+37. We also show that the putative VERITAS excess south of Sh 2–104, is most likely associated with the newly discovered Fermi pulsar PSR J2017+3625 and not the H ii region.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, California Institute of Technology, Harvard-Smithsonian Center for Astrophysics, Harvard University, NASA Goddard Space Flight Center, Universitat de Barcelona, Columbia University, University of California at Berkeley

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- Scopus rating (2012): CiteScore 5.51
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- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
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- Web of Science (2007): Indexed yes
High northern geomagnetic field behavior and new constraints on the Gilsá event: Paleomagnetic and \(^{40}\text{Ar}^{39}\text{Ar}\) results of \(\sim\)0.5–3.1 Ma basalts from Jökuldalur, Iceland

Recent paleomagnetic results of extrusive rocks from high southern latitudes (>60°S) and high northern latitudes (>60°N) have been suggested to reflect a hemispheric asymmetry of the geomagnetic field on time-scales of 10^5 to 10^6 yrs, with higher and more stable fields in the north. This interpretation, however, is based on only a few modern-standard paleodirectional data sets and on high northern stable field paleointensity data of rocks that are mainly younger than 100 kyr. The sparsity of modern-standard data questions the validity (and age range) of this potential geomagnetic asymmetry. In 2013 and 2014, we sampled basaltic lava flows in Jökuldalur, north-eastern Iceland, to obtain high-standard paleodirectional and paleointensity data at relatively high-northern latitudes (65.2°N). On average, we sampled >15 cores per site at 51 sites of predominantly Matuyama age. Complete demagnetization was carried out on all samples using AF or thermal demagnetization. We present 45 distinct paleomagnetic directions based on overall N>10 ChRM per site and \(\alpha_{95}<3.5°\). We obtain a mean direction of D=355.7°, I=76.3°, and \(\alpha_{95}=3.2\) for N=45 sites that is not significantly different from a GAD field. The resulting 45 VGPs distribute around the North Pole, and the global mean paleomagnetic pole \(\lambda=87.8°, \phi=224.3°\) is coincident with the North Pole within the \(\alpha_{95}\) confidence limit. We calculate a VGP dispersion \(SB_{\text{Mat}}=20.5\) and an average inclination anomaly \(\Delta I=-0.91°\) for our 38 Matuyama age data. The dispersion \(SB_{\text{overall}}\) overall supports the interpretation of a dependence of \(SBSB\) on latitude during the Matuyama, while the negligible \(\Delta I\) suggests little deviation from a GAD field. Based on relatively strict cut-off criteria we also present six new field strength estimates from the time interval \(\sim\)1.2–1.83 Ma, thus filling a large data gap of the high-northern stable field behavior. We obtain a median VADM of 57±3ZAm\(^{-2}\) (VDM of 60±5Am\(^{-2}\)), which is higher than the median VADM of 16 intensity estimates from Antarctica (39±7 ZAm\(^{-2}\)) from the same period. A higher northern field is also found when using less strict cut-off criteria resulting in 14 field estimates from Jökuldalur, i.e. we find support for higher field strength in the northern hemisphere as compared to the southern hemisphere during the Matuyama. Finally, we deliver a revised magneto-chronostratigraphic model of Jökuldalur and conduct an investigation of the type sections of the so-called Gilsá normal polarity event around 1.62 Ma. Our revised model is based on 11 new \(^{40}\text{Ar}^{39}\text{Ar}\) ages. No evidence is found of the existence of the Gilsá event in Jökuldalur. Instead we find that the normal polarity intervals in the type sections can both be correlated to Olduvai subchron.

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Organisations: Center for Energy Resources Engineering, National Space Institute, Geomagnetism, University of Oxford, University of Iceland, Imperial College London
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How to test NISP instrument for EUCLID mission in laboratory

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Hyperspatial mapping of water, energy and carbon fluxes with Unmanned Aerial Vehicles

Having spatially distributed estimates of energy, water and carbon fluxes between the land and the atmosphere is of critical importance for improving water resource management, agricultural production, weather forecasting, and climate prediction. Traditionally, satellite based remote sensing data of vegetation or temperature has been used as inputs into land surface models (LSMs). However, the coarse resolution of satellite based remote sensing (3-90 km) data could not accurately capture spatial heterogeneity in fluxes due to changes in topography, soil types, and vegetation. With significant advances in navigation, flight control, miniaturized platforms and sensors, Unmanned Aerial Vehicles (UAVs) can provide ultra-high spatial resolution imagery (1 cm to 1 m). This presents a good opportunity to improve land surface modeling. From this perspective, our study explores the possibility to incorporate UAV-based remote sensing into LSMs. A site growing an energy crop with field sensors (eddy covariance, radiation or soil moisture) at DTU-Risø is chosen for the pilot study. A hexacopter (Tarot) equipped with a six band multispectral camera (Visible and near infrared), a thermal camera and a digital camera regularly flew over the flux site. In the near future, a smart UAV platform combining rotary and fixed wing functionality will be used as platform. The imagery acquired by UAVs will be used to retrieve the vegetation indices and land surface temperature. These data used for land surface modeling to estimate biomass, plant diseases or stress, water uptake.

IC 3639 - A new bona fide Compton thick AGN unveiled by NuSTAR

We analyse high-quality NuSTAR observations of the local (z = 0.011) Seyfert 2 active galactic nucleus (AGN) IC 3639, in conjunction with archival Suzaku and Chandra data. This provides the first broadband X-ray spectral analysis of the source, spanning nearly two decades in energy (0.5 -30 keV). Previous X-ray observations of the source below 10 keV indicated strong reflection/obscuration on the basis of a pronounced iron fluorescence line at 6.4 keV. The hard X-ray energy coverage of NuSTAR, together with self-consistent toroidal reprocessing models, enables direct broadband constraints on the obscuring column density of the source. We find the source to be heavily Compton-thick (CTK) with an
obsuring column in excess of $3.6 \times 10^{24}$ cm$^{-2}$, unconstrained at the upper end. We further find an intrinsic 2-10 keV luminosity of $\log_{10}(L_{2-10} \text{ keV} \ [\text{erg s}^{-1}]) = 43.4 \pm 1.1 \pm 0.6$ to 90% confidence, almost 400 times the observed flux, and consistent with various multi-wavelength diagnostics. Such a high intrinsic to observed flux ratio in addition to an Fe-Kα fluorescence line equivalent width exceeding 2 keV is extreme amongst known bona fide CTK AGN, which we suggest are both due to the high level of obscuration present around IC 3639. Our study demonstrates that broadband spectroscopic modelling with NuSTAR enables large corrections for obscuration to be carried out robustly, and emphasises the need for improved modelling of AGN tori showing intense iron fluorescence.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Southampton, Durham University, Georgia Institute of Technology, Pontificia Universidad Catolica de Chile, University of California at Berkeley, Pennsylvania State University, California Institute of Technology, Lawrence Livermore National Laboratory, Virginia Tech, Columbia University, ETH Zurich, NASA Goddard Space Flight Center, National Institute for Astrophysics
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Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
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IC 751: A New Changing Look AGN Discovered By NuSTAR

We present results of five Nuclear Spectroscopic Telescope Array (NuSTAR) observations of the type 2 active galactic nucleus (AGN) in IC 751, three of which were performed simultaneously with XMM-Newton or Swift/X-Ray Telescope. We find that the nuclear X-ray source underwent a clear transition from a Compton-thick ($N_H \approx 2 \times 10^{24} \text{ cm}^{-2}$) to a Compton-thin ($N_H \approx 4 \times 10^{23} \text{ cm}^{-2}$) state on timescales of $\lesssim 3$ months, which makes IC 751 the first changing look AGN discovered by NuSTAR. Changes of the line of sight column density at the $\sim 2\sigma$ level are also found on a timescale of $\sim 48$ hr ($\Delta N_H \sim 10^{23} \text{ cm}^{-2}$). From the lack of spectral variability on timescales of $\sim 100$ ks, we infer that the varying absorber is located beyond the emission-weighted average radius of the broad-line region (BLR), and could therefore be related either to the external part of the BLR or a clumpy molecular torus. By adopting a physical torus X-ray spectral model, we are able to disentangle the column density of the non-varying absorber ($N_H \sim 3.8 \times 10^{23} \text{ cm}^{-2}$) from that of the varying clouds ($N_H \sim (1-150) \times 10^{22} \text{ cm}^{-2}$), and to constrain that of the material responsible for the reprocessed X-ray radiation ($N_H \sim 6 \times 10^{24} \text{ cm}^{-2}$). We find evidence of significant intrinsic X-ray variability, with the flux varying by a factor of five on timescales of a few months in the $2-10$ and $10-50$ keV band.

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Authors: Ricci, C. (Ekstern), Bauer, F. E. (Ekstern), Arevalo, P. (Ekstern), Boggs, S. (Ekstern), Brandt, W. N. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Gandhi, P. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Koss, M. (Ekstern), Markwardt, C. B. (Ekstern), Stern, D. (Ekstern), Treister, E. (Ekstern), Zhang, W. W. (Ekstern)
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Ice Velocity Measurement from SAR: Comparison of Sentinel-1A and RADARSAT-2

Mapping the velocity fields of the continental ice sheets and their outlet glaciers is important in order to monitor and model the response of the cryosphere to global climate change. Since the mid 1990s, space-based SAR data have enabled measurement of ice velocities on a continental scale. Compared to interferometry, Offset Tracking techniques excel in terms of robustness and ease of automation. With the launch of Sentinel-1A in 2014 and Sentinel-1B in 2016, the potential coverage and revisit frequency have greatly improved, allowing monitoring of temporal changes in the icesheet velocity fields.

Two Greenland-wide RADARSAT-2 campaigns were carried out during January-March 2014, and a smaller one in December 2014-February 2015. Ice velocity maps from both campaigns will be presented. A preliminary ice velocity map from the former campaign is attached with this abstract, while the latter awaits processing.

The first Sentinel-1A Greenland-wide observation campaign was carried out in January-March 2015, and ice velocity fields with nearly complete coverage has already been demonstrated [1]. A preliminary IV map using the DTU IPP processor (not all pairs processed) is attached with this abstract.

The overlapping temporal coverage of the second RADARSAT-2 campaign and the first Sentinel-1 campaign allows a comparison of the two sensors in terms of:

Impact of differing imaging modes (stripmap vs TOPS). The better coverage of Sentinel-1 is at the cost of a reduced azimuth resolution, however with a better range-resolution than RADARSAT-2 in standard beam mode. (RS2: 13.5m x
7.7m versus S1: 3m x 21m). Especially on the fast-flowing outlet glaciers, where the offset-tracking relies on the presence of features like glacier crevasses, a high resolution is important. Over the central Greenland ice sheet, where the backscatter is more homogeneous, offset-tracking relies instead on speckle tracking, reducing the need for high resolution. With more than one revisit, Sentinel-1 can generate 24-day baselines, and this allows a comparison of the two sensor modes without the influence of the temporal baseline.

The impact of temporal baseline, 24 days vs 12 days (6 when S1B is commissioned). The smaller temporal baseline of Sentinel-1 eases feature-tracking on fast-moving glaciers, and improves coherence (and thus speckle tracking) over more homogeneous regions. On the other hand, noise and ionospheric scintillations introduce errors on the ice velocity estimate inversely proportional with the temporal baseline.

Data quality (coverage, noise, geometric calibration).

DTU Space has implemented an operational interferometric post processing facility, IPP, which has been upgraded with a highly automated offset tracking capability in the frame of ESA’s Climate Change Initiative. The IPP processor ingests RADARSAT-2 SLC data, Sentinel-1 Interferometric Wideswath (IW) bursted SLC product, and several other past and current sensors (ERS/ENVISAT/ALOS/CosmoSkyMed/TerraSAR-X). Using the same processor ensures that observed differences lies in the data products/sensors rather than being due to different processing techniques.


**General information**

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Organisations: National Space Institute, Microwaves and Remote Sensing
Authors: Kusk, A. (Intern), Dall, J. (Intern)
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**Identification of Dynamic Cover Types in Wetlands by using Multitemporal Cross-polarized Sentinel-1 Images**

Monitoring of long-term land-use and land-cover change patterns may be biased by seasonal changes of different surface properties (e.g. hydrology, phenology, etc.) which become even more prominent in highly dynamic ecosystems such as wetlands (Crews-Meyer, 2008; McClearly, Crews-Meyer and Young 2008; Dronova et al. 2011). These surface dynamics produce transitional states and fine-scale mixtures of classes that may hinder classifications and long-term change detection. Dronova et al. (2015) proposed the term “Dynamic Cover Types” (DCT) to refer to such areas of regimes of periodic or seasonal change. Examples of DCT in the context of wetlands would be seasonally inundated forests, temporal water bodies and waterways, or harvests of reeds and crops such as rice. We assess the spatio-temporal extent of DCT in two study sites; The Camargue, a large coastal wetland in Southern France, and the Lagoon of Fuente de Piedra, a small wetland in Southern Spain. For that we use a multitemporal change detection procedure for polarimetric SAR imagery based on the Complex Wishart distribution developed recently by Conradsen et al (2015), (to be published) and an innovative open source software implementation which makes use of Ipython Notebooks and Docker containers (http://mortcanty.github.io/SARDocker/). The procedure carries out a series of change detection processing routines for the whole time series with a desired significance level. It uses multilook, geocoded and terrain corrected intensity images in C2 matrix. These were generated in the Sentinel Application Platform (SNAP) using 12 Sentinel-1 images (Interferometric Wide, Single Look Complex and cross-polarized) with a monthly resolution. The methodology proposed here for change detection is relatively easy to use and utilizes only open source and free data. It enables an operational monitoring service of short-term change detection. No calibration or validation needed, only interpretation of changes using local knowledge. This has important implications for operational standardized monitoring service such as the ones developed in the –Satellite-based Wetland Observation Service (SWOS) Horizon 2020 project. Besides its easiness to use, this methodology has other important advantages: First, the fine spatial and temporal resolutions of Sentinel-1 SAR data allow us to detect short-time changes for a complete water year regardless of the cloud cover. Second, change detection methods based on classification are affected by classification errors, whose probability of occurrence increases in dynamic and transitional landscapes (Powell et al. 2003). Our approach does not rely on classification and thus is free from such errors. Third, DCT are complex landscapes that often give rise to unique species assemblages (Parrot & Meyer 2012; Watson et. al 2014), and knowing their spatio-temporal extent will assist in biodiversity management. Fourth, annual stable features can be identified and used for training areas, which may facilitate the classification process and improve accuracies. And fifth, estimating the spatio-temporal extent of DCT might shed some light on the wide array of options in classification methodologies available and their different results (Object vs. Pixel based, Support Vector Machines, Random Forest Classifiers, and other algorithms).

**General information**

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, University of Bonn, Jena Optronik GMBH, Research Center Jülich GmbH
INTEGRAL Upper Limits on Gamma-Ray Emission Associated with the Gravitational Wave Event GW150914

Using observations of the INTErnational Gamma-Ray Astrophysics Laboratory (INTEGRAL), we place upper limits on the gamma-ray and hard X-ray prompt emission associated with the gravitational wave event GW150914, which was discovered by the LIGO/Virgo Collaboration. The omnidirectional view of the INTEGRAL/SPI-ACS has allowed us to constrain the fraction of energy emitted in the hard X-ray electromagnetic component for the full high-probability sky region of LIGO triggers. Our upper limits on the hard X-ray fluence at the time of the event range from $F_\gamma = 2 \times 10^{-8}$ erg cm$^{-2}$ to $F_\gamma = 10^{-6}$ erg cm$^{-2}$ in the 75 keV-2 MeV energy range for typical spectral models. Our results constrain the ratio of the energy promptly released in gamma-rays in the direction of the observer to the gravitational wave energy $E_\gamma/E_{GW} < 10^{-6}$.

We discuss the implication of gamma-ray limits for the characteristics of the gravitational wave source, based on the available predictions for prompt electromagnetic emission.
Using observations of the INTEGRAL Gamma-Ray Astrophysics Laboratory (INTEGRAL), we place upper limits on the gamma-ray and hard X-ray prompt emission associated with the gravitational wave event GW150914, discovered by the LIGO/Virgo Collaboration. The omnidirectional view of the INTEGRAL/Gamma-Ray Spectroscopy (SPI-ACS) has allowed us to constrain the fraction of energy emitted in the hard X-ray electromagnetic component for the full high-probability sky region of LIGO triggers. Our upper limits on the hard X-ray fluence at the time of the event range from $F_{\gamma} = 2 \times 10^{-8}$ erg cm$^{-2}$ to $F_{\gamma} = 10^{-6}$ erg cm$^{-2}$ in the 75 keV-2 MeV energy range for typical spectral models. Our results constrain the ratio of the energy promptly released in gamma-rays in the direction of the observer to the gravitational wave energy $E_{\gamma}/E_{GW} < 10^{-6}$. We discuss the implications of gamma-ray limits for the characteristics of the gravitational wave source, based on the available predictions for prompt electromagnetic emission.

Impact and Implication of Cyclone 'Xaver' on Coastal Management in Denmark

The passage of cyclone Xaver on 5-6th December 2013 led to severe floods and to substantial coastal erosion along large parts of the Danish and German coasts. Water levels of nearly 2 meters are the highest on record a.o. at the Hornbaek and Copenhagen tide gauges (TG) (1890-2015). The extremity of the event accentuates the need for robust and updated extreme value statistics and it questions their current use e.g. for design, planning and adaptation purposes. We investigate the coastal impact and implications on coastal management and design water levels for selected Danish locations affected by Xaver.
Impact assessment and coastal climate change adaptation in a local transdisciplinary perspective

From an applied point of view, the authors present and discuss inter- and transdisciplinary approaches to assess and deal with natural coastal hazards and climate change impacts. The construction of a shared working platform for knowledge integration across levels of governance and between research, private and public institutions, and the local communities provides: understanding of the immediate and potential future challenges; appreciation of different stakeholder motives, business agendas, legislative constraints etc., and common focus on how to cost-efficiently adapt to and manage impacts of climate change. The platform is dynamically updated with additional data and knowledge, e.g. from climate change evidence, or, by provision of updated regional models of future sea level rise. In order to integrate natural hazards and impact development over time, models on hydrology, geology and groundwater (e.g. in relation to storm surges, precipitation, morphological change, and subsidence) are developed and applied to get information on floods, inundation and stow in storm sewers etc. (Sorensen et al 2016). In addition, information about buildings, infrastructure, the environment etc. is used to map vulnerability and risk, and strategies for community engagement and capacity-building are included. The initial bias towards the natural sciences, to a large extent dictated by technical stakeholder focus and data availability, is gradually balanced as especially economics and social sciences take a more prominent role. For example, the investment and maintenance costs of securing functional water and wastewater pipes are significantly reduced by incorporation of knowledge about climate change impacts. The presented approaches yield an integrative process-oriented framework to handle uncertainties and reach optimal adaptation, planning, and management solutions.

General information
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Organisations: National Space Institute, Geodesy, Danish Ministry of Energy, Utilities and Climate, University of Queensland, GEO
Authors: Sørensen, C. S. (Intern), Broge, N. H. (Ekstern), Knudsen, P. (Intern), Molgaard, M. R. (Ekstern), Nielsen, P. (Ekstern)
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Improved inland water levels from SAR altimetry using novel empirical and physical retrackers

Satellite altimetry has proven a valuable resource of information on river and lake levels where in situ data are sparse or non-existent. In this study several new methods for obtaining stable inland water levels from CryoSat-2 Synthetic Aperture Radar (SAR) altimetry are presented and evaluated. In addition, the possible benefits from combining physical and empirical retrackers are investigated. The retracking methods evaluated in this paper include the physical SAR Altimetry MOde Studies and Applications (SAMOSA3) model, a traditional subwaveform threshold retracker, the proposed MultipleWaveform Persistent Peak (MWaPP) retracker, and a method combining the physical and empirical retrackers.

Using a physical SAR waveform retracker over inland water has not been attempted before but shows great promise in this study. The evaluation is performed for two medium-sized lakes (Lake Vänern in Sweden and Lake Okeechobe in Florida), and in the Amazon River in Brazil. Comparing with in situ data shows that using the SAMOSA3 retracker generally provides the lowest root-mean-squared-errors (RMSE), closely followed by the MWaPP retracker. For the empirical retrackers, the RMSE values obtained when comparing with in situ data in Lake Vänern and Lake Okeechobe are in the order of 2–5 cm for well-behaved waveforms. Combining the physical and empirical retrackers did not offer significantly improved mean track standard deviations or RMSEs. Based on these studies, it is suggested that future SAR derived water levels are obtained using the SAMOSA3 retracker whenever information about other physical properties apart from range is desired. Otherwise we suggest using the empirical MWaPP retracker described in this paper, which is both easy to implement, computationally efficient, and gives a height estimate for even the most contaminated waveforms.

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Organisations: National Space Institute, Geodesy, University of Newcastle
Authors: Villadsen, H. (Intern), Deng, X. (Ekstern), Andersen, O. B. (Intern), Stenseng, L. (Intern), Nielsen, K. (Intern), Knudsen, P. (Intern)
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Improved oceanographic measurements from SAR altimetry: Results and scientific roadmap from ESA CryoSat Plus for oceans project

The ESA CryoSat mission is the first space mission to carry a radar altimeter that can operate in Synthetic Aperture Radar (SAR) mode. It thus provides the first opportunity to test and evaluate, using real data, the significant potential benefits of SAR altimetry for ocean applications.

The objective of the CryoSat Plus for Oceans (CP4O) project was to develop and evaluate new ocean products from CryoSat data and so maximize the scientific return of CryoSat over oceans. The main focus of CP4O has been on the additional measurement capabilities that are offered by the SAR mode of the SIRAL altimeter, with further work in developing improved geophysical corrections.

CP4O has developed SAR based ocean products for application in four themes: Open Oceans, Coastal Oceans, Polar Oceans and Sea Floor Topography. The team has developed a number of new processing schemes and compared and evaluated the resultant data products. This work has clearly demonstrated the improved ocean measuring capability offered by SAR mode altimetry and has also added significantly to our understanding of the issues around the processing and interpretation of SAR altimeter echoes.

This paper presents an overview of the major results and outlines a proposed roadmap for the further development and exploitation of these results in operational and scientific applications, with particular focus on their relevance for Sentinel-3.

The "CryoSat Plus for Oceans" (CP4O) project has been supported by ESA (Support To Science Element) and CNES.

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Organisations: National Space Institute, Geodesy, Satellite Oceanographic Consultants Ltd., CNES Centre National d'Etudes Spatiales, Noveltis, National Oceanography Centre, ESRIN - ESA Centre for Earth Observation, NOAA, University of Porto, IsardSAT, CLS, Delft University of Technology, EUMETSAT, Deimos/ESRIN
Authors: Cotton, P. D. (Ekstern), Andersen, O. B. (Intern), Stenseng, L. (Intern), Boy, F. (Ekstern), Cancet, M. (Ekstern), Cipollini, P. (Ekstern), Gommenginger, C. (Ekstern), Dinardo, S. (Ekstern), Egido, A. (Ekstern), Fernandes, M. J. (Ekstern), Garcia, P. N. (Ekstern), Moreau, T. (Ekstern), Naeije, M. (Ekstern), Scharroo, R. (Ekstern), Lucas, B. (Ekstern), Benveniste, J. (Ekstern)
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Improved oceanographic measurements with CryoSat SAR altimetry: Application to the coastal zone and arctic

The ESA CryoSat mission is the first space mission to carry a radar altimeter that can operate in Synthetic Aperture Radar “SAR” (or delay-Doppler) and interferometric SAR (SARin) modes. Studies on CryoSat data have analysed and confirmed the improved ocean measuring capability offered by SAR mode altimetry, through increased resolution and precision in sea surface height and wave height measurements, and have also added significantly to our understanding of the issues around the processing and interpretation of SAR altimeter echoes.

We present work in four themes, building on work initiated in the CryoSat Plus for Oceans project (CP4O), each investigating different aspects of the opportunities offered by this new technology.

The first two studies address the coastal zone, a critical region for providing a link between open-ocean and shelf sea measurements with those from coastal in-situ measurements, in particular tide gauges. Although much has been achieved in recent years through the Coastal Altimetry community, (http://www.coastalt.eu/community) there is a limit to the capabilities of pulse-limited altimetry which often leaves an un-measured “white strip” right at the coastline. Firstly, a thorough analysis was made of the performance of “SAR” altimeter data (delay-Doppler processed) in the coastal zone. This quantified the performance, confirming the significant improvement over “conventional” pulse-limited altimetry. In the second study a processing scheme was developed with CryoSat SARin mode data to enable the retrieval of valid oceanographic measurements in coastal areas with complex topography. Thanks to further development of the algorithms, a new approach was achieved that can also be applied to SAR and conventional altimetry data (e.g., Sentinel-3, Jason series, EnviSat).
The third part of the project developed and evaluated improvements to the SAMOSA altimeter re-tracker that is implemented in the Sentinel-3 processing chain. The modifications to the processing scheme should support improved performance in terms of accuracy and efficiency in retrieving oceanographic geophysical parameters from altimeter data.

### General information
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- **Organisations:** National Space Institute, Geodesy, Satellite Oceanographic Consultants Ltd., IsardSAT, Noveltis, STARLAB, National Oceanography Centre, Deimos/ESRIN, ESRIN - ESA Centre for Earth Observation, Serco/ESRIN
- **Authors:** Cotton, P. D. (Ekstern), Garcia, P. N. (Ekstern), Cancet, M. (Ekstern), Stenseng, L. (Intern), Andersen, O. B. (Intern), Martin, F. (Ekstern), Cipollini, P. (Ekstern), Calafat, F. M. (Ekstern), Dinardo, S. (Ekstern), Ambrózio, A. (Ekstern), Benveniste, J. (Ekstern)
- **Number of pages:** 1
- **Publication date:** 2016
- **Event:** Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
- **Main Research Area:** Technical/natural sciences
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  - **Source-ID:** 2346500939
  - **Publication:** Research - peer-review › Conference abstract for conference – Annual report year: 2016

### Improved representations of the Mediterranean Geoid within the GEOMED 2 project. Contributions of local gravity, GOCE and Cryosat2 data

The Mediterranean Sea has always been a lab for geosciences, given its geodynamic peculiarities, the large short-scale variations of the gravity field and the complex circulation. Within the GEOMED 2 project, new improved representations of the Mediterranean marine geoid have been deemed as necessary, so that the Mean Dynamic sea surface Topography (MDT) and the circulation can be modelled with higher accuracy and resolution. This is possible given the availability of gravity-field related satellite data from GOCE, improved models of the land topography and bathymetry and the compilation of a Mediterranean-wide gravity database. The data employed within GEOMED 2 for the determination of the marine geoid are land and marine gravity data, GOCE/GRACE based Global Geopotential Models and a combination of MISTRAL and SRTM/bathymetry terrain models. The processing methodology will be based on the well-known remove-compute-restore method following both stochastic and spectral methods for the determination of the geoid. Classic least-squares collocation (LSC) with errors has been employed investigating both spherical and planar analytical covariance functions models, while fast Fourier transform (FFT)-based techniques have provided the geoid estimation in the frequency domain. In this work, the pre-processing steps consisting in merging and validating all the available gravity observations for the wider Mediterranean are presented and discussed. Furthermore, the latest basin-wide geoid models are estimated from the validated gravity data using all outlined methodologies. The so-determined geoid models are validated against GPS/Levelling observations over land areas, with special emphasis on the coastal to near-coastal regions, as well as satellite altimetry observations from the Jason2, Envisat and Cryosat2 missions.

### General information
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- **Organisations:** National Space Institute, Geodesy, Politecnico di Milano, Aristotle University of Thessaloniki, Géosciences Environnement Toulouse, SHOM, INRIA Sophia Antipolis, University of Zagreb, University of Jaen, General Command of Mapping
- **Authors:** Barzaghi, R. (Ekstern), Vergos, G. S. (Ekstern), Albertella, A. (Ekstern), Carrion, D. (Ekstern), Tziavos, I. N. (Ekstern), Grigoriadis, V. (Ekstern), Bruinsma, S. (Ekstern), Bonvalot, S. (Ekstern), Lequentrec-Lalancette, M. (Ekstern), Bonnefond, P. (Ekstern), Knudsen, P. (Intern), Andersen, O. B. (Intern), Simav, M. (Ekstern), Yildiz, H. (Ekstern), Basic, T. (Ekstern), Gil, A. J. (Ekstern)
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- **Main Research Area:** Technical/natural sciences
- **Links:**
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  - **Publication:** Research - peer-review › Conference abstract for conference – Annual report year: 2016

### Improved retrieval of land ice topography from CryoSat-2 data and its impact for volume-change estimation of the Greenland Ice Sheet

A new methodology for retrieval of glacier and ice sheet elevations and elevation changes from CryoSat-2 data is presented. Surface elevations and elevation changes determined using this approach show significant improvements over ESA's publicly available CryoSat-2 elevation product (L2 Baseline-B). The results are compared to near-coincident airborne laser altimetry from NASA's Operation IceBridge and seasonal height amplitudes from the Ice, Cloud, and Elevation Satellite (ICESat). Applying this methodology to CryoSat-2 data collected in interferometric synthetic aperture mode (SIN) over the high-relief regions of the Greenland Ice Sheet we find an improvement in the root-mean-square error...
(RMSE) of 27 and 40% compared to ESA's L2 product in the derived elevation and elevation changes, respectively. In the interior part of the ice sheet, where CryoSat-2 operates in low-resolution mode (LRM), we find an improvement in the RMSE of 68 and 55% in the derived elevation and elevation changes, respectively. There is also an 86% improvement in the magnitude of the seasonal amplitudes when compared to amplitudes derived from ICESat data. These results indicate that the new methodology provides improved tracking of the snow/ice surface with lower sensitivity to changes in near-surface dielectric properties. To demonstrate the utility of the new processing methodology we produce elevations, elevation changes, and total volume changes from CryoSat-2 data for the Greenland Ice Sheet during the period January 2011 to January 2015. We find that the Greenland Ice Sheet decreased in volume at a rate of 289 ± 20km³ a⁻¹, with high interannual variability and spatial heterogeneity in rates of loss. This rate is 65km³ a⁻¹ more negative than rates determined from ESA's L2 product, highlighting the importance of CryoSat-2 processing methodologies.
Improvements of the Swarm Accelerometer Data Processing

The Swarm satellites were launched on 22 November 2013 and carry accelerometers and GPS receivers as part of their scientific payload. The GPS receivers are not only used for locating the position and time of the magnetic measurements, but also for determining non-gravitational forces like drag and radiation pressure acting on the spacecraft. The accelerometers measure these forces directly, at much finer resolution than the GPS receivers, from which thermospheric neutral densities and potentially winds can be derived. Unfortunately, the acceleration measurements suffer from a variety of disturbances, the most prominent being slow temperature-induced bias variations and sudden bias changes. These disturbances have caused a significant delay of the accelerometer data release. In this presentation, we describe the new, improved four-stage processing that is required for transforming the disturbed acceleration measurements into scientifically valuable thermospheric neutral densities. In the first stage, the sudden bias changes in the acceleration measurements are manually removed using a dedicated software tool. The second stage is the calibration of the accelerometer measurements against the non-gravitational accelerations derived from the GPS receiver, which includes the correction for the slow temperature-induced bias variations. The identification of validity periods for calibration and correction parameters is part of the second stage. In the third stage, the calibrated and corrected accelerations are merged with the non-gravitational accelerations derived from the GPS receiver by a weighted average in the spectral domain, where the weights depend on the frequency. The fourth stage consists of transforming the corrected and calibrated accelerations into thermospheric neutral densities. We describe the methods used in each stage, highlight the difficulties encountered, and comment on the quality of the thermospheric neutral density data set.

General information
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Organisations: National Space Institute, Geomagnetism, European Space Agency, German Research Centre for Geosciences, VZLU - Aeronautical Research & Testing Institute, Delft University of Technology, Leibniz Universität Hannover
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Improving Nearest Neighbour Search in 3D Spatial Access Method

Nearest Neighbour (NN) is one of the important queries and analyses for spatial application. In normal practice, spatial access method structure is used during the Nearest Neighbour query execution to retrieve information from the database. However, most of the spatial access method structures are still facing with unresolved issues such as overlapping among nodes and repetitive data entry. This situation will perform an excessive Input/Output (IO) operation which is inefficient for data retrieval. The situation will become more crucial while dealing with 3D data. The size of 3D data is usually large due to its detail geometry and other attached information. In this research, a clustered 3D hierarchical structure is introduced as a 3D spatial access method structure. The structure is expected to improve the retrieval of Nearest Neighbour information for 3D objects. Several tests are performed in answering Single Nearest Neighbour search and k Nearest Neighbour (kNN) search. The tests indicate that clustered hierarchical structure is efficient in handling Nearest Neighbour query compared to its competitor. From the results, clustered hierarchical structure reduced the repetitive data entry and the accessed page. The proposed structure also produced minimal Input/Output operation. The query response time is also outperformed compared to the other competitor. For future outlook of this research several possible applications are discussed and summarized.

General information
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Organisations: National Space Institute, Geodesy, Universiti Teknologi Malaysia
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Pages: 69-73
Publication date: 2016
Improving Surface Geostrophic Current from a GOCE-Derived Mean Dynamic Topography Using Edge-Enhancing Diffusion Filtering

With increased geoid resolution provided by the gravity and steady-state ocean circulation explorer (GOCE) mission, the ocean's mean dynamic topography (MDT) can be now estimated with an accuracy not available prior to using geodetic methods. However, an altimetric-derived MDT still needs filtering in order to remove short wavelength noise unless integrated methods are used in which the three quantities are determined simultaneously using appropriate covariance functions. We studied nonlinear anisotropic diffusive filtering applied to the ocean’s MDT and a new approach based on edge-enhancing diffusion (EED) filtering is presented. EED filters enable controlling the direction and magnitude of the filtering, with subsequent enhancement of computations of the associated surface geostrophic currents (SGCs). Applying this method to a smooth MDT and to a noisy MDT, both for a region in the Northwestern Pacific Ocean, we found that EED filtering provides similar estimation of the current velocities in both cases, whereas a nonlinear isotropic filter (the Perona and Malik filter) returns results influenced by local residual noise when a difficult case is tested. We found that EED filtering preserves all the advantages that the Perona and Malik filter have over the standard linear isotropic Gaussian filters. Moreover, EED is shown to be more stable and less influenced by outliers. This suggests that the EED filtering strategy would be preferred given its capabilities in controlling/preserving the SGCs.

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Organisations: National Space Institute, Geodesy, Universidad de Alicante
Authors: Sanchez-Reales, J. M. (Ekstern), Andersen, O. B. (Intern), Vigo, M. I. (Ekstern)
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BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.771 SNIP 0.977 CiteScore 1.48
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.73 SNIP 0.863 CiteScore 1.23
Increased Mass Loss and Asynchronous Behavior of Marine-Terminating Outlet Glaciers at Upernavik Isstrøm, NW Greenland

In order to model and predict future behavior of marine terminating glaciers, it is essential to understand the different factors that control a glaciers response to climate change. Here we present a detailed study of the asynchronous changes in dynamic behavior of four adjacent marine-terminating glaciers at Upernavik Isstrøm (UI), Northwest Greenland, between 1992 and 2013. Velocities were stable for all outlets at UI between 1992 and 2005. The northernmost glacier started to accelerate and thin in 2006 and continued to do so into 2011 after which time the velocities stabilized. The second most northerly glacier started to accelerate and thin in 2009 and continued to do so until the last observations in 2013, dramatically increasing the area affected by dynamically induced thinning. The southern glaciers show little change, with the most southerly glacier undergoing slight retreat and deceleration between 1992 and 2013. These observations point out the fact that the UI glaciers are reacting to climate change on different timescales. The asynchronous behavior of the four neighboring glaciers is explained in terms of the individual glaciers’ geometry and terminus position. The northernmost glacier is believed to have had a floating tongue between 1985 and 2007 which disintegrated in 2007-2008. This release of back stress destabilized the glacier causing it to accelerate and thin rapidly. We suggest that the ice tongue broke up due to ocean-warming induced thinning in the late 1990s. Recent response on UI glaciers is found to be related to increased surface melt. Our investigations suggest that three out of the four main glaciers in the UI are likely to be in unstable positions and may have the potential to rapidly thin and accelerate and increase their contribution to sea level in the future.

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Organisations: National Space Institute, Geodesy, Geological Survey of Denmark and Greenland, University of Copenhagen, Cornell University
Authors: Larsen, S. H. (Ekstern), Khan, S. A. (Intern), Ahlstrøm, A. P. (Ekstern), Hvidberg, C. S. (Ekstern), Willis, M. J. (Ekstern), Andersen, S. B. (Ekstern)
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Main Research Area: Technical/natural sciences
Increasing the resolution of marine gravity from CryoSat-2 using 20 and 80Hz altimetry

Achieving a high resolution marine gravity field is essential for the derivation of bathymetry, exploring the ocean tectonics, and practically, safe navigation of ships in the poorly surveyed regions. The accuracy of marine gravity can be improved by the improved altimeter range and dense track coverage. With the launch of CryoSat-2 in 2010, the altimeter range precision is improved by the synthetic aperture radar (SAR) mode. The tracks also cover up to higher latitudes (88°), providing dense spatial coverage in the polar regions. The gravity signal can be recovered from the along track surface slopes (gradients). The accuracy of the recovered gravity signal is dominated by the accuracy of range precision. Therefore, an optimum retracker for the derivation of accurate sea surface height (SSH) estimate should be identified at the first step. In this paper, we will first work on adapting the SAMOSA retracker to optimally fit to the SAR waveforms in the Arctic by additional amplitude fitting. Then, we use the 20 Hz L1c release of the CryoSat-2 products to estimate the SSH and further derive the sea surface height variations to recover the marine gravity. Precision analysis will also carried out to several empirical retrackers to compare the performance of the retrackers. Additionally, the high burst rate and high pulse repetition frequency in the SAR mode also enabled higher along track sampling through post-processing, e.g., 80 Hz posting rate on the surface. We will initially investigate the use the 80 Hz data from the ESA-GPOD service to investigate fine scale regional marine gravity signals. We expect that by more dense along track sampling, the along track SSH variations can be well represented and the along track oceanic surface slopes can be refined when downsampled.

In-depth calibration of a Laue lens prototype composed of Fe and Al mosaic crystals

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In-flight scalar calibration and characterisation of the Swarm magnetometry package
We present the in-flight scalar calibration and characterisation of the Swarm magnetometry package consisting of the absolute scalar magnetometer, the vector magnetometer, and the spacecraft structure supporting the instruments. A significant improvement in the scalar residuals between the pairs of magnetometers is demonstrated, confirming the high performance of these instruments. The results presented here, including the characterisation of a Sun-driven disturbance field, form the basis of the correction of the magnetic vector measurements from Swarm which is applied to the Swarm Level 1b magnetic data.

General information
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Organisations: National Space Institute, Geomagnetism, Institute Physique du Globe de Paris
Authors: Tøffner-Clausen, L. (Intern), Lesur, V. (Ekstern), Olsen, N. (Intern), Finlay, C. (Intern)
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BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.981 SNIP 0.89 CiteScore 1.79
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 0.969 SNIP 0.966 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.493 SNIP 1.081 CiteScore 2.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.063 SNIP 1.231 CiteScore 2.65
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.322 SNIP 0.987 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.677 SNIP 0.746 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.909 SNIP 0.73
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.878 SNIP 0.912
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.827 SNIP 0.775
Influence of atmospheric electric fields on the radio emission from extensive air showers

The atmospheric electric fields in thunderclouds have been shown to significantly modify the intensity and polarization patterns of the radio footprint of cosmic-ray-induced extensive air showers. Simulations indicated a very nonlinear dependence of the signal strength in the frequency window of 30-80 MHz on the magnitude of the atmospheric electric field. In this work we present an explanation of this dependence based on Monte Carlo simulations, supported by arguments based on electron dynamics in air showers and expressed in terms of a simplified model. We show that by extending the frequency window to lower frequencies, additional sensitivity to the atmospheric electric field is obtained.
Influence of the angular scattering of electrons on the runaway threshold in air

The runaway electron mechanism is of great importance for the understanding of the generation of x- and gamma rays in atmospheric discharges. In 1991, terrestrial gamma-ray flashes (TGFs) were discovered by the Compton Gamma-Ray Observatory. Those emissions are bremsstrahlung from high energy electrons that run away in electric fields associated...
with thunderstorms. In this paper, we discuss the runaway threshold definition with a particular interest in the influence of the angular scattering for electron energy close to the threshold. In order to understand the mechanism of runaway, we compare the outcome of different Fokker–Planck and Monte Carlo models with increasing complexity in the description of the scattering. The results show that the inclusion of the stochastic nature of collisions smooths the probability to run away around the threshold. Furthermore, we observe that a significant number of electrons diffuse out of the runaway regime when we take into account the diffusion in angle due to the scattering. Those results suggest using a runaway threshold energy based on the Fokker–Planck model assuming the angular equilibrium that is 1.6 to 1.8 times higher than the one proposed by [1, 2], depending on the magnitude of the ambient electric field. The threshold also is found to be 5 to 26 times higher than the one assuming forward scattering. We give a fitted formula for the threshold field valid over a large range of electric fields. Furthermore, we have shown that the assumption of forward scattering is not valid below 1 MeV where the runaway threshold usually is defined. These results are important for the thermal runaway and the runaway electron avalanche discharge mechanisms suggested to participate in the TGF generation.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics, Masaryk University, Centre National de la Recherche Scientifique

**Authors:** Chanrion, O. (Intern), Bonaventura, Z. (Ekstern), Bourdon, A. (Ekstern), Neubert, T. (Intern)

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**Main Research Area:** Technical/natural sciences

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- Scopus rating (2017): SNIP 1.243 SJR 0.69
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1 SJR 1.433 SNIP 1.258
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.314 SNIP 1.345 CiteScore 1.1
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.542 SNIP 1.346 CiteScore 1.61
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.2 SNIP 1.253 CiteScore 1.54
- ISI indexed (2013): ISI indexed yes
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- Scopus rating (2012): SJR 1.453 SNIP 1.201 CiteScore 1.63
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- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.496 SNIP 1.591 CiteScore 2.69
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.468 SNIP 1.408
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.589 SNIP 1.324
Innovative Sea Surface Monitoring with GNSS-Reflectometry aboard ISS: Overview and Recent Results from GEROS-ISS

GEROS-ISS (GEROS hereafter) stands for GNSS REflectometry, Radio Occultation and Scatterometry onboard the International Space Station. It is a scientific experiment, proposed to the European Space Agency (ESA) in 2011 for installation aboard the ISS. The main focus of GEROS is the dedicated use of signals from the currently available Global Navigation Satellite Systems (GNSS) for remote sensing of the System Earth with focus to Climate Change characterisation. The GEROS mission idea and the current status are briefly reviewed.

General Information

State: Published
Organisations: National Space Institute, Geodesy, European Space Agency, Ohio State University, CLS, DEIMOS Engenharia SA, Nansen Environmental and Remote Sensing Center, National Oceanography Centre, Helmholtz Centre Potsdam, Institute of Space Sciences, IFREMER, University of Southampton, University of Bern, California Institute of Technology, Sapienza University of Rome, German Research Centre for Geosciences
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Inter-comparison of ice sheet mass balance products from GRACE: ESA CCI Round Robin results
Both the Antarctic Ice Sheet (AIS) and the Greenland Ice Sheet (GIS) have been identified as key parameters, so called Essential Climate Variables (ECV), in the climate system. Within the framework of the Climate Change Initiative (CCI) of the European Space Agency (ESA), reliable long-term satellite-based data products are generated for selected ECVs. Since ice sheet mass balance is an ECV parameter of highest interest, both the AIS_cci and the GIS_cci project will provide mass balance products based on satellite gravimetry data: (a) time series of monthly mass changes for individual drainage basins, and (b) gridded mass changes covering the entire ice sheet. Gravimetry Mass Balance (GMB) products are derived from data acquired by the GRACE (Gravity Recovery and Climate Experiment) mission. Although GRACE data have the advantage of being directly sensitive to mass changes, their limited spatial resolution and complex error structures place particular demands on the applied processing strategy. To choose the most suitable algorithm which minimizes the impact of GRACE errors and signal leakage errors on GMB products, an open Round Robin experiment was set up. Participants were asked to provide GMB products according to the specifications of the official products by the ESA CCI using their preferred processing strategy and GRACE release. In addition, the same algorithms should be applied to a series of synthetic datasets, which realistically mimic mass variations in various subsystems of the Earth (e.g. cryosphere, ocean, continental hydrology). By comparing the derived synthetic changes with the a priori known 'synthetic truth', leakage errors can be quantified. Here we inter-compare the Round Robin results from six individual contributions, relying on different processing strategies, including regional integration approaches, mass inversion strategies, and a forward modeling approach. Time series of basin averaged and gridded products are compared with respect to their specific noise level. The minimization of leakage errors is assessed from the synthetic results. Finally, for selected drainage basins the GMB time series are compared to independent mass balance products based on satellite altimetry and firm densification information from a regional climate model. This inter-comparison has aided the algorithm definition for the operational ECV production.

General information
State: Published
Organisations: National Space Institute, Geodynamics, Dresden University of Technology, Technische Universität München, Ohio State University, Ohio University, Ohio Sate University, Delft University of Technology, University of Bristol
Authors: Groth, A. (Ekstern), Horwath, M. (Ekstern), Horvath, A. (Ekstern), Meister, R. (Intern), Sørensen, L. S. (Intern), Forsberg, R. (Intern), Su, X. (Ekstern), Shang, K. (Ekstern), Shum, C. (Ekstern), Ditmar, P. (Ekstern), Ran, J. (Ekstern), Klees, R. (Ekstern), Wouters, B. (Ekstern), Schrama, E. (Ekstern), Shepherd, A. (Ekstern)
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Inter-comparison of state-of-the-art MSS and geoid models in the Arctic Ocean
State-of-the-art Arctic Ocean mean sea surface (MSS) and geoid models are used to support sea ice freeboard estimation from satellite altimeters, and for oceanographic studies. However, errors in a given model in the high frequency domain, e.g. due to unresolved gravity features, can result in errors in the estimated freeboard heights, especially in areas with a sparse lead distribution in consolidated ice conditions. Additionally these errors can impact ocean geostrophic current estimates and remaining biases in the models may impact longer-term, multi-sensor oceanographic time-series of sea level change. This study, part of the ESA CryoVal Sea Ice project, focuses on an inter-comparison of various state-of-the-art Arctic MSS models (UCL13/DTU13/ICEEn) and commonly-used geoid models (EGM08). We show improved definition of gravity features, such as the Gakkel ridge, in the latest MSS models. We quantify remaining errors due to unresolved gravity features and inter-satellite biases within commonly-used models and we show the implications of these potential error sources on freeboard derivation. To identify and quantify the spatial effect of the unresolved features, primarily in the high-frequency domain, we combine a climatology of lead distributions with the gradient of the slope of the sea surface anomalies. The differences between the models are analyzed and used to support improvements in future models.

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Main Research Area: Technical/natural sciences
Links:
**NuSTAR and XMM-Newton observations of 1E1743.1-2843: indications of a neutron star LMXB nature of the compact object**

We report on the results of *NuSTAR* and *XMM-Newton* observations of the persistent X-ray source 1E1743.1-2843, located in the Galactic Center region. The source was observed between 2012 September and October by *NuSTAR* and *XMM-Newton*, providing almost simultaneous observations in the hard and soft X-ray bands. The high X-ray luminosity points to the presence of an accreting compact object. We analyze the possibilities of this accreting compact object being either a neutron star (NS) or a black hole, and conclude that the joint *XMM-Newton* and *NuSTAR* spectrum from 0.3 to 40 keV fits a blackbody spectrum with $kT \approx 1.8$ keV emitted from a hot spot or an equatorial strip on an NS surface. This spectrum is thermally Comptonized by electrons with $kT_{e} \approx 4.6$ keV. Accepting this NS hypothesis, we probe the low-mass X-ray binary (LMXB) or high-mass X-ray binary (HMXB) nature of the source. While the lack of Type-I bursts can be explained in the LMXB scenario, the absence of pulsations in the 2 mHz-49 Hz frequency range, the lack of eclipses and of an IR companion, and the lack of a Ka line from neutral or moderately ionized iron strongly disfavor interpreting this source as a HMXB. We therefore conclude that 1E1743.1-2843 is most likely an NS-LMXB located beyond the Galactic Center. There is weak statistical evidence for a soft X-ray excess which may indicate thermal emission from an accretion disk. However, the disk normalization remains unconstrained due to the high hydrogen column density ($NH \approx 1.6 \times 10^{23}$ cm$^{-2}$).
NuSTAR discovery of a cyclotron line in the accreting X-ray pulsar IGR J16393-4643

The high-mass X-ray binary and accreting X-ray pulsar IGR J16393-4643 was observed by NuSTAR in the 3-79 keV energy band for a net exposure time of 50ks. We present the results of this observation which enabled the discovery of a cyclotron resonant scattering feature with a centroid energy of 29.3(+1.1/-1.3)keV. This allowed us to measure the magnetic field strength of the neutron star for the first time: $B = (2.5 +/- 0.1) \times 10^{12}$ G. The known pulsation period is now observed at $904.0 +/- 0.1$ s. Since 2006, the neutron star has undergone a long-term spin-up trend at a rate of $P' = -2 \times 10^{-8}$ s/s ($-0.6$ s per year, or a frequency derivative of $\nu' = 3 \times 10^{14}$ Hz/s$^{-1}$). In the power density spectrum, a break appears at the pulse frequency which separates the zero slope at low frequency from the steeper slope at high frequency. This addition of angular momentum to the neutron star could be due to the accretion of a quasi-spherical wind, or it could be caused by the transient appearance of a prograde accretion disk that is nearly in corotation with the neutron star whose magnetospheric radius is around $2 \times 10^{8}$ cm.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Georgia College and State University, Russian Academy of Sciences, California Institute of Technology, European Southern Observatory, NASA Goddard Space Flight Center, University of California at Berkeley, Columbia University, Lawrence Livermore National Laboratory
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NuSTAR Hard X-Ray Survey of the Galactic Center Region. II. X-Ray Point Sources

We present the first survey results of hard X-ray point sources in the Galactic Center (GC) region by NuSTAR. We have discovered 70 hard (3-79 keV) X-ray point sources in a 0.6 deg² region around Sgr A* with a total exposure of 1.7 Ms, and 7 sources in the Sgr B2 field with 300 ks. We identify clear Chandra counterparts for 58 NuSTAR sources and assign candidate counterparts for the remaining 19. The NuSTAR survey reaches X-ray luminosities of similar to 4x and similar to 8 x 10^{32} erg s⁻¹ at the GC (8 kpc) in the 3-10 and 10-40 keV bands, respectively. The source list includes three persistent luminous X-ray binaries (XBs) and the likely run-away pulsar called the Cannonball. New source-detection significance maps reveal a cluster of hard (>10 keV) X-ray sources near the Sgr. A diffuse complex with no clear soft X-ray counterparts. The severe extinction observed in the Chandra spectra indicates that all the NuSTAR sources are in the...
central bulge or are of extragalactic origin. Spectral analysis of relatively bright NuSTAR sources suggests that magnetic cataclysmic variables constitute a large fraction (>40%-60%). Both spectral analysis and logN-logS distributions of the NuSTAR sources indicate that the X-ray spectra of the NuSTAR sources should have kT > 20 keV on average for a single temperature thermal plasma model or an average photon index of Gamma = 1.5-2 for a power-law model. These findings suggest that the GC X-ray source population may contain a larger fraction of XBs with high plasma temperatures than the field population.
NuSTAR reveals the extreme properties of the super-Eddington accreting supermassive black hole in PG 1247+267

PG1247+267 is one of the most luminous known quasars at z similar to 2 and is a strongly super-Eddington accreting supermassive black hole (SMBH) candidate. We obtained NuSTAR data of this intriguing source in December 2014 with the aim of studying its high-energy emission, leveraging the broad band covered by the new NuSTAR and the archival XMM-Newton data. Several measurements are in agreement with the super-Eddington scenario for PG1247+267: the soft power law (\(\Gamma = 2.3 \pm 0.1\)); the weak ionized Fe emission line; and a hint of the presence of outflowing ionized gas surrounding the SMBH. The presence of an extreme reflection component is instead at odds with the high accretion rate proposed for this quasar. This can be explained with three different scenarios; all of them are in good agreement with the existing data, but imply very different conclusions: i) a variable primary power law observed in a low state, superimposed on a reflection component echoing a past, higher flux state; ii) a power law continuum obscured by an ionized, Compton thick, partial covering absorber; and iii) a relativistic disk reflector in a lamp-post geometry, with low coronal height and high BH spin. The first model is able to explain the high reflection component in terms of variability. The second does not require any reflection to reproduce the hard emission, while a rather low high-energy cutoff of similar to 100 keV is detected for the first time in such a high redshift source. The third model require a face-on geometry, which may affect the SMBH mass and Eddington ratio measurements. Deeper X-ray broad-band data are required in order to distinguish between these possibilities.
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Scopus rating (2016): CiteScore 3.68 SJR 2.234 SNIP 1.199
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.545 SNIP 1.224 CiteScore 3.5
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.883 SNIP 1.247 CiteScore 2.82
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.747 SNIP 1.159 CiteScore 2.01
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.903 SNIP 1.36 CiteScore 3.14
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.737 SNIP 1.322 CiteScore 3.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.849 SNIP 1.424
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.976 SNIP 1.438
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.907 SNIP 1.291
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.861 SNIP 1.333
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.646 SNIP 1.4
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.265 SNIP 1.338
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.862 SNIP 1.448
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.157 SNIP 1.362
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.845 SNIP 1.35
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.607 SNIP 0.736
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.439 SNIP 1.04
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.478 SNIP 1.07

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NuSTAR_reveals_the_extreme_properties_of_the_super_Eddington.pdf
Investigating the polar electrojet using Swarm satellite magnetic data

The aim of this study is to investigate the magnetic perturbations caused by the polar electrojets, which are described by means of a model consisting of a series of infinite line currents placed at the height of the ionosphere along QD latitudes. The method is applied to Swarm magnetic scalar perturbations (which means observations after removal of contributions from the core, crust and the large-scale magnetosphere) in the Polar Regions (+/- 50 degrees from the poles) for individual satellite passes. The obtained estimates of ionospheric currents provide information on the position and strength of the polar electrojets as well as their temporal evolution. In addition, applying the method to data taken by the Swarm satellites Alpha and Beta allows investigating longitudinal differences of the electrojets.

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Organisations: National Space Institute, Geomagnetism
Authors: Aakjær, C. D. (Intern), Olsen, N. (Intern), Finlay, C. (Intern)
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Planck 2015 results: X. Diffuse component separation: Foreground maps

Planck has mapped the microwave sky in temperature over nine frequency bands between 30 and 857 GHz and in polarization over seven frequency bands between 30 and 353 GHz in polarization. In this paper we consider the problem of diffuse astrophysical component separation, and process these maps within a Bayesian framework to derive an internally consistent set of full-sky astrophysical component maps. Component separation dedicated to cosmic microwave background (CMB) reconstruction is described in a companion paper. For the temperature analysis, we combine the Planck observations with the 9-yr Wilkinson Microwave Anisotropy Probe (WMAP) sky maps and the Haslam et al. 408 MHz map, to derive a joint model of CMB, synchrotron, free-free, spinning dust, CO, line emission in the 94 and 100 GHz channels, and thermal dust emission. Full-sky maps are provided for each component, with an angular resolution varying between 7.5 and 1deg. Global parameters (monopoles, dipoles, relative calibration, and bandpass errors) are fitted jointly with the sky model, and best-fit values are tabulated. For polarization, the model includes CMB, synchrotron, and thermal dust emission. These models provide excellent fits to the observed data, with rms temperature residuals smaller than 4μK over 93% of the sky for all Planck frequencies up to 353 GHz, and fractional errors smaller than 1% in the remaining 7% of the sky. The main limitations of the temperature model at the lower frequencies are internal degeneracies among the spinning dust, free-free, and synchrotron components; additional observations from external low-frequency experiments will be essential to break these degeneracies. The main limitations of the temperature model at the higher frequencies are uncertainties in the 545 and 857 GHz calibration and zero-points. For polarization, the main outstanding issues are instrumental systematics in the 100-353 GHz bands on large angular scales in the form of temperature-to-polarization leakage, uncertainties in the analogue-to-digital conversion, and corrections for the very long time constant of the bolometer detectors, all of which are expected to improve in the near future.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
This paper presents the Planck 2015 likelihoods, statistical descriptions of the 2-point correlation functions of the cosmic microwave background (CMB) temperature and polarization fluctuations that account for relevant uncertainties, both instrumental and astrophysical in nature. They are based on the same hybrid approach used for the previous release, i.e., a pixel-based likelihood at low multipoles ($\ell < 30$) and a Gaussian approximation to the distribution of cross-power spectra at higher multipoles. The main improvements are the use of more and better processed data and of Planck polarization information, along with more detailed models of foregrounds and instrumental uncertainties. The increased redundancy brought by more than doubling the amount of data analysed enables further consistency checks and enhanced immunity to systematic effects. It also improves the constraining power of Planck, in particular with regard to small-scale foreground properties. Progress in the modelling of foreground emission enables the retention of a larger fraction of the sky to determine the properties of the CMB, which also contributes to the enhanced precision of the spectra. Improvements in data processing and instrumental modelling further reduce uncertainties. Extensive tests establish the robustness and
accuracy of the likelihood results, from temperature alone, from polarization alone, and from their combination. For temperature, we also perform a full likelihood analysis of realistic end-to-end simulations of the instrumental response to the sky, which were fed into the actual data processing pipeline; this does not reveal biases from residual low-level instrumental systematics. Even with the increase in precision and robustness, the ΛCDM cosmological model continues to offer a very good fit to the Planck data. The slope of the primordial scalar fluctuations, ns, is confirmed smaller than unity to the baseline cosmology, which are particularly sensitive to data at high multipoles. For instance, the effective number of neutrino species remains compatible with the canonical value of 3.046. For this first detailed analysis of Planck polarization spectra, we concentrate at high multipoles on the E modes, leaving the analysis of the weaker B modes to future work. At low multipoles we use temperature maps at all Planck frequencies along with a subset of polarization data. These data take advantage of Planck's wide frequency coverage to improve the separation of CMB and foreground emission. Within the baseline ΛCDM cosmology this requires τ = 0.078 ± 0.019 for the reionization optical depth, which is significantly lower than estimates without the use of high-frequency data for explicit monitoring of dust emission. At high multipoles we detect residual systematic errors in E polarization, typically at the μK² level; we therefore choose to retain temperature information alone for high multipoles as the recommended baseline, in particular for testing non-minimal models. Nevertheless, the high-multipole polarization spectra from Planck are already good enough to enable a separate high-precision determination of the parameters of the ΛCDM model, showing consistency with those established independently from temperature information alone.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Copenhagen

We present the 8th full focal plane simulation set (FFP8), deployed in support of the Planck 2015 results. FFP8 consists of 10 fiducial mission realizations reduced to 18,144 maps, together with the most massive suite of Monte Carlo realizations of instrument noise and CMB ever generated, comprising 104 mission realizations reduced to about 106 maps. The resulting maps incorporate the dominant instrumental, scanning, and data analysis effects, and the remaining subdominant effects will be included in future updates. Generated at a cost of some 25 million CPU-hours spread across multiple high-performance-computing (HPC) platforms, FFP8 is used to validate and verify analysis algorithms and their implementations, and to remove biases from and quantify uncertainties in the results of analyses of the real data.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen

Planck 2015 results: XVII. Constraints on primordial non-Gaussianity

The Planck full mission cosmic microwave background (CMB) temperature and $E$-mode polarization maps are analysed to obtain constraints on primordial non-Gaussianity (NG). Using three classes of optimal bispectrum estimators – separable template-fitting (KSW), binned, and modal – we obtain consistent values for the primordial local, equilateral, and orthogonal bispectrum amplitudes, quoting as our final result from temperature alone $f_{\text{local}}^{\text{NL}} = 2.5 \pm 5.7$, $f_{\text{equil}}^{\text{NL}} = -16 \pm 70$, and $f_{\text{ortho}}^{\text{NL}} = -34 \pm 32$ (68% CL, statistical). Combining temperature and polarization data we obtain $f_{\text{local}}^{\text{NL}} = 0.8 \pm 5.0$, $f_{\text{equil}}^{\text{NL}} = -4 \pm 43$, and $f_{\text{ortho}}^{\text{NL}} = -26 \pm 21$ (68% CL, statistical). The results are based on comprehensive cross-validation of these estimators on Gaussian and non-Gaussian simulations, are stable across component separation techniques, pass an extensive suite of tests, and are consistent with estimators based on measuring the Minkowski functionals of the CMB. The effect of time-domain de-glitching systematics on the bispectrum is negligible. In spite of these test outcomes we conservatively label the results including polarization data as preliminary, owing to a known mismatch of the noise model in simulations and the data. Beyond estimates of individual shape amplitudes, we present model-independent, three-dimensional reconstructions of the Planck CMB bispectrum and derive constraints on early universe scenarios that generate primordial NG, including general single-field models of inflation, axion inflation, initial state modifications, models producing parity-violating tensor bispectra, and directionally dependent vector models. We present a wide survey of scale-dependent feature and resonance models, accounting for the "look elsewhere" effect in estimating the statistical significance of features. We also look for isocurvature NG, and find no signal, but we obtain constraints that improve significantly with the inclusion of polarization. The primordial trispectrum amplitude in the local model is constrained to be $\tilde{f}_{\text{local}}^{\text{NL}} = (-0.9 \pm 7.7) \times 10^{-4}$ (68% CL statistical), and we perform an analysis of trispectrum shapes beyond the local case. The global picture that emerges is one of consistency with the premises of the $\Lambda$CDM cosmology, namely that the structure we observe today was sourced by adiabatic, passive, Gaussian, and primordial seed perturbations.

General information

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: XVI. Isotropy and statistics of the CMB
We test the statistical isotropy and Gaussianity of the cosmic microwave background (CMB) anisotropies using observations made by the Planck satellite. Our results are based mainly on the full Planck mission for temperature, but also include some polarization measurements. In particular, we consider the CMB anisotropy maps derived from the multifrequency Planck data by several component-separation methods. For the temperature anisotropies, we find excellent agreement between results based on these sky maps over both a very large fraction of the sky and a broad range of angular scales, establishing that potential foreground residuals do not affect our studies. Tests of skewness, kurtosis, multi-normality, N-point functions, and Minkowski functionals indicate consistency with Gaussianity, while a power deficit
at large angular scales is manifested in several ways, for example local map variance. The results of a peak statistics analysis are consistent with the expectations of a Gaussian random field. The "Cold Spot" is detected with several methods, including map kurtosis, peak statistics, and mean temperature profile. We thoroughly probe the large-scale dipolar power asymmetry, detecting it with several independent tests, and address the subject of a posteriori correction. Tests of directionality suggest the presence of angular clustering from large to small scales, but at a significance that is dependent on the details of the approach. We perform the first examination of polarization data, finding the morphology of stacked peaks to be consistent with the expectations of statistically isotropic simulations. Where they overlap, these results are consistent with the Planck 2013 analysis based on the nominal mission data and provide our most thorough view of the statistics of the CMB fluctuations to date.

**General information**

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**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen


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**Publication date:** 2016

**Main Research Area:** Technical/natural sciences
Planck 2015 results: XXII. A map of the thermal Sunyaev-Zeldovich effect

We have constructed all-sky Compton parameters maps, y-maps, of the thermal Sunyaev-Zeldovich (tSZ) effect by applying specifically tailored component separation algorithms to the 30 to 857 GHz frequency channel maps from the Planck satellite. These reconstructed y-maps are delivered as part of the Planck 2015 release. The y-maps are characterized in terms of noise properties and residual foreground contamination, mainly thermal dust emission at large angular scales, and cosmic infrared background and extragalactic point sources at small angular scales. Specific masks are defined to minimize foreground residuals and systematics. Using these masks, we compute the y-map angular power spectrum and higher order statistics. From these we conclude that the y-map is dominated by tSZ signal in the multipole range, 20

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: XXIII. The thermal Sunyaev-Zeldovich effect-cosmic infrared background correlation

We use Planck data to detect the cross-correlation between the thermal Sunyaev-Zeldovich (tSZ) effect and the infrared emission from the galaxies that make up the cosmic infrared background (CIB). We first perform a stacking analysis towards Planck-confirmed galaxy clusters. We detect infrared emission produced by dusty galaxies inside these clusters and demonstrate that the infrared emission is about 50% more extended than the tSZ effect. Modelling the emission with a Navarro-Frenk-White profile, we find that the radial profile concentration parameter is $c_{500} = 1.00^{+0.18}_{-0.15}$. This indicates that infrared galaxies in the outskirts of clusters have higher infrared flux than cluster-core galaxies. We also study the cross-correlation between tSZ and CIB anisotropies, following three alternative approaches based on power spectrum analyses: (i) using a catalogue of confirmed clusters detected in Planck data; (ii) using an all-sky tSZ map built from Planck frequency maps; and (iii) using cross-spectra between Planck frequency maps. With the three different methods, we detect the tSZ-CIB cross-power spectrum at significance levels of (i) 6σ; (ii) 3σ; and (iii) 4σ. We model the tSZ-CIB cross-correlation signature and compare predictions with the measurements. The amplitude of the cross-correlation relative to the fiducial model is $A_{tSZ-CIB} = 1.2 \pm 0.3$. This result is consistent with predictions for the tSZ-CIB cross-correlation assuming the best-fit cosmological model from Planck 2015 results along with the tSZ and CIB scaling relations.

General information

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
We present the Planck Catalogue of Galactic Cold Clumps (PGCC), an all-sky catalogue of Galactic cold clump candidates detected by Planck. This catalogue is the full version of the Early Cold Core (ECC) catalogue, which was made available in 2011 with the Early Release Compact Source Catalogue (ERCSC) and which contained 915 high signal-to-noise sources. It is based on the Planck 48-month mission data that are currently being released to the astronomical community. The PGCC catalogue is an observational catalogue consisting exclusively of Galactic cold sources. The three highest Planck bands (857, 454, and 353 GHz) have been combined with IRAS data at 3 THz to perform a multi-frequency detection of sources colder than their local environment. After rejection of possible extragalactic contaminants, the PGCC catalogue contains 13188 Galactic sources spread across the whole sky, i.e., from the Galactic plane to high latitudes, following the spatial distribution of the main molecular cloud complexes. The median temperature of PGCC sources lies between 13 and 14.5 K, depending on the quality of the flux density measurements, with a temperature ranging from 5.8 to 20 K after removing the sources with the top 1% highest temperature estimates. Using seven independent methods, reliable distance estimates have been obtained for 5574 sources, which allows us to derive their physical properties such as their mass, physical size, mean density, and luminosity. The PGCC sources are located mainly in the solar neighbourhood, but also up to a distance of 10.5 kpc in the direction of the Galactic centre, and range from low-mass cores to large molecular clouds. Because of this diversity and because the PGCC catalogue contains sources in very different environments, the catalogue is useful for investigating the evolution from molecular clouds to cores. Finally, it also includes 54 additional sources located in the Small and Large Magellanic Clouds.

**Planck 2015 results: XXVIII. The Planck Catalogue of Galactic cold clumps**

We present the Planck Catalogue of Galactic Cold Clumps (PGCC), an all-sky catalogue of Galactic cold clump candidates detected by Planck. This catalogue is the full version of the Early Cold Core (ECC) catalogue, which was made available in 2011 with the Early Release Compact Source Catalogue (ERCSC) and which contained 915 high signal-to-noise sources. It is based on the Planck 48-month mission data that are currently being released to the astronomical community. The PGCC catalogue is an observational catalogue consisting exclusively of Galactic cold sources. The three highest Planck bands (857, 454, and 353 GHz) have been combined with IRAS data at 3 THz to perform a multi-frequency detection of sources colder than their local environment. After rejection of possible extragalactic contaminants, the PGCC catalogue contains 13188 Galactic sources spread across the whole sky, i.e., from the Galactic plane to high latitudes, following the spatial distribution of the main molecular cloud complexes. The median temperature of PGCC sources lies between 13 and 14.5 K, depending on the quality of the flux density measurements, with a temperature ranging from 5.8 to 20 K after removing the sources with the top 1% highest temperature estimates. Using seven independent methods, reliable distance estimates have been obtained for 5574 sources, which allows us to derive their physical properties such as their mass, physical size, mean density, and luminosity. The PGCC sources are located mainly in the solar neighbourhood, but also up to a distance of 10.5 kpc in the direction of the Galactic centre, and range from low-mass cores to large molecular clouds. Because of this diversity and because the PGCC catalogue contains sources in very different environments, the catalogue is useful for investigating the evolution from molecular clouds to cores. Finally, it also includes 54 additional sources located in the Small and Large Magellanic Clouds.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen

Planck 2015 results: XXVI. The Second Planck Catalogue of Compact Sources

The Second Planck Catalogue of Compact Sources is a list of discrete objects detected in single-frequency maps from the full duration of the Planck mission and supersedes previous versions. It consists of compact sources, both Galactic and extragalactic, detected over the entire sky. Compact sources detected in the lower frequency channels are assigned to the PCCS2, while at higher frequencies they are assigned to one of two subcatalogues, the PCCS2 or PCCS2E, depending on their location on the sky. The first of these (PCCS2) covers most of the sky and allows the user to produce subsamples at higher reliabilities than the target 80% integral reliability of the catalogue. The second (PCCS2E) contains sources detected in sky regions where the diffuse emission makes it difficult to quantify the reliability of the detections. Both the PCCS2 and PCCS2E include polarization measurements, in the form of polarized flux densities, or upper limits, and orientation angles for all seven polarization-sensitive Planck channels. The improved data-processing of the full-mission maps and their reduced noise levels allow us to increase the number of objects in the catalogue, improving its...
General information

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Scopus rating (2009): SJR 2.976 SNIP 1.438
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Web of Science (2008): Indexed yes
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Web of Science (2007): Indexed yes
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Web of Science (2006): Indexed yes
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Scopus rating (2001): SJR 1.607 SNIP 0.736
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Scopus rating (2000): SJR 2.439 SNIP 1.04
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Original language: English
Planck intermediate results XXXIV. The magnetic field structure in the Rosette Nebula

Planck has mapped the polarized dust emission over the whole sky, making it possible to trace the Galactic magnetic field structure that pervades the interstellar medium (ISM). We combine polarization data from Planck with rotation measure (RM) observations towards a massive star-forming region, the Rosette Nebula in the Monoceros molecular cloud, to study its magnetic field structure and the impact of an expanding H II region on the morphology of the field. We derive an analytical solution for the magnetic field, assumed to evolve from an initially uniform configuration following the expansion of ionized gas and the formation of a shell of swept-up ISM. From the RM data we estimate a mean value of the line-of-sight component of the magnetic field of about 3 $\mu$G (towards the observer) in the Rosette Nebula, for a uniform electron density of about 12 cm$^{-3}$. The dust shell that surrounds the Rosette H II region is clearly observed in the Planck intensity map at 353 GHz, with a polarization signal significantly different from that of the local background when considered as a whole. The Planck observations constrain the plane-of-the-sky orientation of the magnetic field in the Rosette's parent molecular cloud to be mostly aligned with the large-scale field along the Galactic plane. The Planck data are compared with the analytical model, which predicts the mean polarization properties of a spherical and uniform dust shell for a given orientation of the field. This comparison leads to an upper limit of about 45 degrees on the angle between the line of sight and the magnetic field in the Rosette complex, for an assumed intrinsic dust polarization fraction of 4%. This field direction can reproduce the RM values detected in the ionized region if the magnetic field strength in the Monoceros molecular cloud is in the range 6.5-9 $\mu$G. The present analytical model is able to reproduce the RM distribution across the ionized nebula, as well as the mean dust polarization properties of the swept-up shell, and can be directly applied to other similar objects.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics, IT-Department, University of Copenhagen

Planck intermediate results XXXVII. Evidence of unbound gas from the kinetic Sunyaev-Zeldovich effect

By looking at the kinetic Sunyaev-Zeldovich effect (kSZ) in Planck nominal mission data, we present a significant detection of baryons participating in large-scale bulk flows around central galaxies (CGs) at redshift z approximate to 0.1. We estimate the pairwise momentum of the kSZ temperature fluctuations at the positions of the Central Galaxy Catalogue (CGC) samples extracted from Sloan Digital Sky Survey (SDSS-DR7) data. For the foreground-cleaned SEVEM, SMICA, NILC, and COMMANDER maps, we find 1.8-2.5 sigma detections of the kSZ signal, which are consistent with the kSZ evidence found in individual Planck raw frequency maps, although lower than found in the WMAP-9yr W-band (3.3 sigma).

We further reconstruct the peculiar velocity field from the CG density field, and compute for the first time the cross-correlation function between kSZ temperature fluctuations and estimates of CG radial peculiar velocities. This correlation function yields a 3.0-3.7 sigma detection of the peculiar motion of extended gas on Mpc scales in flows correlated up to distances of 80-100 h⁻¹ Mpc. Both the pairwise momentum estimates and the kSZ temperature-velocity field correlation find evidence for kSZ signatures out to apertures of 8 arcmin and beyond, corresponding to a physical radius of >1 Mpc, more than twice the mean virial radius of halos. This is consistent with the predictions from hydrodynamical simulations that most of the baryons are outside the virialized halos. We fit a simple model, in which the temperature-velocity cross-correlation is proportional to the signal seen in a semi-analytic model built upon N-body simulations, and interpret the proportionality constant as an effective optical depth to Thomson scattering. We find τ(T) = (1.4 +/- 0.5) x 10⁻⁴; the simplest interpretation of this measurement is that much of the gas is in a diffuse phase, which contributes little signal to X-ray or thermal Sunyaev-Zeldovich observations.

General information

State: Published
Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Planck intermediate results XXXVIII. E- and B-modes of dust polarization from the magnetized filamentary structure of the interstellar medium

The quest for a B-mode imprint from primordial gravity waves on the polarization of the cosmic microwave background (CMB) requires the characterization of foreground polarization from Galactic dust. We present a statistical study of the filamentary structure of the 353 GHz Planck Stokes maps at high Galactic latitude, relevant to the study of dust emission as a polarized foreground to the CMB. We filter the intensity and polarization maps to isolate filaments in the range of angular scales where the power asymmetry between E-modes and B-modes is observed. Using the Smoothed Hessian Major Axis Filament Finder (SMAFF), we identify 259 filaments at high Galactic latitude, with lengths larger or equal to 2 degrees (corresponding to 3.5 pc in length for a typical distance of 100 pc). These filaments show a preferred orientation parallel to the magnetic field projected onto the plane of the sky, derived from their polarization angles. We present mean maps of the filaments in Stokes I, Q, U, E, and B, computed by stacking individual images rotated to align the orientations of the filaments. Combining the stacked images and the histogram of relative orientations, we estimate the mean polarization fraction of the filaments to be 11%. Furthermore, we show that the correlation between the filaments and the magnetic field orientations may account for the E and B asymmetry and the C-l(TE)/C-l(EE) ratio, reported in the power spectra analysis of the Planck 353 GHz polarization maps. Future models of the dust foreground for CMB polarization studies will need to take into account the observed correlation between the dust polarization and the structure of interstellar matter.

General information
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Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Planck intermediate results XXXV. Probing the role of the magnetic field in the formation of structure in molecular clouds

Within ten nearby (d < 450 pc) Gould belt molecular clouds we evaluate statistically the relative orientation between the magnetic field projected on the plane of sky, inferred from the polarized thermal emission of Galactic dust observed by Planck at 353 GHz, and the gas column density structures, quantified by the gradient of the column density, N-H. The selected regions, covering several degrees in size, are analysed at an effective angular resolution of 10' FWHM, thus sampling physical scales from 0.4 to 40 pc in the nearest cloud. The column densities in the selected regions range from $N_H \approx 10^{21}$ to $10^{23}$ cm$^{-2}$, and hence they correspond to the bulk of the molecular clouds. The relative orientation is evaluated pixel by pixel and analysed in bins of column density using the novel statistical tool called "histogram of relative orientations". Throughout this study, we assume that the polarized emission observed by Planck at 353 GHz is representative of the projected morphology of the magnetic field in each region, i.e., we assume a constant dust grain alignment efficiency, independent of the local environment. Within most clouds we find that the relative orientation changes progressively with increasing N-H, from mostly parallel or having no preferred orientation to mostly perpendicular. In simulations of magnetohydrodynamic turbulence in molecular clouds this trend in relative orientation is a signature of Alfvénic or sub-Alfvénic turbulence, implying that the magnetic field is significant for the gas dynamics at the scales probed by Planck. We compare the deduced magnetic field strength with estimates we obtain from other methods and discuss the
implications of the Planck observations for the general picture of molecular cloud formation and evolution.

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Scopus rating (2015): CiteScore 3.5
Jordens Klimasystem

Uanset hvor man lever på Jorden, har vejret betydning for dagligdagen og tilværelsen. Og selvom vi i Danmark har indrettet os med mange moderne bekvemmeligheder, er vi på adskillige måder fortsat afhængige af vind og vejr. Vi er også vant til, at vejret er omskifteligt, og at det altid er forbundet med en stor usikkerhed at planlægge aktiviteter, der er

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ISM: general, ISM: magnetic fields, ISM: clouds, Dust, extinction, Submillimeter: ISM, Infrared: ISM
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afhængige af en bestemt vejtype. Heldigvis har mennesket haft en enorm evne til at tilpasse sig naturen, og således været i stand til at klare sig i områder fra ekstrem kulde til ekstrem varme.

Når vi taler om vejret, mener vi som regel atmosfærens tilstand på et bestemt sted og tidspunkt, og er typisk interesserede i oplysninger om temperatur, vind, skydække og regn. Vi er også gerne interesserede i vejrodserne nogle timer eller dage ud i fremtiden. Dette materiale handler om Jordens klima, hvor klimaet kan defineres som det gennemsnitlige vejr og vejrets variationer over en længere periode, som man traditionelt fastsætter til 30 år.

Klimaet er således ikke blot gennemsnitlige værdier af f.eks. temperatur og nedbør, men også hvor meget parametrene varierer i løbet af et år, samt hyppigheden og styrken af ekstreme vejfænomener som kraftige orkaner eller voldsomme skybrud. På trods af, at der kan være stor forskel på f.eks. sommervejret fra år til år, så holder klimaet sig som regel nogenlunde konstant.

**Kunsten at lande på en klode**

I sidste uge mislykkedes et europæisk forsøg på at lande på vores naboplanet. Rumfart er endnu ikke nogen rutineopgave, og de fleste forsøg på at nå frem til Mars er da også gået galt.

**Large Observatory for x-ray Timing (LOFT-P): a Probe-class mission concept study**

**General information**

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, National Institute for Astrophysics, NASA Marshall Space Flight Center, Naval Research Laboratory, Massachusetts Institute of Technology, Institute of Space Sciences, ISDC Data Centre for Astrophysics, University of Alabama, University of Helsinki, Texas Tech University, Space Research Centre, Département de physique nucléaire et corpusculaire, Universität Tuebingen, IRFU, University of Amsterdam, University College London
This paper summarizes the results of four recent airborne gravity campaigns, carried out between October 2013 and October 2015. For the measurements, a strapdown inertial measurement unit, type iMAR RQH 1003, was used in combination with a geodetic two-frequency GNSS receiver (Javad Delta). A centralized Kalman-Filter in combination with an RTS-smoother is used to estimate three-dimensional gravity disturbances, i.e. also including the deflections of the vertical (vector gravimetry). A thermal correction is applied to the QA2000 accelerometers in order to remove most of the long term drifts, relaxing the common requirement of an adjustment of the strapdown gravity data. Results were evaluated based on cross-over statistics, indicating standard deviations in the range from 1.0 to 1.4 mGal (without adjustment). This is an excellent result for strapdown gravimetry, clearly reaching the accuracy level of the classical instruments and thereby emphasizing the large potential of strapdown gravimetry for future campaigns.

**General information**

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Organisations: National Space Institute, Geodynamics, Technische Universität Darmstadt
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Research Facility), a consortium of several research institutions, derives Level-2 products by combination of data from the three satellites, and of the various instruments. A number of Level-2 data products are defined and produced by this consortium, including various models of the core and lithospheric field, as well as of the ionospheric and magnetospheric field. In addition, derived parameters like mantle conductivity, thermospheric mass density and winds, field-aligned currents, an ionospheric plasma bubble index, the ionospheric total electron content and the dayside equatorial zonal electrical field are determined.

The present poster describes the various processing chains of SCARF, the Level-2 output data products defined and produced by SCARF, and the timeline of Level-2 product generation.

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Localization and Broadband Follow-Up of the Gravitational-Wave Transient GW150914
A gravitational-wave (GW) transient was identified in data recorded by the Advanced Laser InterferometerGravitational-wave Observatory (LIGO) detectors on 2015 September 14. The event, initially designated G184098and later given the name GW150914, is described in detail elsewhere. By prior arrangement, preliminary estimates of the time, significance, and sky location of the event were shared with 63 teams of observers covering radio, optical, near-infrared, X-ray, and gamma-ray wavelengths with ground- and space-based facilities. In this Letter we describe the low-latency analysis of the GW data and present the sky localization of the first observed compactbinary merger. We summarize the follow-up observations reported by 25 teams via private Gamma-ray Coordinates Network circulars, giving an overview of the participating facilities, the GW sky localization coverage, the timeline, and depth of the observations. As this event turned out to be a binary black hole merger, there is little expectation of a detectable electromagnetic (EM) signature. Nevertheless, this first broadband campaign to search for a counterpart of an Advanced LIGO source represents a milestone and highlights the broad capabilities of the transient astronomy community and the observing strategies that have been developed to pursue neutron star binary merger events. Detailed investigations of the EM data and results of the EM follow-up campaign are being disseminated in papers by the individual teams.

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LOTUS— Preparing Sentinel-3 SAR Altimetry Processing for Ocean and Land

The Sentinel-3 satellite mission with its SRAL instrumentation contains new features compared to the conventional radar altimeter mission that form the basis for new innovative scientific analyses of both ocean and inland water levels. To utilize the full potential of the new data source, new methods and processing chains need to be developed. Subsequently, new potential Copernicus products should be developed that utilize the improved along-track resolution over both the oceans and over land. The main objective of the LOTUS project is to prepare the scientific and operational use of data from Sentinels 3. Then new operational processing, validation and delivery mechanisms need to be developed and implemented for generating the new dynamic products. Finally, the take-up of the new Copernicus products by the value-adding sectors needs to be stimulated and demonstrated to ensure that they will be used for commercial activities. LOTUS will develop processing scheme for extracting high-resolution sea surface heights, wave heights and wind speeds from SAR mode data. Over land, the LOTUS will develop processing scheme for extracting high-resolution river and lake heights, soil moisture, and snow water equivalents. This presentation shows results based on analyses using CRYOSAT data and available S-3 data. Furthermore, new DEMO data sets are presented and examples of scientific impact demonstrated.
LOTUS— Preparing Sentinel-3 SAR Altimetry Processing for Ocean and Land

The Sentinel-3 satellite mission with its SRAL instrumentation contains new features compared to the conventional radar altimeter mission that form the basis for new innovative scientific analyses of both ocean and inland water levels. To utilize the full potential of the new data source, new methods and processing chains need to be developed. Subsequently, new potential Copernicus products should be developed that utilize the improved alongtrack resolution over both the oceans and over land. The main objective of the LOTUS project is to prepare the scientific and operational use of data from Sentinels 3. Then new operational processing, validation and delivery mechanisms need to be developed and implemented for generating the new dynamic products. Finally, the take-up of the new Copernicus products by the value-adding sectors needs to be stimulated and demonstrated to ensure that they will be used for commercial activities. LOTUS will develop processing scheme for extracting high-resolution sea surface heights, wave heights and wind speeds from SAR mode data. Over land, the LOTUS will develop processing scheme for extracting high-resolution river and lake heights, soil moisture, and snow water equivalents. This presentation shows results based on analyses using CRYOSAT data and available S-3 data. Furthermore, new DEMO data sets are presented and examples of scientific impact demonstrated.

General information
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Organisations: National Space Institute, Geodesy, Department of Environmental Engineering, Water Resources Engineering, STARLAB, DHI Denmark, Newcastle University, CLS
Authors: Knudsen, P. (Intern), Andersen, O. B. (Intern), Nielsen, K. (Intern), Stenseng, L. (Intern), Villadsen, H. (Intern), Pellicoquin, C. (Ekstern), Reppucci, A. (Ekstern), Berry, P. (Ekstern), Thibaut, P. (Ekstern), Moreau, T. (Ekstern), Bauer-Gottwein, P. (Intern), Schneider, R. (Intern), Madsen, H. (Ekstern), Petersen, O. (Ekstern), Grode, P. (Ekstern)
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Magnetic Package data quality overview
The ESA Swarm satellites, launched in November 2013, carry on-board instruments devoted to measure extremely accurate data necessary to improve our understanding of Earth’s magnetic field. The Swarm instrument package is made by two magnetometers (one vector and one scalar), one Electric field Instrument (EFI), one Accelerometer and one GPS receiver. This presentation aims at providing an extensive overview of the magnetic instrument status, magnetic data availability and quality.

General information
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Organisations: National Space Institute, Geomagnetism, ESRIN - ESA Centre for Earth Observation, ESTEC
Authors: Qamili, E. (Ekstern), Ottavianelli, G. (Ekstern), Olsen, N. (Intern), Toffner-Clausen, L. (Intern), Mecozzi, R. (Ekstern), Coco, I. (Ekstern), Vogel, P. (Ekstern), Floberghagen, R. (Ekstern)
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Magnetic reversals from planetary dynamo waves

A striking feature of many natural dynamos is their ability to undergo polarity reversals. The best documented example is Earth's magnetic field, which has reversed hundreds of times during its history. The origin of geomagnetic polarity reversals lies in a magnetoohydrodynamic process that takes place in Earth's core, but the precise mechanism is debated. The majority of numerical geodynamo simulations that exhibit reversals operate in a regime in which the viscosity of the fluid remains important, and in which the dynamo mechanism primarily involves stretching and twisting of field lines by columnar convection. Here we present an example of another class of reversing-geodynamo model, which operates in a regime of comparatively low viscosity and high magnetic diffusivity. This class does not fit into the paradigm of reversal regimes that are dictated by the value of the local Rossby number (the ratio of advection to Coriolis force). Instead, stretching of the magnetic field by a strong shear in the east-west flow near the imaginary cylinder just touching the inner core and parallel to the axis of rotation is crucial to the reversal mechanism in our models, which involves a process akin to kinematic dynamo waves. Because our results are relevant in a regime of low viscosity and high magnetic diffusivity, and with geophysically appropriate boundary conditions, this form of dynamo wave may also be involved in geomagnetic reversals.

General information

State: Published
Organisations: National Space Institute, Geomagnetism, ETH Zurich
Authors: Sheyko, A. (Ekstern), Finlay, C. (Intern), Jackson, A. (Ekstern)
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Scopus rating (2016): CiteScore 13.33
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Scopus rating (2012): CiteScore 14.01
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BF1 (2011): BFI-level 2
Scopus rating (2011): CiteScore 13.96
ISI indexed (2011): ISI indexed yes
Magnetotelluric investigation in West Greenland - considering the polar electrojet, ocean and fjords

A magnetotelluric survey has been conducted in North West Greenland, with the purpose of investigating the subsurface. The results of two processing techniques are presented, a single station robust processing and a multiple station processing. The multiple station processing tries to eliminate data originating from other sources than the plane wave by removing incoherent noise between stations and selecting time periods from an eigenvalue criteria. It is successful for periods below 55 s, but has to undergo further investigation at longer periods. The two processing techniques show similar results, however the multiple station technique improves the data quality around 1 s compared to the single station technique. Different challenges are connected with the survey location, where ocean and fjord systems have a large impact on the transfer functions. A 3D model study of the impact of fjords on induction arrows is presented, illustrating the importance of including these in magnetotelluric modelling. This information is included in the 3D modelling of the magnetotelluric survey in Greenland, together with the bathymetry of the ocean. The modelling shows that the impact from the fjords and ocean heavily dominates the signal, making it difficult to differentiate any geology in the subsurface.

General information

State: Published
Organisations: National Space Institute, Geomagnetism, Deutsches Geoforschungszentrum, Goethe University of Frankfurt am Main
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Magnetotelluric investigation in West Greenland - considering the polar electrojet, ocean and fjords
Publication: Research › Ph.D. thesis – Annual report year: 2017

Mass balance of Greenland and the Canadian Ice Caps from combined altimetry and GRACE inversion

The combination of GRACE and altimetry data may yield a high resolution mass balance time series of the Greenland ice sheet, highlighting the varying individual mass loss behaviour of major glaciers. By including the Canadian arctic ice caps in the estimation, a more reliable estimate of the mass loss of both Greenland and the Canadian ice caps may be obtained,
minimizing the leakage errors otherwise unavoidable by GRACE. Actually, the absolute value of the Greenland ice sheet mass loss is highly dependent on methods and how the effects of Arctic Canadian ice caps are separated in the GRACE signal; here altimetry data and firn models may provide important constraints. In the presentation we outline the basis of the joint estimation method, including corrections for firn density and compaction, and use CryoSat and EnviSat data together with GRACE data to provide composite time series of mass loss of the ice caps and ice sheet basins for the period 2003-15. This period shows a marked increase of ice sheet melt, especially in NW and NE Greenland, but also show large variability, with the melt anomaly year of 2012 showing a record mass loss, followed by 2013 with essentially no Greenland mass loss at all, and lately return to the "normal" mass loss rate. While GRACE sees these later year anomalies quite clearly, the CryoSat data are affected strongly by the icesheet-wide 2012 melt event, where change in CryoSat radar penetration in the firn results in an erroneous mass gain estimate over central parts of the Greenland ice sheet. The overall estimate of mass loss trend for Greenland during the CryoSat period yields values around -280 GT/yr, with the Canadian ice cap mass loss estimated at around -40 GT/yr and -25 GT/yr for the Baffin and Ellesmere regions, respectively. The used estimation methods can readily be extended to other altimetry mission data, such as Sentinel-3 and AltiKa, and could also potentially be used to further integrate other EO parameters such as ice velocity changes of the major outlet glaciers, as produced e.g. in the ESA Greenland Ice Sheet CCI project.

Measuring a truncated disk in Aquila X-1

We present NuSTAR and Swift observations of the neutron star Aquila X-1 during the peak of its 2014 July outburst. The spectrum is soft with strong evidence for a broad Fe Kα line. Modeled with a relativistically broadened reflection model, we find that the inner disk is truncated with an inner radius of 15 ± 3RG. The disk is likely truncated by either the boundary layer and/or a magnetic field. Associating the truncated inner disk with pressure from a magnetic field gives an upper limit of B<5 ± 2x10⁸. Although the radius is truncated far from the stellar surface, material is still reaching the neutron star surface as evidenced by the X-ray burst present in the NuSTAR observation.
METH-33 - Performance assessment for the high resolution and wide swath (HRWS) post-Sentinel-1 SAR system

The next generation, post-Sentinel-1, ESA’s C-band synthetic aperture radar (SAR) system is conceived to provide simultaneously high azimuth resolution and wide swath width (HRWS). There are different ways in which the imaging capabilities of the HRWS SAR system can be exploited, which translate to different operation modes. The more attractive are the wide swath modes, operating in ScanSAR, with 400 km swath width and a resolution of 5m x 5m for single/dual-polarization and, maybe even more noteworthy, the fully-polarimetric 280 km swath width at 5m x 5m single-look resolution. These modes represent a factor four improvement in terms of azimuth resolution with respect to Sentinel-1.
Considering also the extended swath or the quad-pol capabilities, the information rate will increase by close to an order of magnitude. Indeed, wide unambiguous swath coverage and high azimuth resolution pose contradicting requirements on the design of spaceborne SAR systems. Nevertheless, recent studies have shown that by applying Digital Beam Forming (DBF) techniques, such as Scan-on-Receive (SCORE), and Multiple Azimuth Phase centers (MAPS), it becomes possible to overcome these fundamental limitations of conventional SAR systems. The use of MAPS in azimuth enables the decoupling of the high azimuth resolution and wide-swath SAR coverage. It employs a multichannel receiver in combination with mutually displaced multiple aperture elements and the azimuth resolution results determined by the length of the individual sub-aperture elements. At the same time, employing multiple channels in elevation, according to the SCORE technique, allows to collect radar echoes from a wide image swath despite using a receiver aperture with large vertical extension. This trade-off between antenna gain and swath width can thus be relaxed.

In this framework, DLR has reviewed the capabilities of the HRWS SAR system in light of the associated requirements provided by ESA and of the science requirements associated to operational GMES applications. Indeed, many and potentially new applications can benefit from the HRWS SAR operational modes. Moreover, a HRWS application performance toolkit has been designed and implemented to compare product-level performance for different operating modes and mission scenarios. The established applications defined within the GMES services and selected for the HRWS performance study are: Deformation monitoring, Regional land cover, Ocean applications (wind and currents retrieval and oil spill monitoring), Land ice (wet snow mapping and ice drift), Sea ice (iceberg detection and ice motion), Iceberg detection and Security (vessel detection).

Thus, the resulting HRWS toolkit includes for every application analytical expressions or numerical models and, if these are not available, real SAR images as well as numerical algorithms and some explicit simulations of the data and of the inversion process are employed. The tool uses as input the HRWS SAR instrument performance for the different applicable modes and produces as output results comparable with the existing C-band SAR missions. Due to its wider swath, high resolution and multipolarimetric capabilities, the performance for the HRWS SAR system show a substantial improvement when compared to those of Sentinel-1A, for most of the applications and operational scenarios. In the final paper a short description of the employed product-level performance models together with the main results will be provided. Furthermore, an analysis based on the different applications performance and on their relative relevance will give a single operational mode for the best compromise.
Miocene uplift of the NE Greenland margin linked to plate tectonics: Seismic evidence from the Greenland Fracture Zone, NE Atlantic: Margin Uplift and Plate Tectonics

Tectonic models predict that, following breakup, rift margins undergo only decaying thermal subsidence during their post-rift evolution. However, post-breakup stratigraphy beneath the NE Atlantic shelves shows evidence of regional-scale unconformities, commonly cited as outer margin responses to inner margin episodic uplift, including the formation of coastal mountains. The origin of these events remains enigmatic. We present a seismic reflection study from the
Greenland Fracture Zone – East Greenland Ridge (GFZ-EGR) and the NE Greenland shelf. We document a regional intra-Miocene seismic unconformity (IMU), which marks the termination of syn-rift deposition in the deep-sea basins and onset of: (i) thermo-mechanical coupling across the GFZ, (ii) basin compression, and (iii) contourite deposition, north of the EGR. The onset of coupling across the GFZ is constrained by results of 2-D flexural backstripping. We explain the thermo-mechanical coupling and the deposition of contourites by the formation of a continuous plate boundary along the Mohns and Knipovich ridges, leading to an accelerated widening of the Fram Strait. We demonstrate that the IMU event is linked to onset of uplift and massive shelf-progradation on the NE Greenland margin. Given an estimated middle-to-late Miocene (~15-10 Ma) age of the IMU, we speculate that the event is synchronous with uplift of the East and West Greenland margins. The correlation between margin uplift and plate-motion changes further indicates that the uplift was triggered by plate tectonic forces, induced perhaps by a change in the Iceland plume (a hot pulse) and/or by changes in intra-plate stresses related to global tectonics.

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Web of Science (2017): Indexed Yes
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Scopus rating (2015): SJR 2.657 SNIP 1.26 CiteScore 3.73
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.356 SNIP 1.346 CiteScore 3.52
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.886 SNIP 1.515 CiteScore 4.09
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.711 SNIP 1.492 CiteScore 3.6
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.75 SNIP 1.335 CiteScore 2.96
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.929 SNIP 1.698
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.615 SNIP 1.753
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Scopus rating (2004): SJR 2.63 SNIP 1.212
Scopus rating (2003): SJR 3.153 SNIP 1.73
Scopus rating (2002): SJR 3.278 SNIP 2.009
Scopus rating (2001): SJR 3.339 SNIP 1.903
Modelled glacier dynamics over the last quarter of a century at Jakobshavn Isbræ

Observations over the past 2 decades show substantial ice loss associated with the speed-up of marineterminating glaciers in Greenland. Here we use a regional three-dimensional outlet glacier model to simulate the behaviour of Jakobshavn Isbræ (JI) located in western Greenland. Our approach is to model and understand the recent behaviour of JI with a physical process-based model. Using atmospheric forcing and an ocean parametrization we tune our model to reproduce observed frontal changes of JI during 1990-2014. In our simulations, most of the JI retreat during 1990-2014 is driven by the ocean parametrization used and the glacier's subsequent response, which is largely governed by bed geometry. In general, the study shows significant progress in modelling the temporal variability of the flow at JI. Our results suggest that the overall variability in modelled horizontal velocities is a response to variations in terminus position. The model simulates two major accelerations that are consistent with observations of changes in glacier terminus. The first event occurred in 1998 and was triggered by a retreat of the front and moderate thinning of JI prior to 1998. The second event, which started in 2003 and peaked in the summer 2004, was triggered by the final breakup of the floating tongue. This break-up reduced the buttressing at the JI terminus that resulted in further thinning. As the terminus retreated over a reverse bed slope into deeper water, sustained high velocities over the last decade have been observed at JI. Our model provides evidence that the 1998 and 2003 flow accelerations are most likely initiated by the ocean parametrization used but JI's subsequent dynamic response was governed by its own bed geometry. We are unable to reproduce the observed 2010-2012 terminus retreat in our simulations. We attribute this limitation to either inaccuracies in basal topography or to misrepresentations of the climatic forcings that were applied. Nevertheless, the model is able to simulate the previously observed increase in mass loss through 2014.

General information
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Organisations: National Space Institute, Geodesy, University of Alaska Fairbanks, University of Luxembourg, University of Bristol, Utrecht University, University of Copenhagen
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Scopus rating (2016): CiteScore 5.49 SJR 3.696 SNIP 1.825
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 4.118 SNIP 1.663 CiteScore 5.35
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Scopus rating (2014): SJR 3.976 SNIP 1.727 CiteScore 5.39
Modelling dynamics of Jakobshavn Isbræ and its contribution to sea level rise over the past and future century

The rate of net ice mass loss from Greenland’s marine terminating glaciers has more than doubled over the past two decades, highlighting their importance for future sea level rise. Current projections are built upon observations from a short term record spanning only from several years to a decade. However, the last decade is dominated by anomalous dynamic changes and is therefore not representative of multi-decadal behaviour of glacier dynamics.

A regional three-dimensional outlet glacier model developed as part of the PISM is used to simulate the behaviour of Jakobshavn Isbræ (JI; located in west Greenland) since the end of the Little Ice Age (LIA). The model is forced with different climate variables: near-surface air temperature, surface mass balance (SMB), sea-surface temperature and salinity. In order to accurately simulate and understand the longer term controls of dynamic changes, the model is constrained by observed terminus positions (1900-2014) and mass change estimates (1997-2014). The present study is the first that successfully simulated JI’s behaviour over the last century. For the period 1990-2014, the model simulated two major accelerations in 1998 and 2003 that are consistent with observations of changes in glacier terminus. An initial, and most probably the first significant acceleration of JI after the end of LIA was modelled in ~1930. Overall, I found that the ocean influence in JI’s behaviour over the last century is significant and most of the JI retreat during 1840–2014 is driven by the ocean parametrization and the glacier’s subsequent response, which was largely governed by its own bed geometry. In my simulations, the retreat of the front reduced the buttressing at the terminus and generated a dynamic response in the upstream region of JI which finally led to flow acceleration. This buttressing effect tends to govern JI’s behaviour. Consequently, the results showed that the dynamic changes modelled at JI are triggered at the terminus.

In a final phase, using this model that has been adjusted to the longer-term record, I performed experiments to the near future (i.e., 2013-2100) using five ocean temperature scenarios and two atmospheric scenarios (RCP 4.5 and RCP 8.5) as climate forcing. In terms of mass change, I found that from the end of the LIA until the end of the 21st century JI’s mass change was and will remain predominately dynamically controlled (between 74 % and 86 % of the mass change is dynamic in origin). The study further indicates that the change in mass loss at JI is already triggered and that an eminent collapse of the terminus by the end of the century with retreat of up to 40 km along JI’s downward-sloping, marine-based bed is inevitable. A cooling experiment suggested that 0.9 °C of ocean cooling is needed to reverse the current retreat trend which however, will restart once cooling stops. The modelled cumulative mass change for the period 1840-2012 is ~1215 Gt or 3.4 mm SLR equivalent. For the 21st century, the best case scenario with regards to future warming (i.e., no increase in surface ocean temperature relative to present day) suggested mass loss estimates amount to ~1860 Gt by the year 2100 (67 % increase relative to 1840-2012) or 5.2 mm SLR equivalent. In the worst case scenario with regards to future warming expected mass loss of JI amounts to 3275 Gt by the year 2100 (192 % increase relative to 1840-2012) or
9.1 mm SLR equivalent. Overall, the study is unique both in approach and results obtained, and shows significant progress in modelling the temporal variability of the flow at JI. The study improves our quantitative understanding of the past and future of JI’s dynamics.

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Authors: Muresan, I. S. (Intern), Khan, S. A. (Intern)
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Relations
Projects:
Modelling dynamics of Jakobshavn Isbræ and its contribution to sea level rise over the past and future century
Multidimensional Big Spatial Data Modeling Through A Case Study: Lte Rf Subsystem Power Consumption Modeling

This paper presents a case study for comparing different multidimensional mathematical modeling methodologies used in multidimensional spatial big data modeling and proposing a new technique. An analysis of multidimensional modeling approaches (neural networks, polynomial interpolation and homotopy continuation) was conducted for finding an approach with the highest accuracy for obtaining reliable information about a cell phone consumed power and emitted radiation from streams of measurements of different physical quantities and the uncertainty ranges of these measure ments. The homotopy continuation numerical approach proved to have the highest accuracy (97%). This approach was validated against another device with a different RF subsystem design. The approach modelled the power consumption of the validation device with an accuracy of 98%.

General information
State: Published
Organisations: National Space Institute, Geodesy, Micromove.com
Authors: Antón Castro, F. (Intern), Musiige, D. (Intern), Mioc, D. (Intern), Lauлагnet, V. (Ekstern)
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Scopus rating (2009): SJR 0.155 SNIP 0.294
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Multi-Instrument Observations of Geomagnetic Storms in the Arctic Ionosphere

We present a multi-instrumented approach for the analysis of the Arctic ionosphere during the 19 February 2014 highly complex, multiphase geomagnetic storm. The geomagnetic storm was the result of two powerful and subsequent Earth-directed coronal mass ejections (CMEs). The first one was launched from the solar corona on 16 February and the second one on 18 February. We focus on effects of such solar-originated geomagnetic disturbances on the high latitude ionosphere because our present understanding of the fundamental ionospheric processes – particularly during perturbed times – in this region is still incomplete.

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Multimwavelength study of quiescent states of Mrk 421 with unprecedented hard x-ray coverage provided by NuSTAR in 2013

We present coordinated multimwavelength observations of the bright, nearby BL Lacertae object Mrk 421 taken in 2013 January-March, involving GASP-WEBT, Swift, NuSTAR, Fermi-LAT, MAGIC, VERITAS, and other collaborations and instruments, providing data from radio to very high energy (VHE) γ-ray bands. NuSTAR yielded previously unattainable sensitivity in the 3-79 keV range, revealing that the spectrum softens when the source is dimmer until the X-ray spectral shape saturates into a steep τ≈3 power law, with no evidence for an exponential cutoff or additional hard components up to ~80 keV. For the first time, we observed both the synchrotron and the inverse-Compton peaks of the spectral energy distribution (SED) simultaneously shifted to frequencies below the typical quiescent state by an order of magnitude. The fractional variability as a function of photon energy shows a double-bump structure that relates to the two bumps of the broadband SED. In each bump, the variability increases with energy, which, in the framework of the synchrotron self-Compton model, implies that the electrons with higher energies are more variable. The measured multi band variability, the significant X-ray-to-VHE correlation down to some of the lowest fluxes ever observed in both bands, the lack of correlation between optical/UV and X-ray flux, the low degree of polarization and its significant (random) variations, the short estimated electron cooling time, and the significantly longer variability timescale observed in the NuSTAR light curves point toward in situ electron acceleration and suggest that there are multiple compact regions contributing to the broadband emission of Mrk 421 during low-activity states.

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Numerical simulation of positive streamer development in thundercloud field enhanced near raindrops

As the threshold field strength for the breakdown in air significantly exceeds the maximum measured thundercloud strength 3 kV/cm/atm, the problem of lightning initiation remains unclear. According to the popular idea, lightning can be initiated from streamer discharges developed in the enhanced electric field in a vicinity of hydrometeors. To test the idea, we carry out numerical simulations of positive streamer development around charged water drops at air pressure typical at thundercloud altitudes and at different background fields, drop sizes and charges. With real drop sizes and charges, the electric field required for the streamer formation is stronger than the measured fields; therefore, second mechanism is required to amplify the local field.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Russian Federal Nuclear Center
Authors: Babich, L. P. (Ekstern), Bochkov, E. I. (Ekstern), Kutsyk, I. M. (Ekstern), Neubert, T. (Intern)
Pages: 449-454
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Main Research Area: Technical/natural sciences
NuSTAR and Swift observations of the very high state in GX 339-4: Weighing the black hole with X-rays
We present results from spectral fitting of the very high state of GX 339-4 with Nuclear Spectroscopic Telescope Array (NuSTAR) and Swift. We use relativistic reflection modeling to measure the spin of the black hole and inclination of the inner disk and find a spin of $a = 0.95(-0.08)(+0.02)$ and inclination of $30\,\text{degrees} +/- 1\,\text{degrees}$ (statistical errors). These values agree well with previous results from reflection modeling. With the exceptional sensitivity of NuSTAR at the high-energy side of the disk spectrum, we are able to constrain multiple physical parameters simultaneously using continuum fitting. By using the constraints from reflection as input for the continuum fitting method, we invert the conventional fitting procedure to estimate the mass and distance of GX 339-4 using just the X-ray spectrum, finding a mass of $9.0(-1.2)(+1.6)\,\text{M}_{\odot}$ and distance of $8.4 +/- 0.9\,\text{kpc}$ (statistical errors).
NuSTAR and XMM-Newton Observations of the Hard X-Ray Spectrum of Centaurus A

We present simultaneous XMM-Newton and NuSTAR observations spanning 3–78 keV of the nearest radiogalaxy, Centaurus A (Cen A), performed during a very high flux state. The accretion geometry around the central engine in Cen A is still debated, and we investigate possible configurations using detailed X-ray spectral modeling. NuSTAR imaged the central region of Cen A with subarcminute resolution at X-ray energies above 10 keV for the first time, but finds no evidence for an extended source or other off-nuclear point-sources. The XMM-Newton and NuSTAR spectra agree well and can be described with an absorbed power-law with photon index $\Gamma = 1.815 \pm 0.005$ and a fluorescent Fe Kα line in good agreement with literature values. The spectrum does not require a high-energy exponential rollover, with a constraint of $E_{\text{fold}} > 1$ MeV. Athermal Comptonization continuum describes the data well, with parameters that agree with values measured by INTEGRAL, in particular an electron temperature of $kT_e \approx 220$ keV, assuming a 10 eV seed photon input temperature. We do not find evidence for reflection or a broad iron line and put stringent upper limits of $R < 0.01$ on the reflection fraction and accretion disk illumination. We discuss different scenarios for the physical origin of the observed X-ray spectrum, and conclude that the inner disk is replaced by an advection-dominated accretion flow or that the hard X-rays are dominated by synchrotron self-Compton emission from the inner regions of the radio jet or a combination thereof.

General information
State: Published
Organisations: National Space Institute, Astrophysics, California Institute of Technology, Radboud University Nijmegen, Universidad de Valparaiso, Universität Würzburg, University of California at Berkeley, Lawrence Livermore National Laboratory, Dr. Karl-Remeis-Sternwarte and Erlangen Center for Astroparticle Physics, Virginia Tech, Columbia University, Stanford University, Università degli Studi Roma Tre, University of California, San Diego, NASA Goddard Space Flight Center
Authors: Fürst, F. (Ekstern), Müller, C. (Ekstern), Madsen, K. K. (Ekstern), Lanz, L. (Ekstern), Rivers, E. (Ekstern), Brightman, M. (Ekstern), Arevalo, P. (Ekstern), Baloković, M. (Ekstern), Beuchert, T. (Ekstern), Bogg, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Dauser, T. (Ekstern), Farrah, D. (Ekstern), Graefe, C. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Kadler, M. (Ekstern), King, A. (Ekstern), Krauss, F. (Ekstern), Madejski,
NuSTAR observations of the black holes GS 1354-645: Evidence of rapid black hole spin

We present the results of a NuSTAR study of the dynamically confirmed stellar-mass black hole GS 1354-645. The source was observed during its 2015 "hard" state outburst; we concentrate on spectra from two relatively bright phases. In the higher-flux observation, the broadband NuSTAR spectra reveal a clear, strong disk reflection spectrum, blurred by a degree that requires a black hole spin of $a = c/\sqrt{GM(2)} > 0.98$ (1 sigma statistical limits only). The fits also require a high inclination: $0 \leq i \approx 75 (2)\text{degrees}$. Strong "dips" are sometimes observed in the X-ray light curves of sources viewed at such an angle; these are absent, perhaps indicating that dips correspond to flared disk structures that only manifest at higher accretion rates. In the lower flux observation, there is evidence of radial truncation of the thin accretion disk. We discuss these results in the context of spin in stellar-mass black holes, and inner accretion flow geometries at moderate accretion rates.

General Information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Michigan, University of California at Berkeley, California Institute of Technology, Columbia University, NASA Goddard Space Flight Center
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**NuSTAR observations of water megamaser AGN**

Aims. We study the connection between the masing disk and obscuring torus in Seyfert 2 galaxies.

Methods. We present a uniform X-ray spectral analysis of the high energy properties of 14 nearby megamaser active galactic nuclei observed by NuSTAR. We use a simple analytical model to localize the maser disk and understand its connection with the torus by combining NuSTAR spectral parameters with the available physical quantities from VLBI mapping.

Results. Most of the sources that we analyzed are heavily obscured, showing a column density in excess of similar to 10^{23} cm^{-2}; in particular, 79% are Compton-thick (N_H > 1.5 x 10^{24} cm^{-2}). When using column densities measured by NuSTAR with the assumption that the torus is the extension of the maser disk, and further assuming a reasonable density profile, we can predict the torus dimensions. They are found to be consistent with mid-IR interferometry parsec-scale observations of Circinus and NGC 1068. In this picture, the maser disk is intimately connected to the inner part of the torus. It is probably made of a large number of molecular clouds that connect the torus and the outer part of the accretion disk, giving rise to a thin disk rotating in most cases in Keplerian or sub-Keplerian motion. This toy model explains the established close connection between water megamaser emission and nuclear obscuration as a geometric effect.

**General information**

State: Published

Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Lawrence Livermore National Laboratory, Pennsylvania State University, National Institute for Astrophysics, California Institute of Technology, New York University Abu Dhabi, Pontificia Universidad Catolica de Chile, University of California at Berkeley, Columbia University, ETH Zurich, SLAC National Accelerator Laboratory, Georgia Institute of Technology, NASA Goddard Space Flight Center, University of Southampton


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NUSTAR, SWIFT, and GROND Observations of the Flaring MEV Blazar PMN J0641-0320

MeV blazars are a sub-population of the blazar family, exhibiting larger-than-average jet powers, accretion luminosities, and black hole masses. Because of their extremely hard X-ray continua, these objects are best studied in the X-ray domain. Here, we report on the discovery by the Fermi Large Area Telescope and subsequent follow-up observations with NuSTAR, Swift, and GROND of a new member of the MeV blazar family: PMN J0641-0320. Our optical spectroscopy provides confirmation that this is a flat-spectrum radio quasar located at a redshift of z = 1.196. Its very hard NuSTAR spectrum (power-law photon index of similar to 1 up to similar to 80 keV) indicates that the emission is produced via inverse Compton scattering of photons coming from outside the jet. The overall spectral energy distribution of PMN J0641-0320 is typical of powerful blazars and, using a simple one-zone leptonic emission model, we infer that the emission region is located either inside the broad line region or within the dusty torus.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Lawrence Livermore National Laboratory, National Institute for Astrophysics, Indian Institute of Astrophysics, NASA Goddard Space Flight Center, SLAC National Accelerator Laboratory, Max-Planck Institut für Extraterrestrische Physik, University of Turin, California Institute of Technology, Deutsches Elektronen-Zeuthen, Universita degli Studi di Bologna, University of California at Berkeley,
Columbia University, Clemson University
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Observing and Modelling the High Water Level from Satellite Radar Altimetry During Tropical Cyclones

This paper investigates the capability of observing tropical cyclones using satellite radar altimetry. Two representative cyclones Yasi (February 2011) and Larry (March 2006) in the northeast Australian coastal area are selected based also on available tide gauge sea level measurements. It is shown that altimetry data can capture high water levels induced by Larry and Yasi through a careful re-processing and re-editing of the data. About 18 years of data from multi-satellite altimetry missions including TOPEX/Poseidon, Jason-1 and Jason-2, and seven tide gauges around the northern Australian coast are integrated using a multivariate regression approach. The results reveal that the multi-regression model can, in general, explain >60 % of sea level variances in the study area. The model is then validated using independent data from tide gauge in Townsville. The comparison results indicate that the high sea levels predicted by the model taken into account of both altimetry and tide-gauge data agree well with those observed at Townsville during cyclone Larry.

General information
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Organisations: National Space Institute, Geodesy, University of Newcastle
Authors: Deng, X. (Ekstern), Gharineiat, Z. (Ekstern), Andersen, O. B. (Intern), G. Stewart, M. (Ekstern)
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Oceans Melting Greenland: Early Results from NASA's Ocean-Ice Mission in Greenland

Melting of the Greenland Ice Sheet represents a major uncertainty in projecting future rates of global sea level rise. Much of this uncertainty is related to a lack of knowledge about subsurface ocean hydrographic properties, particularly heat content, how these properties are modified across the continental shelf, and about the extent to which the ocean interacts with glaciers. Early results from NASA's five-year Oceans Melting Greenland (OMG) mission, based on extensive hydrographic and bathymetric surveys, suggest that many glaciers terminate in deep water and are hence vulnerable to increased melting due to ocean-ice interaction. OMG will track ocean conditions and ice loss at glaciers around Greenland through the year 2020, providing critical information about ocean-driven Greenland ice mass loss in a warming climate.

General information
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Omnibus test for change detection in a time sequence of polarimetric SAR data

Based on an omnibus likelihood ratio test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated p-value and a factorization of this test statistic, change analysis in a (short) time series of multilook, polarimetric SAR data in the covariance matrix representation is carried out. The omnibus test statistic and its factorization detect if and when change(s) occur. The technique is demonstrated on airborne EMISAR C-band data but may be applied to ALOS, COSMO-SkyMed, RadarSat-2, Sentinel-1, TerraSAR-X, and Yoagan or other dual- and quad/full-pol data also.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, A. A. (Intern), Conradsen, K. (Intern), Skriver, H. (Intern)
Pages: 3398-3401
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On the feasibility of space-based radar ice sounding of the Antarctic ice sheet at P-band

Space-based radio echo sounding (RES) of the continental ice sheets can potentially offer full coverage, uniform data quality and sampling. Ice sounding radars must operate at low frequencies in order to ensure low attenuation of the signal as it propagates down through the ice and back from base of the ice sheet. Typical frequencies of airborne radar ice sounders are between 60 MHz and 150 MHz. However, the lowest possible frequency for space-based radar ice sounders is 435 MHz. In 2004 the International Telecommunication Union (ITU) radio regulations allocated a 6 MHz band at 435 MHz (P-band) enabling space-based Earth observation radar missions at a frequency that might be applicable for ice sounding. The payload of ESA's Earth Explorer 7 mission, Biomass, is a P-band radar. At P-band the attenuation and scattering properties of the ice sheets are not as well known as they are at the lower frequencies commonly used from aircraft, but in 2005 ESA commissioned development of a P-band polarimetric airborne radar ice sounder (POLARIS) [1], and encouraging results were obtained with data acquired in Greenland. In February 2011 POLARIS data were acquired in Antarctica as part of a close scientific collaboration between seven organizations in Europe and North and South America [2]. The primary objective of this IceGrav campaign was to measure gravity in Queen Maud Land, but a secondary objective was to acquire P-band sounder data, benefitting from the large coverage offered by the Basler DC3 aircraft used.

In this study the feasibility of space-based radar ice sounding is assessed. A two-step approach is applied: (1) Key ice sheet parameters are estimated from the airborne POLARIS data acquired in Antarctica. (2) The performance of potential space-based ice sounding radars is simulated based on the estimated ice parameters and system parameters envisioned for a space-based radar. The first step is accomplished by establishing empirical models of the attenuation coefficients and backscatter coefficients for the surface, volume and base of glaciers, ice shelves, central ice sheets etc.. The models are used in combination with the POLARIS system parameters and the data acquisition geometry to iteratively simulate return waveforms, compare them with the measured waveforms, and adjust the ice parameters until the simulated waveforms and the measured waveforms match.

This iterative approach is supplemented by a direct data analysis estimating the scattering patterns via the Doppler spectra of the POLARIS data. The scattering patterns of the ice surfaces are relevant because the geometry of a space-based radar increases the risk that off-nadir surface clutter masks the nadir depth-signal of interest. Currently the ice sheet model is being established and validated. At the symposium measured and simulated satellite waveforms will be compared, and the feasibility of space-based ice sounding will be addressed.

Peering through the dust: NuSTAR observations of two first-2MASS red quasars

Some reddened quasars appear to be transitional objects in the paradigm of merger-induced black hole growth/galaxy evolution, where a heavily obscured nucleus starts to be unveiled by powerful quasar winds evacuating the surrounding cocoon of dust and gas. Hard X-ray observations are able to peer through this gas and dust, revealing the properties of circumnuclear obscuration. Here, we present NuSTAR and XMM-Newton/Chandra observations of FIRST-2MASS-selected red quasars F2M 0830+3759 and F2M 1227+3214. We find that though F2M 0830+3759 is moderately obscured ($N_{H_2} = (2.1 \pm 0.2) \times 10^{22}$ cm$^{-2}$) and F2M 1227+3214 is mildly absorbed ($N_{H_2} < 5.5 \times 10^{22}$ cm$^{-2}$) along the line of sight, heavier global obscuration may be present in both sources, with cm$^{-2}$ and <5.5 $\times$ 10$^{22}$ cm$^{-2}$for F2M 0830+3759 and F2M 1227+3214, respectively. F2M 0830+3759 also has an excess of soft X-ray emission below 1 keV, which is well accommodated by a model where 7% of the intrinsic X-ray emission from the active galactic nucleus (AGN) is scattered into the line of sight.
While F2M 1227+3214 has a dust-to-gas ratio \( (E(B-V)/N_H) \) consistent with the Galactic value, the value of \( E(B-V)/N_H \) for F2M 0830+3759 is lower than the Galactic standard, consistent with the paradigm that the dust resides on galactic scales while the X-ray reprocessing gas originates within the dust sublimation zone of the broad-line region. The X-ray and 6.1 μm luminosities of these red quasars are consistent with the empirical relations derived for high-luminosity, unobscured quasars, extending the parameter space of obscured AGNs previously observed by NuSTAR to higher luminosities.
Performance of a Processor for On-Board RFI Detection and Mitigation in MetOpSG Radiometers

An RFI processor breadboard has been designed and developed for the second generation MetOp satellites. RFI detection is based on the anomalous amplitude, kurtosis, and cross-frequency algorithms. These are implemented in VHDL code in an FPGA. Thus, algorithm performance can very well be assessed by proper code simulation. Such simulations show that the kurtosis algorithm as implemented works according to theory when subjected to pulsed sinusoidal and QPSK signals.

General information
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Organisations: National Space Institute, Microwaves and Remote Sensing, Harp Technologies Ltd.
Authors: Skou, N. (Intern), Kristensen, S. S. (Intern), Lahtinen, J. (Ekstern), Kovanen, A. (Ekstern)
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Performing High-Quality Science on CubeSats

January 2016 the International Space Science Institute in Berne, Switzerland, hosted a two-day Forum to focus on the rapid evolution of CubeSats as an enabling technology platform, with special emphasis on their promise to perform high-quality science. The Forum was initiated in coordination with a then-ongoing, and recently published study performed by the US National Academies on the same topic (goo.gl/osCSQ3), and was focused on the international context of CubeSats-enabled science. This report summarizes the conclusions from this Forum to inform the growing international community of the activities in this area of research. Our discussions focused on four themes characteristic of CubeSats and their evolution: 1) identification of appropriate science in a variety of research disciplines, 2) technology development, 3) international vs. national approaches, and 4) educational benefits. These discussions will be followed by a few Appendices, each describing a concrete and illustrative example of a national or international engagement with science-focused CubeSats, or their enabling technologies.

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Planck 2015 results: III. LFI systematic uncertainties

We present the current accounting of systematic effect uncertainties for the Low Frequency Instrument (LFI) that are relevant to the 2015 release of the Planck cosmological results, showing the robustness and consistency of our data set, especially for polarization analysis. We use two complementary approaches: (i) simulations based on measured data and physical models of the known systematic effects; and (ii) analysis of difference maps containing the same sky signal ("null-maps"). The LFI temperature data are limited by instrumental noise. At large angular scales the systematic effects are below the cosmic microwave background (CMB) temperature power spectrum by several orders of magnitude. In polarization the systematic uncertainties are dominated by calibration uncertainties and compete with the CMB E-modes in the multipole range 10-20. Based on our model of all known systematic effects, we show that these effects introduce a slight bias of around 0.2σ on the reionization optical depth derived from the 70GHz EE spectrum using the 30 and 353GHz channels as foreground templates. At 30GHz the systematic effects are smaller than the Galactic foreground at all scales in temperature and polarization, which allows us to consider this channel as a reliable template of synchrotron emission. We assess the residual uncertainties due to LFI effects on CMB maps and power spectra after component separation and show that these effects are smaller than the CMB amplitude at all scales. We also assess the impact on non-Gaussianity studies and find it to be negligible. Some residuals still appear in null maps from particular sky survey pairs, particularly at 30 GHz, suggesting possible straylight contamination due to an imperfect knowledge of the beam far sidelobes.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: II. Low Frequency Instrument data processings

We present an updated description of the Planck Low Frequency Instrument (LFI) data processing pipeline, associated with the 2015 data release. We point out the places where our results and methods have remained unchanged since the 2013 paper and we highlight the changes made for the 2015 release, describing the products (especially timelines) and the ways in which they were obtained. We demonstrate that the pipeline is self-consistent (principally based on simulations) and report all null tests. For the first time, we present LFI maps in Stokes Q and U polarization. We refer to other related papers where more detailed descriptions of the LFI data processing pipeline may be found if needed.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: I. Overview of products and scientific results

The European Space Agency's Planck satellite, which is dedicated to studying the early Universe and its subsequent evolution, was launched on 14 May 2009. It scanned the microwave and submillimetre sky continuously between 12 August 2009 and 23 October 2013. In February 2015, ESA and the Planck Collaboration released the second set of cosmology products based on data from the entire Planck mission, including both temperature and polarization, along with a set of scientific and technical papers and a web-based explanatory supplement. This paper gives an overview of the main characteristics of the data and the data products in the release, as well as the associated cosmological and astrophysical science results and papers. The data products include maps of the cosmic microwave background (CMB), the thermal Sunyaev-Zeldovich effect, diffuse foregrounds in temperature and polarization, catalogues of compact Galactic and extragalactic sources (including separate catalogues of Sunyaev-Zeldovich clusters and Galactic cold clumps), and extensive simulations of signals and noise used in assessing uncertainties and the performance of the analysis methods. The likelihood code used to assess cosmological models against the Planck data is described, along with a CMB lensing likelihood. Scientific results include cosmological parameters derived from CMB power spectra, gravitational lensing, and cluster counts, as well as constraints on inflation, non-Gaussianity, primordial magnetic fields, dark energy, and modified gravity, and new results on low-frequency Galactic foregrounds.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: IV. Low Frequency Instrument beams and window functions

This paper presents the characterization of the in-flight beams, the beam window functions, and the associated uncertainties for the Planck Low Frequency Instrument (LFI). The structure of the paper is similar to that presented in the 2013 Planck release; the main differences concern the beam normalization and the delivery of the window functions to be used for polarization analysis. The in-flight assessment of the LFI main beams relies on measurements performed during observations of Jupiter. By stacking data from seven Jupiter transits, the main beam profiles are measured down to -25 dB at 30 and 44 GHz, and down to -30 dB at 70 GHz. It has been confirmed that the agreement between the simulated beams and the measured beams is better than 1% at each LFI frequency band (within the 20 dB contour from the peak, the rms values are 0.1% at 30 and 70 GHz; 0.2% at 44 GHz). Simulated polarized beams are used for the computation of the effective beam window functions. The error budget for the window functions is estimated from both main beam and sidelobe contributions, and accounts for the radiometer band shapes. The total uncertainties in the effective beam window functions are 0.7% and 1% at 30 and 44 GHz, respectively (at $\ell = 600$); and 0.5% at 70 GHz (at $\ell = 1000$).

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results IX. Diffuse component separation: CMB maps

We present foreground-reduced cosmic microwave background (CMB) maps derived from the full Planck data set in both temperature and polarization. Compared to the corresponding Planck 2013 temperature sky maps, the total data volume is larger by a factor of 3.2 for frequencies between 30 and 70 GHz, and by 1.9 for frequencies between 100 and 857 GHz. In addition, systematic errors in the forms of temperature-to-polarization leakage, analogue-to-digital conversion uncertainties, and very long time constant errors have been dramatically reduced, to the extent that the cosmological polarization signal may now be robustly recovered on angular scales $\ell \gtrsim 40$. On the very largest scales, instrumental systematic residuals are still non-negligible compared to the expected cosmological signal, and modes with $\ell < 20$ are accordingly suppressed in the current polarization maps by high-pass filtering. As in 2013, four different CMB component separation algorithms are applied to these observations, providing a measure of stability with respect to algorithmic and modelling choices. The resulting polarization maps have rms instrumental noise ranging between 0.21 and 0.27 $\mu$K averaged over 55’ pixels, and between 4.5 and 6.1 $\mu$K averaged over pixels. The cosmological parameters derived from the analysis of temperature power spectra are in agreement at the 1σ level with the Planck 2015 likelihood. Unresolved mismatches between the noise properties of the data and simulations prevent a satisfactory description of the higher-order statistical properties of the polarization maps. Thus, the primary applications of these polarization maps are those that do not require massive simulations for accurate estimation of uncertainties, for instance estimation of cross-spectra and cross-correlations, or stacking analyses. However, the amplitude of primordial non-Gaussianity is consistent with zero within $2\sigma$ for all local, equilateral, and orthogonal configurations of the bispectrum, including for polarization $E$-modes. Moreover, excellent agreement is found regarding the lensing $\ell$-mode power spectrum, both internally among the various component separation codes and with the best-fit Planck 2015 $\Lambda$ cold dark matter model.
The Planck High Frequency Instrument (HFI) has observed the full sky at six frequencies (100, 143, 217, 353, 545, and 857 GHz) in intensity and at four frequencies in linear polarization (100, 143, 217, and 353 GHz). In order to obtain sky maps, the time-ordered information (TOI) containing the detector and pointing samples must be processed and the angular response must be assessed. The full mission TOI is included in the Planck 2015 release. This paper describes the
HFI TOI and beam processing for the 2015 release. HFI calibration and map making are described in a companion paper. The main pipeline has been modified since the last release (2013 nominal mission in intensity only), by including a correction for the nonlinearity of the warm readout and by improving the model of the bolometer time response. The beam processing is an essential tool that derives the angular response used in all the Planck science papers and we report an improvement in the effective beam window function uncertainty of more than a factor of 10 relative to the 2013 release. Noise correlations introduced by pipeline filtering function are assessed using dedicated simulations. Angular cross-power spectra using data sets that are decorrelated in time are immune to the main systematic effects.

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Planck 2015 results: VIII. High Frequency Instrument data processing: Calibration and maps

This paper describes the processing applied to the cleaned, time-ordered information obtained from the Planck High Frequency Instrument (HFI) with the aim of producing photometrically calibrated maps in temperature and (for the first time) in polarization. The data from the entire 2.5-year HFI mission include almost five full-sky surveys. HFI observes the sky over a broad range of frequencies, from 100 to 857 GHz. To obtain the best accuracy on the calibration over such a large range, two different photometric calibration schemes have been used. The 545 and 857 GHz data are calibrated using models of planetary atmospheric emission. The lower frequencies (from 100 to 353 GHz) are calibrated using the time-variable cosmological microwave background dipole, which we call the orbital dipole. This source of calibration only depends on the satellite velocity with respect to the solar system. Using a CMB temperature of TCMB = 2.7255 ± 0.0006 K, it permits an independent measurement of the amplitude of the CMB solar dipole (3364.3 ± 1.5 μK), which is approximatively 1σ higher than the WMAP measurement with a direction that is consistent between the two experiments. We describe the pipeline used to produce the maps of intensity and linear polarization and in particular the leakage induced by flux mismatch between the detectors that leads to spurious polarization signal.

General information

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Planck 2015 results: VI. LFI mapmaking

This paper describes the mapmaking procedure applied to Planck Low Frequency Instrument (LFI) data. The mapmaking step takes as input the calibrated timelines and pointing information. The main products are sky maps of I, Q, and U Stokes components. For the first time, we present polarization maps at LFI frequencies. The mapmaking algorithm is based on a destriping technique, which is enhanced with a noise prior. The Galactic region is masked to reduce errors arising from bandpass mismatch and high signal gradients. We apply horn-uniform radiometer weights to reduce the effects of beam-shape mismatch. The algorithm is the same as used for the 2013 release, apart from small changes in parameter settings. We validate the procedure through simulations. Special emphasis is put on the control of systematics, which is particularly important for accurate polarization analysis. We also produce low-resolution versions of the maps and corresponding noise covariance matrices. These serve as input in later analysis steps and parameter estimation. The noise covariance matrices are validated through noise Monte Carlo simulations. The residual noise in the map products is characterized through analysis of half-ring maps, noise covariance matrices, and simulations.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
Planck 2015 results: V. LFI calibration

We present a description of the pipeline used to calibrate the Planck Low Frequency Instrument (LFI) timelines into thermodynamic temperatures for the Planck 2015 data release, covering four years of uninterrupted operations. As in the 2013 data release, our calibrator is provided by the spin-synchronous modulation of the cosmic microwave background dipole, but we now use the orbital component, rather than adopting the Wilkinson Microwave Anisotropy Probe (WMAP) solar dipole. This allows our 2015 LFI analysis to provide an independent Solar dipole estimate, which is in excellent agreement with that of HFI and within 1σ (0.3% in amplitude) of the WMAP value. This 0.3% shift in the peak-to-peak dipole temperature from WMAP increases the overall level of the LFI maps by 0.45% (30 GHz), 0.64% (44 GHz), and 0.82% (70 GHz) in temperature with respect to the 2013 Planck data release, thus reducing the discrepancy with the power spectrum measured by WMAP. We estimate that the LFI calibration uncertainty is now at the level of 0.20% for the 70 GHz map, 0.26% for the 44 GHz map, and 0.35% for the 30 GHz map. We provide a detailed description of the impact of all the changes implemented in the calibration since the previous data release.

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Planck 2015 results: XIII. Cosmological parameters

This paper presents cosmological results based on full-mission Planck observations of temperature and polarization anisotropies of the cosmic microwave background (CMB) radiation. Our results are in very good agreement with the 2013 analysis of the Planck nominal-mission temperature data, but with increased precision. The temperature and polarization power spectra are consistent with the standard spatially-flat 6-parameter ΛCDM cosmology with a power-law spectrum of adiabatic scalar perturbations (denoted "base ΛCDM" in this paper). From the Planck temperature data combined with Planck lensing, for this cosmology we find a Hubble constant, $H_0 = (67.8 \pm 0.9)$ km s$^{-1}$Mpc$^{-1}$, a matter density parameter $\Omega_m = 0.308 \pm 0.012$, and a tilted scalar spectral index with $n_s = 0.968 \pm 0.006$, consistent with the 2013 analysis. Note that in this abstract we quote 68% confidence limits on measured parameters and 95% upper limits on other parameters. We present the first results of polarization measurements with the Low Frequency Instrument at large angular scales. Combined with the Planck temperature and lensing data, these measurements give a reionization optical depth of $\tau = 0.066 \pm 0.016$, corresponding to a reionization redshift of $z_{\text{re}} = 8.8^{+1.7}_{-1.4}$. These results are consistent with those from WMAP polarization measurements cleaned for dust emission using 353-GHz polarization maps from the High Frequency Instrument. We find no evidence for any departure from base ΛCDM in the neutrino sector of the theory; for example, combining Planck observations with other astrophysical data we find $N_{\text{eff}} = 3.15 \pm 0.23$ for the effective number of relativistic degrees of freedom, consistent with the value $N_{\text{eff}} = 3.046$ of the Standard Model of particle physics. The sum of neutrino masses is constrained to $\sum m_\nu < 0.23$ eV. The spatial curvature of our Universe is found to be very...
close to zero, with $|\Delta K| < 0.005$. Adding a tensor component as a single-parameter extension to base $\Lambda$CDM we find an upper limit on the tensor-to-scalar ratio of $r_{0.002} < 0.11$, consistent with the Planck 2013 results and consistent with the B-mode polarization constraints from a joint analysis of BICEP2, Keck Array, and Planck (BKP) data. Adding the BKP B-mode data to our analysis leads to a tighter constraint of $r_{0.002} < 0.09$ and disfavour inflationary models with a $V(\phi) \phi^2$ potential. The addition of Planck polarization data leads to strong constraints on deviations from a purely adiabatic spectrum of fluctuations. We find no evidence for any contribution from isocurvature perturbations or from cosmic defects. Combining Planck data with other astrophysical data, including Type Ia supernovae, the equation of state of dark energy is constrained to $w = -1.006 \pm 0.045$, consistent with the expected value for a cosmological constant. The standard big bang nucleosynthesis predictions for the helium and deuterium abundances for the best-fit Planck base $\Lambda$CDM cosmology are in excellent agreement with observations. We also constraints on annihilating dark matter and on possible deviations from the standard recombination history. In neither case do we find no evidence for new physics. The Planck results for base $\Lambda$CDM are in good agreement with baryon acoustic oscillation data and with the JLA sample of Type Ia supernovae. However, as in the 2013 analysis, the amplitude of the fluctuation spectrum is found to be higher than inferred from some analyses of rich cluster counts and weak gravitational lensing. We show that these tensions cannot easily be resolved with simple modifications of the base $\Lambda$CDM cosmology. Apart from these tensions, the base $\Lambda$CDM cosmology provides an excellent description of the Planck CMB observations and many other astrophysical data sets.
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Planck 2015 results: XIV. Dark energy and modified gravity

We study the implications of Planck data for models of dark energy (DE) and modified gravity (MG) beyond the standard cosmological constant scenario. We start with cases where the DE only directly affects the background evolution, considering Taylor expansions of the equation of state $w(a)$, as well as principal component analysis and parameterizations related to the potential of a minimally coupled DE scalar field. When estimating the density of DE at early times, we significantly improve present constraints and find that it has to be below $\sim 2\%$ (at 95\% confidence) of the critical density, even when forced to play a role for $z < 50$ only. We then move to general parameterizations of the DE or MG perturbations that encompass both effective field theories and the phenomenology of gravitational potentials in MG models. Lastly, we test a range of specific models, such as $k$-essence, $f(R)$ theories, and coupled DE. In addition to the latest Planck data, for our main analyses, we use background constraints from baryonic acoustic oscillations, type-Ia supernovae, and local measurements of the Hubble constant. We further show the impact of measurements of the cosmological perturbations, such as redshift-space distortions and weak gravitational lensing. These additional probes are important tools for testing MG models and for breaking degeneracies that are still present in the combination of Planck and background data sets. All results that include only background parameterizations (expansion of the equation of state, early DE, general potentials in minimally-coupled scalar fields or principal component analysis) are in agreement with $\Lambda$CDM. When testing models that also change perturbations (even when the background is fixed to $\Lambda$CDM), some tensions appear in a few scenarios: the maximum one found is $\sim 2\sigma$ for Planck TT+lowP when parameterizing observables related to the gravitational potentials with a chosen time dependence; the tension increases to, at most, $3\sigma$ when external data sets are included. It however disappears when including CMB lensing.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen
We compute and investigate four types of imprint of a stochastic background of primordial magnetic fields (PMFs) on the cosmic microwave background (CMB) anisotropies: the impact of PMFs on the CMB temperature and polarization spectra, which is related to their contribution to cosmological perturbations; the effect on CMB polarization induced by Faraday rotation; the impact of PMFs on the ionization history; magnetically-induced non-Gaussianities and related non-zero bispectra; and the magnetically-induced breaking of statistical isotropy. We present constraints on the amplitude of PMFs that are derived from different Planck data products, depending on the specific effect that is being analysed. Overall, Planck data constrain the amplitude of PMFs to less than a few nanoGauss, with different bounds that depend on the considered model. In particular, individual limits coming from the analysis of the CMB angular power spectra, using the Planck likelihood, are $B_1^{\text{Mpc}} < 4.4 \, \text{nG}$ (where $B_1^{\text{Mpc}}$ is the comoving field amplitude at a scale of 1 Mpc) at 95% confidence level, assuming zero helicity. By considering the Planck likelihood, based only on parity-even angular power spectra, we obtain $B_1^{\text{Mpc}} < 5.6 \, \text{nG}$ for a maximally helical field. For nearly scale-invariant PMFs we obtain $B_1^{\text{Mpc}} < 2.0 \, \text{nG}$ and $B_1^{\text{Mpc}} < 0.9 \, \text{nG}$ if the impact of PMFs on the ionization history of the Universe is included in the analysis. From the analysis of magnetically-induced non-Gaussianity, we obtain three different values, corresponding to three applied methods, all below 5 nG. A search for preferred directions in the magnetically-induced passive tensor bispectrum yields $B_1^{\text{Mpc}} < 2.8 \, \text{nG}$. For nearly scale-invariant PMFs we obtain $B_1^{\text{Mpc}} < 2.0 \, \text{nG}$ and $B_1^{\text{Mpc}} < 0.9 \, \text{nG}$ if the impact of PMFs on the ionization history of the Universe is included in the analysis. From the analysis of magnetically-induced non-Gaussianity, we obtain three different values, corresponding to three applied methods, all below 5 nG. A search for preferred directions in the magnetically-induced passive tensor bispectrum yields $B_1^{\text{Mpc}} < 2.8 \, \text{nG}$. A search for preferred directions in the magnetically-induced passive-tensor bispectrum gives $B_1^{\text{Mpc}} < 3 \, \text{nG}$. The analysis of the Faraday rotation of CMB polarization by PMFs uses the Planck power spectra in EE and BB at 70 GHz and gives $B_1^{\text{Mpc}} < 1380 \, \text{nG}$. In our final analysis, we consider the harmonic-space correlations produced by Alfvén waves, finding no significant evidence for the presence of these waves. Together, these results comprise a comprehensive set of constraints on possible PMFs with Planck data.
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Planck 2015 results: XV. Gravitational lensing

We present the most significant measurement of the cosmic microwave background (CMB) lensing potential to date (at a level of 400σ), using temperature and polarization data from the Planck 2015 full-mission release. Using a polarization-only estimator, we detect lensing at a significance of 5σ. We cross-check the accuracy of our measurement using the wide frequency coverage and complementarity of the temperature and polarization measurements. Public products based on this measurement include an estimate of the lensing potential over approximately 70% of the sky, an estimate of the lensing potential power spectrum in bandpowers for the multipole range 40≤L≤400, and an associated likelihood for cosmological parameter constraints. We find good agreement between our measurement of the lensing potential power spectrum and that found in the ΛCDM model that best fits the Planck temperature and polarization power spectra. Using the lensing likelihood alone we obtain a percent-level measurement of the parameter combination σ8ω0.25m = 0.591 ± 0.021. We combine our determination of the lensing potential with the E-mode polarization, also measured by Planck, to generate an estimate of the lensing B-mode. We show that this lensing B-mode estimate is correlated with the B-modes observed directly by Planck at the expected level and with a statistical significance of 10σ, confirming Planck’s sensitivity to this known sky signal. We also correlate our lensing potential estimate with the large-scale temperature anisotropies, detecting a cross-correlation at the 3σ level, as expected because of dark energy in the concordance ΛCDM model.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen

Planck 2015 results: XVIII. Background geometry and topology of the Universe

Maps of cosmic microwave background (CMB) temperature and polarization from the 2015 release of Planck data provide the highest-quality full-sky view of the surface of last scattering available to date. This enables us to detect possible departures from a globally isotropic cosmology. We present the first searches using CMB polarization for correlations induced by a possible non-trivial topology with a fundamental domain that intersects, or nearly intersects, the last-scattering surface. The limits on the radius $i$ of the largest sphere inscribed in the fundamental domain (at log-likelihood ratio $\Delta \ln \mathcal{L} > -5$ relative to a simply-connected flat Planck best-fit model) are: $i > 0.97 \chi_{\text{rec}}$ for the T3 cubic torus; and $i > 0.56 \chi_{\text{rec}}$ for the T1 slab. The limit for the T3 cubic torus from the matched-circles search is numerically equivalent, $i > 0.97 \chi_{\text{rec}}$ at 99% confidence level from polarization data alone. We also perform a Bayesian search for an anisotropic global Bianchi VIIh geometry. In the non-physical setting, where the Bianchi cosmology is decoupled from the standard cosmology, Planck temperature data favour the inclusion of a Bianchi component with a Bayes factor of at least 2.3 units of log-evidence. However, the cosmological parameters that generate this pattern are in strong disagreement with those found from CMB anisotropy data alone. Fitting the induced polarization pattern for this model to the Planck data requires an amplitude of $0.10 \pm 0.04$ compared to the value of $+1$ if the model were to be correct. In the physically motivated setting, where the Bianchi parameters are coupled and fitted simultaneously with the standard cosmological parameters, we find no evidence for a Bianchi VIIh cosmology and constrain the vorticity of such models to $|\omega/H|_0 < 7.6 \times 10^{-10}$ (95% CL).

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Planck 2015 results: XX. Constraints on inflation

We present the implications for cosmic inflation of the Planck measurements of the cosmic microwave background (CMB) anisotropies in both temperature and polarization based on the full Planck survey, which includes more than twice the integration time of the nominal survey used for the 2013 release papers. The Planck full mission temperature data and a first release of polarization data on large angular scales measure the spectral index of curvature perturbations to be $n_s = 0.968 \pm 0.006$ and tightly constrain its scale dependence to $dn_s/d\ln k = -0.003 \pm 0.007$ when combined with the Planck lensing likelihood. When the Planck high-$\ell$ polarization data are included, the results are consistent and uncertainties are further reduced. The upper bound on the tensor-to-scalar ratio is $r<0.11$ (95% CL). This upper limit is consistent with the B-mode polarization constraint $r<0.12$ (95% CL) obtained from a joint analysis of the BICEP2/Keck Array and Planck data. These results imply that $V(\phi) \propto \phi^2$ and natural inflation are now disfavoured compared to models predicting a smaller tensor-to-scalar ratio, such as $R^2$ inflation. We search for several physically motivated deviations from a simple power-law spectrum of curvature perturbations, including those motivated by a reconstruction of the inflaton potential not relying on the slow-roll approximation. We find that such models are not preferred, either according to a Bayesian model comparison or according to a frequentist simulation-based analysis. Three independent methods reconstructing the primordial power spectrum consistently recover a featureless and smooth $\tilde{P} \propto \bar{k} R(\bar{k})$ over the range of scales $0.008$ Mpc$^{-1} \leq k \leq 0.1$ Mpc$^{-1}$. At large scales, each method finds deviations from a power law, connected to a deficit at multipoles $\ell = 20-40$ in the temperature power spectrum, but at an uncompelling statistical significance owing to the large cosmic variance present at these multipoles. By combining power spectrum and non-Gaussianity bounds, we constrain models with generalized Lagrangians, including Galileon models and axion monodromy models. The Planck data are consistent with adiabatic primordial perturbations, and the estimated values for the parameters of the
base $\Lambda$ cold dark matter ($\Lambda$CDM) model are not significantly altered when more general initial conditions are admitted. In correlated mixed adiabatic and isocurvature models, the 95% CL upper bound for the non-adiabatic contribution to the observed CMB temperature variance is $|\alpha_{\text{non-adi}}| < 1.9\%$, 4.0\%, and 2.9\% for CDM, neutrino density, and neutrino velocity isocurvature modes, respectively. We have tested inflationary models producing an anisotropic modulation of the primordial curvature power spectrum finding that the dipolar modulation in the CMB temperature field induced by a CDM isocurvature perturbation is not preferred at a statistically significant level. We also establish tight constraints on a possible quadrupolar modulation of the curvature perturbation. These results are consistent with the Planck 2013 analysis based on the nominal mission data and further constrain slow-roll single-field inflationary models, as expected from the increased precision of Planck data using the full set of observations.

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Planck 2015 results: XXI. The integrated Sachs-Wolfe effect: XXI. The integrated Sachs-Wolfe effect

This paper presents a study of the integrated Sachs-Wolfe (ISW) effect from the Planck 2015 temperature and polarization data release. This secondary cosmic microwave background (CMB) anisotropy caused by the large-scale time-evolving gravitational potential is probed from different perspectives. The CMB is cross-correlated with different large-scale structure (LSS) tracers: radio sources from the NVSS catalogue; galaxies from the optical SDSS and the infrared WISE surveys; and the Planck 2015 convergence lensing map. The joint cross-correlation of the CMB with the tracers yields a structure (LSS) tracers: radio sources from the NVSS catalogue; galaxies from the optical SDSS and the infrared WISE gravitational potential is probed from different perspectives. The CMB is cross-correlated with different large-scale data release. This secondary cosmic microwave background (CMB) anisotropy caused by the large-scale time-evolving gravitational potential is probed from different perspectives. The CMB is cross-correlated with different large-scale structure (LSS) tracers: radio sources from the NVSS catalogue; galaxies from the optical SDSS and the infrared WISE surveys; and the Planck 2015 convergence lensing map. The joint cross-correlation of the CMB with the tracers yields a detection at 4σ where most of the signal-to-noise is due to the Planck lensing and the NVSS radio catalogue. In fact, the ISW effect is detected from the Planck data only at ≈3σ (through the ISW-lensing bispectrum), which is similar to the detection level achieved by combining the cross-correlation signal coming from all the galaxy catalogues mentioned above. We study the ability of the ISW effect to place constraints on the dark-energy parameters; in particular, we show that ΩΛ is detected at more than 3σ. This cross-correlation analysis is performed only with the Planck temperature data, since the polarization scales available in the 2015 release do not permit significant improvement of the CMB-LSS cross-correlation detectability. Nevertheless, the Planck polarization data are used to study the anomalously large ISW signal previously reported through the aperture photometry on stacked CMB features at the locations of known superclusters and supervoids, which is in conflict with ΛCDM expectations. We find that the current Planck polarization data do not exclude that this signal could be caused by the ISW effect. In addition, the stacking of the Planck lensing map on the locations of superstructures exhibits a positive cross-correlation with these large-scale structures. Finally, we have improved our previous reconstruction of the ISW temperature fluctuations by combining the information encoded in all the previously mentioned LSS tracers. In particular, we construct a map of the ISW secondary anisotropies and the corresponding uncertainties map, obtained from simulations. We also explore the reconstruction of the ISW anisotropies caused by the large-scale structure traced by the 2MASS Photometric Redshift Survey (2MPZ) by directly inverting the density field into the gravitational potential field.

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We present cluster counts and corresponding cosmological constraints from the Planck full mission data set. Our catalogue consists of 439 clusters detected via their Sunyaev-Zeldovich (SZ) signal down to a signal-to-noise ratio of 6, and is more than a factor of 2 larger than the 2013 Planck cluster cosmology sample. The counts are consistent with those from 2013 and yield compatible constraints under the same modelling assumptions. Taking advantage of the larger catalogue, we extend our analysis to the two-dimensional distribution in redshift and signal-to-noise. We use mass estimates from two recent studies of gravitational lensing of background galaxies by Planck clusters to provide priors on the hydrostatic bias parameter, \((1-b)\). In addition, we use lensing of cosmic microwave background (CMB) temperature fluctuations by Planck clusters as an independent constraint on this parameter. These various calibrations imply constraints on the present-day amplitude of matter fluctuations in varying degrees of tension with those from the Planck analysis of primary fluctuations in the CMB; for the lowest estimated values of \((1-b)\) the tension is mild, only a little over one standard deviation, while it remains substantial \((3.7\sigma)\) for the largest estimated value. We also examine constraints on extensions to the base flat \(\Lambda\)CDM model by combining the cluster and CMB constraints. The combination appears to favour non-minimal neutrino masses, but this possibility does little to relieve the overall tension because it simultaneously lowers the implied value of the Hubble parameter, thereby exacerbating the discrepancy with most current astrophysical estimates. Improving the precision of cluster mass calibrations from the current 10%-level to 1% would significantly strengthen these combined analyses and provide a stringent test of the base \(\Lambda\)CDM model.

Planck 2015 results: XXIV. Cosmology from Sunyaev-Zeldovich cluster counts

We present cluster counts and corresponding cosmological constraints from the Planck full mission data set. Our catalogue consists of 439 clusters detected via their Sunyaev-Zeldovich (SZ) signal down to a signal-to-noise ratio of 6, and is more than a factor of 2 larger than the 2013 Planck cluster cosmology sample. The counts are consistent with those from 2013 and yield compatible constraints under the same modelling assumptions. Taking advantage of the larger catalogue, we extend our analysis to the two-dimensional distribution in redshift and signal-to-noise. We use mass estimates from two recent studies of gravitational lensing of background galaxies by Planck clusters to provide priors on the hydrostatic bias parameter, \((1-b)\). In addition, we use lensing of cosmic microwave background (CMB) temperature fluctuations by Planck clusters as an independent constraint on this parameter. These various calibrations imply constraints on the present-day amplitude of matter fluctuations in varying degrees of tension with those from the Planck analysis of primary fluctuations in the CMB; for the lowest estimated values of \((1-b)\) the tension is mild, only a little over one standard deviation, while it remains substantial \((3.7\sigma)\) for the largest estimated value. We also examine constraints on extensions to the base flat \(\Lambda\)CDM model by combining the cluster and CMB constraints. The combination appears to favour non-minimal neutrino masses, but this possibility does little to relieve the overall tension because it simultaneously lowers the implied value of the Hubble parameter, thereby exacerbating the discrepancy with most current astrophysical estimates. Improving the precision of cluster mass calibrations from the current 10%-level to 1% would significantly strengthen these combined analyses and provide a stringent test of the base \(\Lambda\)CDM model.

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Planck 2015 results: XXV. Diffuse low-frequency Galactic foregrounds

We discuss the Galactic foreground emission between 20 and 100 GHz based on observations by Planck and WMAP. The total intensity in this part of the spectrum is dominated by free-free and spinning dust emission, whereas the polarized intensity is dominated by synchrotron emission. The Commander component-separation tool has been used to separate the various astrophysical processes in total intensity. Comparison with radio recombination line templates verifies the recovery of the free-free emission along the Galactic plane. Comparison of the high-latitude Hα emission with our free-free map shows residuals that correlate with dust optical depth, consistent with a fraction (4%-30%) of Hα having been scattered by high-latitude dust. We highlight a number of diffuse spinning dust morphological features at high latitude. There is substantial spatial variation in the spinning dust spectrum, with the emission peak (in $l_\nu$) ranging from below 20 GHz to more than 50 GHz. There is a strong tendency for the spinning dust component near many prominent H ii regions to have a higher peak frequency, suggesting that this increase in peak frequency is associated with dust in the photo-dissociation regions around the nebulae. The emissivity of spinning dust in these diffuse regions is of the same order as previous detections in the literature. Over the entire sky, the Commander solution finds more anomalous microwave emission (AME) than the WMAP component maps, at the expense of synchrotron and free-free emission. This can be explained by the difficulty in separating multiple broadband components with a limited number of frequency maps. Future surveys, particularly at 5-20 GHz, will greatly improve the separation by constraining the synchrotron spectrum. We combine Planck and WMAP data to make the highest signal-to-noise ratio maps yet of the intensity of the all-sky polarized synchrotron emission at frequencies above a few GHz. Most of the high-latitude polarized emission is associated with distinct large-scale loops and spurs, and we re-discuss their structure. We argue that nearly all the emission at 40deg $> l >$90deg is part of the Loop I structure, and show that the emission extends much further in to the southern Galactic hemisphere than previously recognised, giving Loop I an ovoid rather than circular outline. However, it does not continue as far as the “Fermi bubble/microwave haze”, making it less probable that these are part of the same structure. We identify a number of new faint features in the polarized sky, including a dearth of polarized synchrotron emission directly correlated with a narrow, roughly 20deg long filament seen in Hα at high Galactic latitude. Finally, we look for evidence of polarized AME, however many AME regions are significantly contaminated by polarized synchrotron emission, and we find a 2σ upper limit of 1.6% in the Perseus region.

General information

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Planck 2015 results: XXVII. The second Planck catalogue of Sunyaev-Zeldovich sources

We present the all-sky Planck catalogue of Sunyaev-Zeldovich (SZ) sources detected from the 29 month full-mission data. The catalogue (PSZ2) is the largest SZ-selected sample of galaxy clusters yet produced and the deepest systematic all-sky survey of galaxy clusters. It contains 1653 detections, of which 1203 are confirmed clusters with identified counterparts in external data sets, and is the first SZ-selected cluster survey containing >103 confirmed clusters. We present a detailed analysis of the survey selection function in terms of its completeness and statistical reliability, placing a lower limit of 83% on the purity. Using simulations, we find that the estimates of the SZ strength parameter $Y_{5R_{500}}$ are robust to pressure-profile variation and beam systematics, but accurate conversion to $Y_{500}$ requires the use of prior information on the cluster extent. We describe the multi-wavelength search for counterparts in ancillary data, which makes use of radio, microwave, infra-red, optical, and X-ray data sets, and which places emphasis on the robustness of the counterpart match. We discuss the physical properties of the new sample and identify a population of low-redshift X-ray under-luminous clusters revealed by SZ selection. These objects appear in optical and SZ surveys with consistent properties for their mass, but are almost absent from ROSAT X-ray selected samples.

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Planck intermediate results XLI. A map of lensing-induced B-modes

The secondary cosmic microwave background (CMB) B-modes stem from the post-decoupling distortion of the polarization E-modes due to the gravitational lensing effect of large-scale structures. These lensing-induced B-modes constitute both a valuable probe of the dark matter distribution and an important contaminant for the extraction of the primary CMB B-modes from inflation. Planck provides accurate nearly all-sky measurements of both the polarization E-modes and the integrated mass distribution via the reconstruction of the CMB lensing potential. By combining these two data products, we have produced an all-sky template map of the lensing-induced B-modes using a real-space algorithm that minimizes the impact of sky masks. The cross-correlation of this template with an observed (primordial and secondary) B-mode map can be used to measure the lensing B-mode power spectrum at multipoles up to 2000. In particular, when cross-correlating with the B-mode contribution directly derived from the Planck polarization maps, we obtain lensing-induced B-mode power spectrum measurement at a significance level of 12 sigma, which agrees with the theoretical expectation derived from the Planck best-fit Lambda cold dark matter model. This unique nearly all-sky
secondary B-mode template, which includes the lensing-induced information from intermediate to small (10 less than or similar to 1 less than or similar to 1000) angular scales, is delivered as part of the Planck 2015 public data release. It will be particularly useful for experiments searching for primordial B-modes, such as BICEP2/Keck Array or LiteBIRD, since it will enable an estimate to be made of the lensing-induced contribution to the measured total CMB B-modes.

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Planck intermediate results: XLIII. Spectral energy distribution of dust in clusters of galaxies

Although infrared (IR) overall dust emission from clusters of galaxies has been statistically detected using data from the Infrared Astronomical Satellite (IRAS), it has not been possible to sample the spectral energy distribution (SED) of this emission over its peak, and thus to break the degeneracy between dust temperature and mass. By complementing the IRAS spectral coverage with Planck satellite data from 100 to 857 GHz, we provide new constraints on the IR spectrum of thermal dust emission in clusters of galaxies. We achieve this by using a stacking approach for a sample of several hundred objects from the Planck cluster sample. This procedure averages out fluctuations from the IR sky, allowing us to reach a significant detection of the faint cluster contribution. We also use the large frequency range probed by Planck, together with component-separation techniques, to remove the contamination from both cosmic microwave background anisotropies and the thermal Sunyaev-Zeldovich effect (tSZ) signal, which dominate at ν ≤ 353 GHz. By excluding dominant spurious signals or systematic effects, averaged detections are reported at frequencies 353 GHz ≤ ν ≤ 5000 GHz. We confirm the presence of dust in clusters of galaxies at low and intermediate redshifts, yielding an SED with a shape similar to that of the Milky Way. Planck’s resolution does not allow us to investigate the detailed spatial distribution of this emission (e.g., whether it comes from intergalactic dust or simply the dust content of the cluster galaxies), but the radial distribution of the emission appears to follow that of the stacked SZ signal, and thus the extent of the clusters. The recovered SED allows us to constrain the dust mass responsible for the signal and its temperature.

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BFI (2008): BFI-level 2
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Scopus rating (2000): SJR 2.439 SNIP 1.04
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.478 SNIP 1.07
Planck intermediate results XLII. Large-scale Galactic magnetic fields

Recent models for the large-scale Galactic magnetic fields in the literature have been largely constrained by synchrotron emission and Faraday rotation measures. We use three different but representative models to compare their predicted polarized synchrotron and dust emission with that measured by the Planck satellite. We first update these models to match the Planck synchrotron products using a common model for the cosmic-ray leptons. We discuss the impact on this analysis of the ongoing problems of component separation in the Planck microwave bands and of the uncertain cosmic-ray spectrum. In particular, the inferred degree of ordering in the magnetic fields is sensitive to these systematic uncertainties, and we further show the importance of considering the expected variations in the observables in addition to their mean morphology. We then compare the resulting simulated emission to the observed dust polarization and find that the dust predictions do not match the morphology in the Planck data but underpredict the dust polarization away from the plane. We modify one of the models to roughly match both observables at high latitudes by increasing the field ordering in the thin disc near the observer. Though this specific analysis is dependent on the component separation issues, we present the improved model as a proof of concept for how these studies can be advanced in future using complementary information from ongoing and planned observational projects.

General information

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Planck intermediate results: XLIV. Structure of the Galactic magnetic field from dust polarization maps of the southern Galactic cap

Using data from the Planck satellite, we study the statistical properties of interstellar dust polarization at high Galactic latitudes around the south pole (b < −60°). Our aim is to advance the understanding of the magnetized interstellar medium (ISM), and to provide a modelling framework of the polarized dust foreground for use in cosmic microwave background (CMB) component-separation procedures. We examine the Stokes I, Q, and U maps at 353GHz, and particularly the statistical distribution of the polarization fraction (p) and angle (ψ), in order to characterize the ordered and turbulent components of the Galactic magnetic field (GMF) in the solar neighbourhood. The Q and U maps show patterns at large angular scales, which we relate to the mean orientation of the GMF towards Galactic coordinates (l0,b0) = (70° ± 5°,24° ± 5°). The histogram of the observed p values shows a wide dispersion up to 25%. The histogram of ψ has a standard deviation of 12° about the regular pattern expected from the ordered GMF. We build a phenomenological model that connects the distributions of p and ψ to a statistical description of the turbulent component of the GMF, assuming a uniform effective polarization fraction (p0) of dust emission. To compute the Stokes parameters, we approximate the integration along the line of sight (LOS) as a sum over a set of N independent polarization layers, in each of which the turbulent component of the GMF is obtained from Gaussian realizations of a power-law power spectrum. We are able to reproduce the observed p and ψ distributions using a p0 value of 26%, a ratio of 0.9 between the strengths of the turbulent and mean components of the GMF, and a small value of N. The mean value of p (inferred from the fit of the large-scale patterns in the Stokes maps) is 12 ± 1%. We relate the polarization layers to the density structure and to the correlation length of the GMF along the LOS. We emphasize the simplicity of our model (involving only a few parameters), which can be easily computed on the celestial sphere to produce simulated maps of dust polarization. Our work is an important step towards a model that can be used to assess the accuracy of component-separation methods in present and future CMB experiments designed to search the B mode CMB polarization from primordial gravity waves.

General information
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The Virgo cluster is the largest Sunyaev-Zeldovich (SZ) source in the sky, both in terms of angular size and total integrated flux. Planck’s wide angular scale and frequency coverage, together with its high sensitivity, enable a detailed study of this big object through the SZ effect. Virgo is well resolved by Planck, showing an elongated structure that correlates well with the morphology observed from X-rays, but extends beyond the observed X-ray signal. We find good agreement between the SZ signal (or Compton parameter, $y(c)$) observed by Planck and the expected signal inferred from X-ray observations and simple analytical models. Owing to its proximity to us, the gas beyond the virial radius in Virgo can be studied with unprecedented sensitivity by integrating the SZ signal over tens of square degrees. We study the signal in the outskirts of Virgo and compare it with analytical models and a constrained simulation of the environment of Virgo. Planck data suggest that significant amounts of low-density plasma surround Virgo, out to twice the virial radius. We find the SZ signal in the outskirts of Virgo to be consistent with a simple model that extrapolates the inferred pressure at lower radii, while assuming that the temperature stays in the keV range beyond the virial radius. The observed signal is also consistent with simulations and points to a shallow pressure profile in the outskirts of the cluster. This reservoir of gas at large radii can be linked with the hottest phase of the elusive warm/hot intergalactic medium. Taking the lack of symmetry of Virgo into account, we find that a prolate model is favoured by the combination of SZ and X-ray data, in agreement with predictions. Finally, based on the combination of the same SZ and X-ray data, we constrain the total amount of gas in Virgo. Under the hypothesis that the abundance of baryons in Virgo is representative of the cosmic average, we also infer a distance for Virgo of approximately 18 Mpc, in good agreement with previous estimates.
Planck intermediate results: XLVIII. Disentangling Galactic dust emission and cosmic infrared background anisotropies

Using the Planck 2015 data release (PR2) temperature maps, we separate Galactic thermal dust emission from cosmic infrared background (CIB) anisotropies. For this purpose, we implement a specifically tailored component-separation method, the so-called generalized needlet internal linear combination (GNILC) method, which uses spatial information (the angular powerspectra) to disentangle the Galactic dust emission and CIB anisotropies. We produce significantly improved all-sky maps of Planck thermal dust emission, with reduced CIB contamination, at 353, 545, and 857 GHz. By reducing the CIB contamination of the thermal dust maps, we provide more accurate estimates of the local dust temperature and dust spectral index over the sky with reduced dispersion, especially at high Galactic latitudes above b = ±20°. We find that the dust temperature is T = (19.4 ± 1.3) K and the dust spectral index is β = 1.6 ± 0.1 averaged over the whole sky, while T = (19.4 ± 1.5) K and β = 1.6 ± 0.2 on 21% of the sky at high latitudes. Moreover, subtracting the new CIB-removed thermal dust maps from the CMB-removed Planck maps gives access to the CIB anisotropies over 60% of the sky at Galactic latitudes |b| > 20°. Because they are a significant improvement over previous Planck products, the GNILC maps are recommended for thermal dust science. The new CIB maps can be regarded as indirect tracers of the dark matter and they are recommended for exploring cross-correlations with lensing and large-scale structure optical surveys. The reconstructed GNILC thermal dust and CIB maps are delivered as Planck products.
Planck intermediate results: XLVII. Planck constraints on reionization history

We investigate constraints on cosmic reionization extracted from the Planck cosmic microwave background (CMB) data. We combine the Planck CMB anisotropy data in temperature with the low-multipole polarization data to fit ΛCDM models with various parameterizations of the reionization history. We obtain a Thomson optical depth τ = 0.058 ± 0.012 for the commonly adopted instantaneous reionization model. This confirms, with data solely from CMB anisotropies, the low value suggested by combining Planck 2015 results with other data sets, and also reduces the uncertainties. We reconstruct the history of the ionization fraction using either a symmetric or an asymmetric model for the transition between the neutral and ionized phases. To determine better constraints on the duration of the reionization process, we also make use of measurements of the amplitude of the kinetic Sunyaev-Zeldovich (kSZ) effect using additional information from the high-resolution Atacama Cosmology Telescope and South Pole Telescope experiments. The average redshift at which reionization occurs is found to lie between z = 7.8 and 8.8, depending on the model of reionization adopted. Using kSZ...
constraints and a redshift-symmetric reionization model, we find an upper limit to the width of the reionization period of Δz <2.8. In all cases, we find that the Universe is ionized at less than the 10% level at redshifts above z ≅ 10. This suggests that an early onset of reionization is strongly disfavoured by the Planck data. We show that this result also reduces the tension between CMB-based analyses and constraints from other astrophysical sources.

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Planck intermediate results: XLVI. Reduction of large-scale systematic effects in HFI polarization maps and estimation of the reionization optical depth

This paper describes the identification, modelling, and removal of previously unexplained systematic effects in the polarization data of the Planck High Frequency Instrument (HFI) on large angular scales, including new mapmaking and calibration procedures, new and more complete end-to-end simulations, and a set of robust internal consistency checks on the resulting maps. These maps, at 100, 143, 217, and 353 GHz, are early versions of those that will be released in final
form later in 2016. The improvements allow us to determine the cosmic reionization optical depth τ using, for the first time, the low-multipole EE data from HFI, reducing significantly the central value and uncertainty, and hence the upper limit. Two different likelihood procedures are used to constrain τ from two estimators of the CMB E-and B-mode angular power spectra at 100 and 143 GHz, after debiasing the spectra from a small remaining systematic contamination. These all give fully consistent results. A further consistency test is performed using cross-correlations derived from the Low Frequency Instrument maps of the Planck 2015 data release and the new HFI data. For this purpose, end-to-end analyses of systematic effects from the two instruments are used to demonstrate the near independence of their dominant systematic error residuals. The tightest result comes from the HFI-based τ posterior distribution using the maximum likelihood power spectrum estimator from EE data only, giving a value $0.055 \pm 0.009$. In a companion paper these results are discussed in the context of the best-fit Planck$\Lambda$CDM cosmological model and recent models of reionization.

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Planck intermediate results: XLV. Radio spectra of northern extragalactic radio sources

Continuum spectra covering centimetre to millimetre wavelengths are presented for a northern sample of 104 extragalactic radio sources, mainly active galactic nuclei, based on four-epoch Planck data. The nine Planck frequencies, from 30 to 857 GHz, are complemented by a set of simultaneous ground-based radio observations between 1.1 and 37 GHz. The single-survey Planck data confirm that the flattest high-frequency radio spectral indices are close to zero, indicating that the original accelerated electron energy spectrum is much harder than commonly thought, with power-law index around 1.5 instead of the canonical 2.5. The radio spectra peak at high frequencies and exhibit a variety of shapes. For a small set of low-z sources, we find a spectral upturn at high frequencies, indicating the presence of intrinsic cold dust. Variability can generally be approximated by achromatic variations, while sources with clear signatures of evolving shocks appear to be limited to the strongest outbursts.

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Planck intermediate results XXIX. All-sky dust modelling with Planck, IRAS, and WISE observations

We present all-sky modelling of the high resolution Planck, IRAS, and WISE infrared (IR) observations using the physical dust model presented by Draine & Li in 2007 (DL, ApJ, 657, 810). We study the performance and results of this model, and discuss implications for future dust modelling. The present work extends the DL dust modelling carried out on nearby galaxies using Herschel and Spitzer data to Galactic dust emission. We employ the DL dust model to generate maps of the dust mass surface density \( \Sigma(M_d) \), the dust optical extinction \( A(V) \), and the starlight intensity heating the bulk of the dust, parametrized by \( U \)-min. The DL model reproduces the observed spectral energy distribution (SED) satisfactorily over most of the sky, with small deviations in the inner Galactic disk and in low ecliptic latitude areas, presumably due to zodiacal light contamination. In the Andromeda galaxy (M31), the present dust mass estimates agree remarkably well (within 10%) with DL estimates based on independent Spitzer and Herschel data. We compare the DL optical extinction \( A(V) \) for the diffuse interstellar medium (ISM) with optical estimates for approximately 2 x 10(5) quasi-stellar objects (QSOs) observed in the Sloan Digital Sky Survey (SDSS). The DL \( A(V) \) estimates are larger than those determined towards QSOs by a factor of about 2, which depends on \( U \)-min. The DL fitting parameter \( U \)-min, effectively determined by the wavelength where the SED peaks, appears to trace variations in the far-IR opacity of the dust grains per unit \( A(V) \), and not only in the starlight intensity. These results show that some of the physical assumptions of the DL model will need to be revised. To circumvent the model deficiency, we propose an empirical renormalization of the DL \( A(V) \) estimate, dependent of \( U \)-min, which compensates for the systematic differences found with QSO observations. This renormalization, made to match the \( A(V) \) estimates towards QSOs, also brings into agreement the DL \( A(V) \) estimates with those derived for molecular clouds from the near-IR colours of stars in the 2 micron all sky survey (2MASS). The DL model and the QSOs data are also used to compress the spectral information in the Planck and IRAS observations for the diffuse ISM to a family of 20 SEDs normalized per \( A(V) \), parameterized by \( U \)-min, which may be used to test and empirically calibrate dust models. The family of SEDs and the maps generated with the DL model are made public in the Planck Legacy Archive.

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Web of Science (2008): Indexed yes
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Web of Science (2007): Indexed yes
Planck intermediate results XXXIII. Signature of the magnetic field geometry of interstellar filaments in dust polarization maps

Planck observations at 353 GHz provide the first fully sampled maps of the polarized dust emission towards interstellar filaments and their backgrounds (i.e., the emission observed in the surroundings of the filaments). The data allow us to determine the intrinsic polarization properties of the filaments and therefore to provide insight into the structure of their magnetic field (B). We present the polarization maps of three nearby (several parsecs long) star-forming filaments of moderate column density (N-H about 10^{22} cm^{-2}): Musca, B211, and L1506. These three filaments are detected above the background in dust total and polarized emission. We use the spatial information to separate Stokes I, Q, and U of the filaments from those of their backgrounds, an essential step in measuring the intrinsic polarization fraction (p) and angle (\psi) of each emission component. We find that the polarization angles in the three filaments (\psi_{fil}) are coherent along their lengths and not the same as in their backgrounds (\psi_{bg}). The differences between \psi_{fil} and \psi_{bg} are 12 degrees and 54 degrees for Musca and L1506, respectively, and only 6 degrees in the case of B211. These differences for Musca and L1506 are larger than the dispersions of \psi, both along the filaments and in their backgrounds. The observed changes of \psi_{fil} and \psi_{bg} are direct evidence of variations of the orientation of the plane of the sky (POS) projection of the magnetic field. As in previous studies, we find a decrease of several per cent in p with N-H from the backgrounds to the crest of the filaments. We show that the bulk of the drop in p within the filaments cannot be explained by random fluctuations of the orientation of the magnetic field because they are too small (\sigma_{\psi} < 10°). We recognize the degeneracy between the dust alignment efficiency (by, e.g., radiative torques) and the structure of the B-field in causing variations in p, but we argue that the decrease in p from the backgrounds to the filaments results in part from depolarization associated with the 3D structure of the B-field: both its orientation in the POS and with respect to the POS. We do not resolve the inner structure of the filaments, but at the smallest scales accessible with Planck (similar to 0.2 pc), the observed changes of psi and p hold information on the magnetic field structure within filaments. They show that both the mean field and its fluctuations in the filaments are different from those of their backgrounds, which points to a coupling between the matter and the B-field in the filament formation process.

General information
State: Published
Organisations: National Space Institute, Astrophysics, University of Copenhagen
Planck intermediate results XXXII. The relative orientation between the magnetic field and structures traced by interstellar dust

The role of the magnetic field in the formation of the filamentary structures observed in the interstellar medium (ISM) is a debated topic owing to the paucity of relevant observations needed to test existing models. The Planck all-sky maps of linearly polarized emission from dust at 353 GHz provide the required combination of imaging and statistics to study the correlation between the structures of the Galactic magnetic field and of interstellar matter over the whole sky, both in the diffuse ISM and in molecular clouds. The data reveal that structures, or ridges, in the intensity map have counterparts in the Stokes Q and/or U maps. We focus our study on structures at intermediate and high Galactic latitudes, which cover two orders of magnitude in column density, from $10^{20}$ to $10^{22}$ cm$^{-2}$. We measure the magnetic field orientation on the plane of the sky from the polarization data, and present an algorithm to estimate the orientation of the ridges from the dust intensity map. We use analytical models to account for projection effects. Comparing polarization angles on and off the structures, we estimate the mean ratio between the strengths of the turbulent and mean components of the magnetic field to be between 0.6 and 1.0, with a preferred value of 0.8. We find that the ridges are usually aligned with the magnetic field measured on the structures. This statistical trend becomes more striking for increasing polarization fraction and decreasing column density. There is no alignment for the highest column density ridges. We interpret the increase in alignment with polarization fraction as a consequence of projection effects. We present maps to show that the decrease in alignment for high column density is not due to a loss of correlation between the distribution of matter and the geometry of the magnetic field. In molecular complexes, we also observe structures perpendicular to the magnetic field, which, statistically, cannot be accounted for by projection effects. This first statistical study of the relative orientation between the matter structures and the magnetic field in the ISM points out that, at the angular scales probed by Planck, the field...
geometry projected on the plane of the sky is correlated with the distribution of matter. In the diffuse ISM, the structures of matter are usually aligned with the magnetic field, while perpendicular structures appear in molecular clouds. We discuss our results in the context of models and MHD simulations, which attempt to describe the respective roles of turbulence, magnetic field, and self-gravity in the formation of structures in the magnetized ISM.

**General information**

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Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2
Planck intermediate results XXXI. Microwave survey of Galactic supernova remnants

The all-sky Planck survey in 9 frequency bands was used to search for emission from all 274 known Galactic supernova remnants. Of these, 16 were detected in at least two Planck frequencies. The radio-through-microwave spectral energy distributions were compiled to determine the mechanism for microwave emission. In only one case, IC 443, is there high-frequency emission clearly from dust associated with the supernova remnant. In all cases, the low-frequency emission is from synchrotron radiation. As predicted for a population of relativistic particles with energy distribution that extends continuously to high energies, a single power law is evident for many sources, including the Crab and PKS 1209-51/52. A decrease in flux density relative to the extrapolation of radio emission is evident in several sources. Their spectral energy distributions can be approximated as broken power laws, \( S_v \propto v^{-\alpha} \), with the spectral index, \( \alpha \), increasing by 0.5-1 above a break frequency in the range 10-60 GHz. This break could be due to synchrotron losses.

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Web of Science (2017): Indexed yes
Planck intermediate results XXXIX. The Planck list of high-redshift source candidates

The Planck mission, thanks to its large frequency range and all-sky coverage, has a unique potential for systematically detecting the brightest, and rarest, submillimetre sources on the sky, including distant objects in the high-redshift Universe, a novel method, based on a component-separation procedure using a combination of Planck and IRAS data, has been validated and characterized on numerous simulations, and applied to select the most luminous cold submillimetre sources with spectral energy distributions peaking between 353 and 857 GHz at 5' resolution. A total of 2151 Planck high-z source candidates (the PHZ) have been detected in the cleanest 26% of the sky, with flux density at 545 GHz above 500 mJy. Embedded in the cosmic infrared background close to the confusion limit, these high-z candidates exhibit colder colours than their surroundings, consistent with redshifts $z > 2$, assuming a dust temperature of $T_{\nu,\text{dust}} = 35K$ and a spectral index of $\beta_{\nu,\text{dust}} = 1.5$. Exhibiting extremely high luminosities, larger than 10(14) L-circle-dot, the PHZ objects may be made of multiple galaxies or clumps at high redshift, as suggested by a first statistical analysis based on a comparison with number count models. Furthermore, first follow-up observations obtained from optical to submillimetre wavelengths, which can be found in companion papers, have confirmed that this list consists of two distinct populations. A small fraction (around 3%) of the sources have been identified as strongly gravitationally lensed star-forming galaxies at redshift 2 to 4, while the vast majority of the PHZ sources appear as overdensities of dusty star-forming galaxies, having colours consistent with being at $z > 2$, and may be considered as proto-cluster candidates. The PHZ provides an original sample, which is complementary to the Planck Sunyaev-Zeldovich Catalogue (PSZ2); by extending the population of virialized massive galaxy clusters detected below $z < 1.5$ through their SZ signal to a population of sources at $z > 1.5$, the PHZ may contain the progenitors of today's clusters. Hence the Planck list of high-redshift source candidates opens a new window on the study of the early stages of structure formation, particularly understanding the intensively star-forming phase at high-$z$.

General information

State: Published

Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Innovation and Research-based consultancy, University of Copenhagen


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Planck intermediate results XXX. The angular power spectrum of polarized dust emission at intermediate and high Galactic latitudes

The polarized thermal emission from diffuse Galactic dust is the main foreground present in measurements of the polarization of the cosmic microwave background (CMB) at frequencies above 100 GHz. In this paper we exploit the uniqueness of the Planck HFI polarization data from 100 to 353 GHz to measure the polarized dust angular power spectra C-\ell(EE) and C-\ell(BB) over the multipole range 40 < \ell < 600 well away from the Galactic plane. These measurements will bring new insights into interstellar dust physics and allow a precise determination of the level of contamination for CMB polarization experiments. Despite the non-Gaussian and anisotropic nature of Galactic dust, we show that general statistical properties of the emission can be characterized accurately over large fractions of the sky using angular power spectra. The polarization power spectra of the dust are well described by power laws in multipole, C-\ell proportional to l(\alpha), with exponents \alpha(EE,BB) = -2.42 +/- 0.02. The amplitudes of the polarization power spectra vary with the average brightness in a way similar to the intensity power spectra. The frequency dependence of the dust polarization spectra is consistent with modified blackbody emission with beta(d) = 1.59 and T_d = 19.6 K down to the lowest Planck HFI frequencies. We find a systematic difference between the amplitudes of the Galactic B- and E-modes, C-\ell(BB) = C-\ell(EE) = 0.5. We verify that these general properties are preserved towards high Galactic latitudes with low dust column densities. We show that even in the faintest dust-emitting regions there are no "clean" windows in the sky where primordial CMB B-mode polarization measurements could be made without subtraction of foreground emission. Finally, we investigate the level of dust polarization in the specific field recently targeted by the BICEP2 experiment. Extrapolation of the Planck 353 GHz data to 150 GHz gives a dust power D-\ell(BB) equivalent to \ell(\ell + 1)C-\ell(BB)/(2\pi) of 1.32 x 10^{-2} \mu K-CMB^2 and there is an additional uncertainty (+0.28, -0.24) x 10^{-2} \mu K-CMB^2 from the extrapolation.

This level is the same magnitude as reported by BICEP2 over this l range, which highlights the need for assessment of the CMB polarized dust signal even in the cleanest windows of the sky.
Planck intermediate results XXXVI. Optical identification and redshifts of Planck SZ sources with telescopes at the Canary Islands observatories: XXXVI. Optical identification and redshifts of Planck SZ sources with telescopes at the Canary Islands observatories

We present the results of approximately three years of observations of Planck Sunyaev-Zeldovich (SZ) sources with telescopes at the Canary Islands observatories as part of the general optical follow-up programme undertaken by the Planck Collaboration. In total, 78 SZ sources are discussed. Deep-imaging observations were obtained for most of these sources; spectroscopic observations in either in long-slit or multi-object modes were obtained for many. We effectively used 37.5 clear nights. We found optical counterparts for 73 of the 78 candidates. This sample includes 53 spectroscopic redshift determinations, 20 of them obtained with a multi-object spectroscopic mode. The sample contains new redshifts for 27 Planck clusters that were not included in the first Planck SZ source catalogue (PSZ1).

General information
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Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Authors: Ade, P. A. R. (Ekstern), Aghanim, N. (Ekstern), Arnaud, M. (Ekstern), Ashdown, M. (Ekstern), Aumont, J. (Ekstern), Baccigalupi, C. (Ekstern), Banday, A. J. (Ekstern), Barreiro, R. B. (Ekstern), Barrena, R. (Ekstern), Bartolo, N. (Ekstern), Battaner, E. (Ekstern), Benabed, K. (Ekstern), Benoit-Levy, A. (Ekstern), Bernard, J. -. (Ekstern), Bersanelli, M. (Ekstern), Bielewicz, P. (Ekstern), Bock, H. (Ekstern), Bonaldi, A. (Ekstern), Bonavera, L. (Ekstern), Bond, J. R. (Ekstern), Borrill, J. (Ekstern), Bouchet, F. R. (Ekstern), Burenin, R. (Ekstern), Burigana, C. (Ekstern), Calabrese, E. (Ekstern), Cardoso, J. -. (Ekstern), Catalano, A. (Ekstern), Chamballu, A. (Ekstern), Chary, R. -.
Positive streamer initiation from raindrops in thundercloud fields

The threshold field for the electric gas discharge in air is ≈26 kV cm⁻¹ atm⁻¹, yet the maximum field measured (from balloons) is ≈3 kV cm⁻¹ atm⁻¹. The question of how lightning is stimulated is therefore one of the outstanding problems in atmospheric electricity. According to the popular idea first suggested by Loeb and developed further by Phelps, lightning can be initiated from streamers developed in the enhanced electric field around hydrometeors. In our paper, we prove by numerical simulations that positive streamers are initiated, specifically, around charged water drops. The simulation model includes the kinetics of free electrons, and positive and negative ions, the electron impact ionization and photon ionization of the neutral atmospheric constituents, and the formation of space charge electric fields. Simulations were conducted at air pressure 0.4 atm, typical at thundercloud altitudes, and at different background electric fields, drop sizes, and charges. We show that the avalanche-to-streamer transition is possible near drops carrying 63–485 pC in thundercloud fields with intensity of 10 kV cm⁻¹ atm⁻¹ and 15 kV cm⁻¹ atm⁻¹ for drops sizes of 1 mm and 0.5 mm, respectively. Thus, the electric field required for the streamer formation is larger than the measured thunderstorm fields. Therefore, the results of simulations suggest that second mechanisms must operate to amplify the local field. Such mechanisms could be electric field space variations via collective effects of many hydrometeors or runaway breakdown. ©2016. American Geophysical Union.

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Probing Earth's conductivity structure beneath oceans by scalar geomagnetic data: autonomous surface vehicle solution

The electric conductivity distribution of the Earth's crust and upper mantle provides a key to unraveling its structure. Information can be obtained from vector data time series of the natural variations of the magnetic and electric field in a directional stable reference frame. Applying this method, known as magnetotellurics, to oceanic regions is challenging since only vector instruments placed at the sea bottom can provide such data. Here, we discuss a concept of marine induction surveying which is based on sea-surface scalar magnetic field measurements from a modern position-keeping platform. The concept exploits scalar magnetic responses that relate variations of the scalar magnetic field at the survey sites with variations of the horizontal magnetic field at a reference site. A 3-D model study offshore Oahu Island (Hawaii) demonstrates that these responses are sensitive to the conductivity structure beneath the ocean. We conclude that the sensitivity, depending on the bathymetry gradient, is typically largest near the coast offshore. We show that such sea-surface marine induction surveys can be performed with the Wave Glider, an easy-to-deploy, autonomous, energy-harvesting floating platform with position-keeping capability. Graphical abstract.
Recent Arctic Sea Level Variations from Satellites

Sea level monitoring in the Arctic region has always been an extreme challenge for remote sensing, and in particular for satellite altimetry. Despite more than two decades of observations, altimetry is still limited in the inner Arctic Ocean. We have developed an updated version of the Danish Technical University's (DTU) Arctic Ocean altimetric sea level timeseries starting in 1993 and now extended up to 2015 with CryoSat-2 data. The time-series covers a total of 23 years, which allows higher accuracy in sea level trend determination. The record shows a sea level trend of $2.2 \pm 1.1$ mm/yr for
the region between 66°N and 82°N. In particular, a local increase of 15 mm/y is found in correspondence to the Beaufort Gyre. An early estimate of the mean sea level trend budget closure in the Arctic for the period 2005–2015 was derived by using the Equivalent Water Heights obtained from GRACE Tellus Mascons data and the steric sea level from the NOAA Global Ocean Heat and Salt Content dataset. In this first attempt, we computed the budget based on seasonally averaged values, obtaining the closure with a difference of 0.4 mm/y. This closure is clearly inside the uncertainties of the various components in the sea level trend budget.

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Authors: Andersen, O. B. (Intern), Piccioni, G. (Ekstern)
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Recent geomagnetic secular variation from Swarm and ground observatories as estimated in the CHAOS-6 geomagnetic field model
We use more than 2 years of magnetic data from the Swarm mission, and monthly means from 160 ground observatories as available in March 2016, to update the CHAOS time-dependent geomagnetic field model. The new model, CHAOS-6, provides information on time variations of the core-generated part of the Earth's magnetic field between 1999.0 and 2016.5. We present details of the secular variation (SV) and secular acceleration (SA) from CHAOS-6 at Earth's surface and downward continued to the core surface. At Earth's surface, we find evidence for positive acceleration of the field intensity in 2015 over a broad area around longitude 90 degrees E that is also seen at ground observatories such as Novosibirsk. At the core surface, we are able to map the SV up to at least degree 16. The radial field SA at the core surface in 2015 is found to be largest at low latitudes under the India-South-East Asia region, under the region of northern South America, and at high northern latitudes under Alaska and Siberia. Surprisingly, there is also evidence for significant SA in the central Pacific region, for example near Hawaii where radial field SA is observed on either side of a jerk in 2014. On the other hand, little SV or SA has occurred over the past 17 years in the southern polar region. Inverting for a quasi-geostrophic core flow that accounts for this SV, we obtain a prominent planetary-scale, anticyclonic, gyre centred on the Atlantic hemisphere. We also find oscillations of non-axisymmetric, azimuthal, jets at low latitudes, for example close to 40 degrees W, that may be responsible for localized SA oscillations. In addition to scalar data from Orsted, CHAMP, SAC-C and Swarm, and vector data from Orsted, CHAMP and Swarm, CHAOS-6 benefits from the inclusion of along-track differences of scalar and vector field data from both CHAMP and the three Swarm satellites, as well as east-west
differences between the lower pair of Swarm satellites, Alpha and Charlie. Moreover, ground observatory SV estimates are fit to a Huber-weighted rms level of 3.1 nT/year for the eastward components and 3.8 and 3.7 nT/year for the vertical and southward components. We also present an update of the CHAOS high-degree lithospheric field, making use of along-track differences of CHAMP scalar and vector field data to produce a new static field model that agrees well with the MF7 field model out to degree 110.

**General information**
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Organisations: National Space Institute, Geomagnetism, Université de Grenoble
Authors: Finlay, C. (Intern), Olsen, N. (Intern), Kotsiaros, S. (Intern), Gillet, N. (Ekstern), Tøffner-Clausen, L. (Intern)
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ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.677 SNIP 0.746 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.909 SNIP 0.73
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.878 SNIP 0.912
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.827 SNIP 0.775
Scopus rating (2007): SJR 1.114 SNIP 0.712
Scopus rating (2006): SJR 0.924 SNIP 1.011
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.818 SNIP 0.798
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.832 SNIP 0.849
Web of Science (2004): Indexed yes
Recent results and perspectives on cosmology and fundamental physics from microwave surveys

Recent cosmic microwave background (CMB) data in temperature and polarization have reached high precision in estimating all the parameters that describe the current so-called standard cosmological model. Recent results about the integrated Sachs-Wolfe (ISW) effect from CMB anisotropies, galaxy surveys, and their cross-correlations are presented. Looking at fine signatures in the CMB, such as the lack of power at low multipoles, the primordial power spectrum (PPS) and the bounds on non-Gaussianities, complemented by galaxy surveys, we discuss inflationary physics and the generation of primordial perturbations in the early universe. Three important topics in particle physics, the bounds on neutrinos masses and parameters, on thermal axion mass and on the neutron lifetime derived from cosmological data are reviewed, with attention to the comparison with laboratory experiment results. Recent results from cosmic polarization rotation (CPR) analyses aimed at testing the Einstein equivalence principle (EEP) are presented. Finally, we discuss the perspectives of next radio facilities for the improvement of the analysis of future CMB spectral distortion experiments.

General information

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Universidad de Cantabria, Università degli studi di Ferrara, National Institute for Astrophysics, La Sapienza - Università di Roma, Observatorio Nacional, Sorbonne Universités, Stockholm University, University of Padua
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Reflectivity around the gold L-edges of x-ray reflector of the soft x-ray telescope onboard ASTRO-H

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Number of pages: 8
Publication date: 2016
Satellite tidal magnetic signals constrain oceanic lithosphere-asthenosphere boundary

The tidal flow of electrically conductive oceans through the geomagnetic field results in the generation of secondary magnetic signals, which provide information on the subsurface structure. Data from the new generation of satellites were shown to contain magnetic signals due to tidal flow; however, there are no reports that these signals have been used to infer subsurface structure. We use satellite-detected tidal magnetic fields to image the global electrical structure of the oceanic lithosphere and upper mantle down to a depth of about 250 km. Themodel derived from more than 12 years of satellite data reveals a ≈72-km-thick upper resistive layer followed by a sharp increase in electrical conductivity likely associated with the lithosphere-asthenosphere boundary, which separates colder rigid oceanic plates from the ductile and hotter asthenosphere.

Satellitter og droner i Arktis: - multiuse af en rumbaseret infrastruktur

Satellitter og droner har mange anvendelser som en platform, der kan imødekomme både Forsvarets og civilsamfundets behov og således udgøre grundstammen i en fælles infrastruktur. Samtidig er der et betydeligt potentiale i en satellit- og dronebaseret infrastruktur i Arktis som en katalysator for en bæredygtig økonomisk udvikling. Investeringer i en rumbaseret infrastruktur i Arktis vil derfor ikke blot bidrage til løsningen
Scintillations and TEC gradients from Europe to Africa: a picture by the MiSW project

MiSW (Mitigation of space weather threats to GNSS services) is an EU/FP7 project with the purpose of tackling the research challenges associated with Space Weather effects on GNSS (Global Navigation Satellite System). In particular, the objective of MiSW is to develop suitable algorithms capable of enabling Satellite Based Augmentation Systems (e.g. EGNOS) in the low-latitude African sector. For this purpose, MiSW has created a detailed picture of extreme space weather events that occurred in the past and in the current solar cycle. Despite its weakness, the current solar cycle has featured two superstorms that happened during the descending phase, in March and in June 2015. The latter has been studied in detail through a careful analysis of GNSS data acquired by TEC (Total Electron Content) and scintillation.
monitors and by IGS and regional geodetic networks located in Europe and in Africa. The investigation enabled creating the actual scenarios of TEC gradients and scintillation that occurred over a wide latitudinal extent between 21 and 30 June 2015. The investigation is based on calibrated TEC from different receivers, aiming at the estimation of east-west and north-south TEC gradients and on the integration of calibrated TEC and TEC gradients with the scintillation data. The impact of the storm on GNSS performance has also been investigated in terms of losses of lock. The results of this study highlight the importance of assessing the latitudinal and longitudinal TEC gradients as crucial information to identify to what extent different ionospheric sectors are severely affected by scintillation. On the other hand, this study also shows evidences of how TEC gradients are not always responsible for the observed scintillation. Finally, the outcomes of the study demonstrate the complex relation between scintillation, TEC gradients and losses of GNSS satellites lock.

General information
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Organisations: National Space Institute, Geodesy, Istituto Nazionale di Geofisica e Vulcanologia, University of Nottingham, Thales Alenia Space, Thales, Centrum Badan Kosmicznych Polskiej Akademii Nauk, Sveučilište U Zagrebu Fakultet Elektrotehniike I Racunars, European Commission - Joint Research Center, EISCAT Scientific Association, University of Bath
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Conference: European Geosciences Union General Assembly 2016, Vienna, Austria, 17/04/2016 - 17/04/2016
Main Research Area: Technical/natural sciences

Sea Extremes: Integrated impact assessment in coastal climate adaptation
We investigate effects of sea level rise and a change in precipitation pattern on coastal flooding hazards. Historic and present in situ and satellite data of water and groundwater levels, precipitation, vertical ground motion, geology, and geotechnical soil properties are combined with flood protection measures, topography, and infrastructure to provide a more complete picture of the water-related impact from climate change at an exposed coastal location. Results show that future sea extremes evaluated from extreme value statistics may, indeed, have a large impact. The integrated effects from future storm surges and other geo- and hydro-parameters need to be considered in order to provide for the best protection and mitigation efforts, however. Based on the results we present and discuss a simple conceptual model setup that can e.g. be used for ‘translation’ of regional sea level rise evidence and projections to concrete impact measures. This may be used by potentially affected stakeholders – often working in different sectors and across levels of governance, in a common appraisal of the challenges faced ahead. The model may also enter dynamic tools to evaluate local impact as sea level research advances and projections for the future are updated.

General information
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Organisations: National Space Institute, Geodesy, Danish Geodata Agency, GEO
Authors: Sørensen, C. S. (Intern), Knudsen, P. (Intern), Broge, N. (Ekstern), Molgaard, M. (Ekstern), Andersen, O. B. (Intern)
Seeking an optimal algorithm for a new satellite-based Sea Ice Drift Climate Data Record: Motivations, plans and initial results from the ESA CCI Sea Ice project

The Sea Ice Essential Climate Variable (ECV) as defined by GCOS pertains of both sea ice concentration, thickness, and drift. Now in its second phase, the ESA CCI Sea Ice project is conducting the necessary research efforts to address sea ice drift. Accurate estimates of sea ice drift direction and magnitude are essential for quantification of the role of dynamic sea ice processes contributing to polar sea ice volume and ocean-atmosphere heat exchange. Error-characterised, long-term sea ice drift information are required for assessing the performance of climate simulations and further develops the physical parameterizations. Sea ice drift products are also required to locate regions of convergent and divergent ice motion across spatio-temporal scales from meters / hours to basins / years. The work in the CCI Sea Ice project includes defining metrics for assessing the accuracy of algorithms, selecting relevant satellite and “ground-truth” data, building the Round-Robin Data Package for testing the algorithms, and finally selection of the most promising algorithm(s) for processing of a new sea ice drift climate dataset. Specific efforts are dedicated to the definition of per-grid-cell uncertainties in the final product. This contribution reviews the motivation for the work, the plans for sea ice drift algorithms intercomparison and selection, and early results from our activity.

General information

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Organisations: National Space Institute, Microwaves and Remote Sensing, IFREMER, Alfred Wegener Institute, Finnish Meteorological Institute, University of Hamburg, Norwegian Meteorological Institute, Danish Meteorological Institute
Authors: Lavergne, T. (Ekstern), Dybkjær, G. (Ekstern), Girard-Ardhuin, F. (Ekstern), Hollands, T. (Ekstern), Karvonen, J. (Ekstern), Kern, S. (Ekstern), Pedersen, L. (Ekstern), Saldo, R. (Intern)
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Main Research Area: Technical/natural sciences

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Sentinel-1 provides ice drift observations for Copernicus Marine Environment Monitoring Service (CMEMS)

Sea ice drift information with an accuracy that allows also ice deformation (divergence, shear, vorticity) to be derived is being operationally generated in the Copernicus Marine Environment Monitoring Service (CMEMS). The method is based on 2-dimensional digital cross correlation where subsections of 2 consecutive images (typically 12-36h apart) are compared and the ice displacement defined as the shift in location of images 1 that maximizes the cross correlation with image 2. The method is also known as Maximum Cross Correlation or MCC. Implementation was carried out in the context of the PolarView project in 2007 when large volumes of ENVISAT ASAR images of the Polar regions became available.
during the International Polar Year. A dataset of daily ice drift vectors of the Polar Regions (North and South) is now available covering the time period from 2007 to the present time. In 2009 the processing became part of the GMES Marine Core Service MyOcean and when ENVISAT seized operation in 2012, this enabled a switch to daily RADARSAT-2 coverage of key regions in both hemispheres covered by the GMES Space Component Data Access (GSC-DA) grant. From October 2014, the data provision has switched to Sentinel-1 the source for SAR data, and the daily coverage of ice drift is now similar to what was reached with ENVISAT during the IPY. With the Launch of Sentinel-1B in 2016, daily coverage of most of the Arctic Ocean will become possible. Already today approximately 10,000 Sentinel-1A image pairs are matched every month in the processing system. The quality of the ice drift vectors are routinely verified against GPS locations of drift buoys and the RMS difference between the baseline product available through the Copernicus Marine Environment Monitoring Service data portal and GPS drifters is ~500 meters per day. A significant part of this RMS difference can be ascribed to the different nature of a point measurement and an area measurement. This accuracy is sufficient to support the generation of daily maps of ice divergence, shear and vorticity as the spatial derivatives of the ice drift field. The deformation fields are produced in the FP7 POLAR ICE project which develops methods for downstream distribution of ice related information to end-users in Polar Regions. The presentation will provide more details on the processing system and examples of the products and the POLAR ICE downstream service.

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Organisations: National Space Institute, Microwaves and Remote Sensing, Danish Meteorological Institute
Authors: Toudal Pedersen, L. (Ekstern), Saldo, R. (Intern)
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Sentinel-3 First look for Coastal Applications – Initial comparison with Cryosat-2 in the North Sea
Cryosat-2 offered the first ever possibility to perform coastal altimetric studies using SAR-Interferometry as well as SAR altimetry in preparation for the Sentinel-3 mission. With this technological leap forward it is now able to observe sea level in very small water bodies and also to provide coastal sea level very close to the shore. We perform an investigation into the retrieval of sea surface height in the North Sea and around Denmark and performing the first inter-comparison between SAR altimetry from Sentinel-3 and Cryosat-2. The availability of a radiometer on-board Sentinel-3 used for i.e. the wet troposphere corrections is also tested and compared with similar wet troposphere correction for Cryosat-2 based on a model (ESMWF). The use of the Cryosat-2 and Sentinel-3 is furthermore investigated for possible assimilation into sea level forecasting along the coasts of Denmark. This is a part of the EU sponsored project LOTUS in which the possibility of new Sentinel-3 downstream services are outlined. The advantage of the SAR data compared with conventional altimetry in the coastal zone, is the fact that the increased spatial resolution of Sentinel-3 and Cryosat-2 SAR provide valuable sea level observations within the narrow Straits around Denmark which are crucial to constrain the waterflow in and out of the Baltic Sea. These narrow straits were not well monitored by i.e. ENVISAT due to land contamination within the altimeter footprint.

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Organisations: National Space Institute, Geodesy, DHI Denmark, DHI
Authors: Andersen, O. B. (Intern), Abulaitijiang, A. (Intern), Knudsen, P. (Intern), Grode, P. (Ekstern), Sørensen, J. (Ekstern), Pedersen, O. (Ekstern)
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Short-Term Change Detection in Wetlands Using Sentinel-1 Time Series
Automated monitoring systems that can capture wetlands’ high spatial and temporal variability are essential for their management. SAR-based change detection approaches offer a great opportunity to enhance our understanding of complex and dynamic ecosystems. We test a recently-developed time series change detection approach (S1-omnibus) using Sentinel-1 imagery of two wetlands with different ecological characteristics; a seasonal isolated wetland in southern Spain and a coastal wetland in the south of France. We test the S1-omnibus method against a commonly-used pairwise comparison of consecutive images to demonstrate its advantages. Additionally, we compare it with a pairwise change detection method using a subset of consecutive Landsat images for the same period of time. The results show how S1-omnibus is capable of capturing in space and time changes produced by water surface dynamics, as well as by
agricultural practices, whether they are sudden changes, as well as gradual. S1-omnibus is capable of detecting a wider array of short-term changes than when using consecutive pairs of Sentinel-1 images. When compared to the Landsat-based change detection method, both show an overall good agreement, although certain landscape changes are detected only by either the Landsat-based or the S1-omnibus method. The S1-omnibus method shows a great potential for an automated monitoring of short time changes and accurate delineation of areas of high variability and of slow and gradual changes.

**General information**

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Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing, University of Bonn, Jena Optronik GMBH
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**Silicon pore optics for the ATHENA telescope**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Cosine Science and Computing B.V., ESTEC, Micronit Microfluidics B.V., SRON Netherlands Institute for Space Research, Physikalisch-Technische Bundesanstalt, Max-Planck Institut für Extraterrestrische Physik, National Institute for Astrophysics, Media Lario
Simulating X-ray telescopes with McXtrace: A case study of ATHENA's optics

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Authors: Della Monica Ferreira, D. (Intern), Bergbäck Knudsen, E. (Intern), Westergaard, N. J. S. (Intern), Christensen, F. E. (Intern), Massahi, S. (Intern), Shortt, B. (Ekstern), Spiga, D. (Ekstern), Solstade, M. (Ekstern), Lefmann, K. (Ekstern)
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Simulation and modeling of silicon pore optics for the ATHENA X-ray telescope

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Simultaneous all-channel OTDM demultiplexing based on complete optical Fourier transformation

We demonstrate simultaneous OTDM demultiplexing of all 16-channels for 160-Gbit/s DPSK and 320-Gbit/s DQPSK signals based on complete OFT. Furthermore, numerical simulations show promising results for extending the proposed technique to spectrally efficient Nyquist-OTDM.

Single and Multipolarimetric P-Band SAR Tomography of Subsurface Ice Structure

In this paper, first results concerning the characterization of the subsurface of ice sheets and glaciers through single and multipolarization synthetic aperture radar (SAR) tomography (TomoSAR) are illustrated. To this aim, the processing of data acquired in the framework of the European Space Agency IceSAR 2012 campaign is discussed. IceSAR 2012 was conceived so as to support the secondary objectives of the future Earth Explorer mission BIOMASS, which will be a SAR instrument with media penetration capabilities due to the use of the P-band frequency. In this regard, a tomographic study of ice was motivated by the fact that cryospheric remote sensing is of fundamental importance in order to understand more in depth the morphology and the dynamic processes regulating ice sheets. The main objective of the tomographic experiment of the campaign herein discussed was indeed to assess the capability of P-band SAR to retrieve any information about ice subsurface structure. Imaging has been achieved through TomoSAR techniques, applied to airborne multibaseline data acquired in the southwest of Greenland. Different imaging approaches are compared, and the main results achieved are presented: It is found that scattering in the upper layers of glacial subsurface can be achieved up to an extent of about 20–60 m, conditional on the different types of glaciological zone observed. Moreover, clear morphological structures have been found beneath the ice surface at one of the investigated sites.
Brightness temperatures at 1.4 GHz (L-band) measured by the Soil Moisture and Ocean Salinity (SMOS) Mission have been used to derive the thickness of sea ice. The retrieval method is applicable only for relatively thin ice and not during the melting period. Hitherto, the availability of ground truth sea ice thickness measurements for validation of SMOS sea ice products was mainly limited to relatively thick ice. The situation has improved with an extensive field campaign in the Barents Sea during an anomalous ice edge retreat and subsequent freeze-up event in March 2014. A sea ice forecast system for ship route optimisation has been developed and was tested during this field campaign with the ice-strengthened research vessel RV Lance. The ship cruise was complemented with coordinated measurements from a helicopter and the research aircraft Polar 5. Sea ice thickness was measured using an electromagnetic induction (EM) system from the bow of RV Lance and another EM-system towed below the helicopter. Polar 5 was equipped among others with the L-band radiometer EMIRAD-2. The experiment yielded a comprehensive data set allowing the evaluation of the operational forecast and route optimisation system as well as the SMOS-derived sea ice thickness product that has been used for the initialization of the forecasts. Two different SMOS sea ice thickness products reproduce the main spatial patterns of the ground truth measurements while the main difference being an underestimation of thick deformed ice. Ice thicknesses derived from the surface elevation measured by an airborne laser scanner and from simultaneous EMIRAD-2 brightness temperatures correlate well up to 1.5 m which is more than the previously anticipated maximal SMOS retrieval thickness.
Snapshots of circum-Greenland elevation change, viewed from the PROMICE airborne surveys in 2007, 2011, and 2015

For the Greenland ice sheet, the period from 2007-2015 is characterized by a large variability in climate conditions, with record-breaking melt in 2010 and 2012 and minor net mass loss in 2013. As a part of the Programme for Monitoring of the Greenland Ice Sheet (PROMICE) funded by the Danish Energy Agency, repeat airborne LiDAR surveys have been conducted around the entire margin of Greenland ice sheet. In addition to LiDAR measurements, ice-penetrating radar measurements were carried out in 2007 and 2011, to estimate ice sheet thickness along the flight-path. As the only one of its kind, the repeat surveys have been performed in late summer, to coincide with the end of the balance year. With the third survey successfully conducted in 2015, a unique opportunity for evaluating elevation changes at a consistent and tailored circum-Greenland fluxgate consist with this PROMICE dataset.

Here, we combine available satellite observations of elevation changes of the Greenland ice sheet, with the PROMICE
dataset, to estimate the state of the Greenland ice sheet seen from the PROMICE fluxgate. The PROMICE LiDAR snapshots will guide the contemporary observations from satellites to target the balance year.

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Organisations: National Space Institute, Geodynamics, Geodesy

Authors: Simonsen, S. B. (Intern), Forsberg, R. (Intern), Hvidegaard, S. M. (Intern), Nielsen, J. E. (Intern), Skourup, H. (Intern), Stenseng, L. (Intern), Sørensen, L. S. (Intern)

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**Something is "subsiding" in the state of Denmark - Operational prospects for nationwide subsidence mapping with Sentinel-1**

Synthetic Aperture Radar Interferometry (InSAR) has proven to be a highly valuable tool for deformation monitoring applications, and with the emergence of the operational Sentinel-1 mission, the expectations have further increased. However, the technique is also notorious for being challenging, both in implementation and in interpretation. As such, it has mainly been applied in an opportunistic manner - stacks of archived data were processed in batch over specific areas of interest, results would be somehow validated, and reported to the end-user. Due to lack of a stable and reliable SAR data source, it has so far been very hard to build an operational large-scale system for nationwide InSAR deformation monitoring. The Sentinel-1 constellation will bring a paradigm shift to the field with its operational characteristics: mission configuration, acquisition planning, and data distribution policy. However, operational workflows are still to be designed and deployed. State-of-the-art processing algorithms might be considered ready, but other components of the operational chain are still to be profiled if not designed from scratch. Moreover, an important factor for a nationwide mapping system is dissemination of the results to a broader audience than the one consisting of InSAR domain specialists. The objective of this contribution is to, as far as possible at this early stage, address the following questions and/or identify the bottlenecks, from the national-scale perspective: How to integrate algorithmic state-of-the-art in a single processing system? How to operationally deploy the re-defined state-of-the-art? How to validate results? How to communicate results to non-InSAR communities? These questions will be addressed through a case study for the country of Denmark. Specifically, a strategy for development of a nationwide Sentinel-1 InSAR deformation mapping system will be discussed. Denmark is a good case for a first assessment, both due to its size, and due to the expected signal characteristics. Moreover, the proposed map product will be periodically updated and will be of a different resolution for urban and non-urban areas. The availability of reliable in-situ measurements on both local and national scale therefore will over time allow for reliable validation. Initial results will be presented and will serve as basis for a discussion on how to communicate and streamline a portfolio of subsidence products to end users, which is a challenge in itself. We will conclude with a discussion on remaining open questions regarding how to address these issues as a community. This contribution will focus mainly on the overall system level, rather than on algorithmic details.

**General information**

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Organisations: National Space Institute, Geodesy, PPO.Labs, NORUT Information Technology, Danish Geodata Agency, Geological Survey of Norway

Authors: Marinkovic, P. (Ekstern), Larsen, Y. (Ekstern), Fredenslund Levinsen, J. (Ekstern), Broge, N. H. (Ekstern), Sørensen, C. S. (Intern), Dehls, J. (Ekstern)

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**Spaceborne measurement of Greenland ice sheet changes: the ESA Greenland CCI project**

The ESA “Greenland_ice_sheet_cci” project is currently making past and present space measurements of Greenland ice sheet changes available for use by scientists, stakeholders and the general public. The data are part of a large set of ECV’s (Essential Climate Variables) made available by the ESA Climate Initiative, as a contribution to the global Climate Observing System.

The ECV data produced for the Greenland ice sheet include detailed grids of elevation changes and ice flow velocities, as well as line data of grounding lines and calving front locations for major outlet glaciers. The “ice_sheets_cci” goal is to
generate a consistent, validated, long-term and timely set of ECV’s, a.o. to improve the impact of satellite data on climate research and coupled ice sheet/climate models. Special focus is on use of data from ESA missions such as ERS, Envisat and the new Sentinel missions, but in the 2nd phase of the project, just initiated, mass balance data from the GRACE mission will also be included.

In the presentation the current CCI results are highlighted, including Greenland-wide elevation change results from ERS, Envisat and CryoSat, ice velocities for the coastal regions and major outlet glaciers, new Greenland-wide ice velocities from the ESA Sentinel-1 mission, and 14 years of mass changes from GRACE.

The ECV data confirm a consistent overall picture of accelerating mass loss of the Greenlandic ice sheet, a mass loss which has more the doubled in the last decade. Current rates of changes well above 250 GT/year, corresponding to 0.7 mm/year global sea level rise, and originating especially from mass loss associated with major outlet glacier systems. In the future it is proposed to add additional ECV parameters to the products, including a.o. high-resolution mass change products from GRACE/CryoSat/S-3, and ocean sea level rise regional “finger print” data from the associated closure of the overall global sea level budget, in cooperation with Glaciers, Antarctica and Sea Level CCI projects.

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**Authors:** Forsberg, R. (Intern), Sørensen, L. S. (Intern), Meister, R. (Intern), Simonsen, S. B. (Intern), Dall, J. (Intern), Kusk, A. (Intern), Nagler, T. (Ekstern), Hetzenegger, M. (Ekstern), Evensberget, D. (Ekstern), Hauglund, K. (Ekstern), Khvorostovsky, K. (Ekstern), Shepherd, A. (Ekstern), Hogg, A. (Ekstern), Andersen, S. (Ekstern), Hvidberg, C. (Ekstern), Svensen, S. (Ekstern), Engdahl, M. (Ekstern)

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**BFI (2016):** BFI-level 1  
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We present an analysis of Nuclear Spectroscopic Telescope Array observations of a hard intermediate state of the transient black hole GX 339-4 taken in 2015 January. With the source softening significantly over the course of the 1.3 day long observation we split the data into 21 sub-sets and find that the spectrum of all of them can be well described by a
power-law continuum with an additional relativistically blurred reflection component. The photon index increases from \(\sim 1.69\) to \(\sim 1.77\) over the course of the observation. The accretion disk is truncated at around nine gravitational radii in all spectra. We also perform timing analysis on the same 21 individual data sets, and find a strong type-C quasi-periodic oscillation (QPO), which increases in frequency from \(\sim 0.68\) to \(\sim 1.05\) Hz with time. The frequency change is well correlated with the softening of the spectrum. We discuss possible scenarios for the production of the QPO and calculate predicted inner radii in the relativistic precession model as well as the global disk mode oscillations model. We find discrepancies with respect to the observed values in both models unless we allow for a black hole mass of \(\sim 100\), which is highly unlikely. We discuss possible systematic uncertainties, in particular with the measurement of the inner accretion disk radius in the relativistic reflection model. We conclude that the combination of observed QPO frequencies and inner accretion disk radii, as obtained from spectral fitting, is difficult to reconcile with current models.

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Massachusetts Institute of Technology, California Institute of Technology, University of California at Berkeley, National Institute for Astrophysics, University of Southampton, Columbia University, Institute of Astronomy, NASA Goddard Space Flight Center, University of Erlangen-Nuremberg  
Authors: Fürst, F. (Ekstern), Grinberg, V. (Ekstern), Tomsick, J. A. (Ekstern), Bachetti, M. (Ekstern), Boggs, S. E. (Ekstern), Brightman, M. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Gandhi, P. (Ekstern), Grefenstette, B. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Madsen, K. K. (Ekstern), Parker, M. L. (Ekstern), Pottschmidt, K. (Ekstern), Stern, D. (Ekstern), Walton, D. J. (Ekstern), Wilms, J. (Ekstern), Zhang, W. W. (Ekstern)

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Reconstruction of historical Arctic sea level is generally difficult due to the limited coverage and quality of both tide gauge and altimetry data in the area. Here a strategy to achieve a stable and plausible reconstruction of Arctic sea level from 1950 to today is presented. This work is based on the combination of tide gauge records and a new 20-year reprocessed satellite altimetry derived sea level pattern. Hence the study is limited to the area covered by satellite altimetry (68°N and 82°N). It is found that timestep cumulative reconstruction as suggested by Church and White (2000) may yield widely variable results and is difficult to stabilize due to the many gaps in both tide gauge and satellite data. A more robust sea level reconstruction approach is to use datum adjustment of the tide gauges in combination with satellite altimetry, as described by (Ray and Douglas, 2011). In this approach, a datum-fit of each tide gauges is used and the method takes into account the entirety of each tide gauge record. This makes the Arctic sea level reconstruction much less prone to drifting. From our reconstruction, we found that the Arctic mean sea level trend is around 1.5 mm +/- 0.3 mm/y for the period 1950 to 2010, between 68°N and 82°N. This value is in good agreement with the global mean trend of 1.8 +/- 0.3 mm/y over the same period as found by Church and White (2004).
Study on offshore wind farm wakes based on Envisat ASAR, Radarsat-2 and Sentinel-1
Downstream of operating wind farms the mean wind speed is reduced as compared to the upwind conditions. In the offshore environment it is of particular interest to quantify the wind farm wake because turbine arrays are often located in the vicinity of other wind farms. The wakes reduce the annual energy production in clustered wind farms. Envisat ASAR, Radarsat-2 and Sentinel-1 are used in the study covering wind farms in the North Sea and Kattegat Strait. Three types of
In this study, the GOCE (Gravity field and steady state Ocean Circulation Explorer) gradiometry data were used to study geologic structures and mass variations within the lithosphere in areas of known subduction zones. The advantage of gravity gradiometry over other gravity methods is that gradients are extremely sensitive to localized density contrasts within regional geological settings, which makes it ideally suited for detecting subduction zones. Second order gravity gradients of disturbing potential were extracted from global geopotential model, the fifth release GOCE model ‘EGM_TIM_RL05’. In order to remove the signal which mainly corresponds to the gravity signal of the lower mantle, long wavelength part of the gravity signal was removed up to degree and order 60. Because the areas with notable topography differences coincide with subduction zones, topography correction was also performed. Few pattern recognition methods were tested on all 6 gravity gradient tensor components represented as global scale maps with resolution of 100km (corresponds to the resolution of the GOCE satellite data). By adjusting pattern recognition methods’ features and optimizing various input patterns, the best method was applied. That is a combination of methods based on SURF (Speeded Up Robust Features) and MSER (Maximally Stable Extremal Regions) algorithms provided in MATLAB’s Computer Vision System Toolbox. Based on 6 gravity gradient components, the global gradient anomaly maps were produced and used as starting point for analysis based on image processing. On obtained maps, locations of known subduction zones were represented with characteristic elongated patterns and cross-sections. Cross sections of well-known subduction zones were used as input patterns for pattern recognition method on global maps. The search for discrete point correspondences between these images was divided into three main steps: Interest point detection, interest point description and matching between images. Resulting routine compares vertical gravity gradient anomaly signal in the areas with known subduction zones with all locations on the Earth (covered by GOCE gravity gradients). Searching, comparing and detecting the compatible signal lead to correct detection of all known subduction zones but also gave indications for locations of unknown subduction. Apart from subduction zones, certain geological features were detected and studied. The method proved its advantages and should be easily adjusted and conducted on other datasets with similar representations.
Sunlight effects on the 3D polar current system determined from low Earth orbit measurements

Interaction between the solar wind and the Earth's magnetosphere is associated with large-scale currents in the ionosphere at polar latitudes that flow along magnetic field lines (Birkeland currents) and horizontally. These current systems are tightly linked, but their global behaviors are rarely analyzed together. In this paper, we present estimates of the average global Birkeland currents and horizontal ionospheric currents from the same set of magnetic field measurements. The magnetic field measurements, from the low Earth orbiting Swarm and CHAMP satellites, are used to co-estimate poloidal and toroidal parts of the magnetic disturbance field, represented in magnetic apex coordinates. The use of apex coordinates reduces effects of longitudinal and hemispheric variations in the Earth's main field. We present global currents from both hemispheres during different sunlight conditions. The results show that the Birkeland currents vary with the conductivity, which depends most strongly on solar EUV emissions on the dayside and on particle precipitation at pre-midnight magnetic local times. In sunlight, the horizontal equivalent current flows in two cells, resembling an opposite ionospheric convection pattern, which implies that it is dominated by Hall currents. By combining the Birkeland current maps and the equivalent current, we are able to calculate the total horizontal current, without any assumptions about the conductivity. We show that the total horizontal current is close to zero in the polar cap when it is dark. That implies that the equivalent current, which is sensed by ground magnetometers, is largely canceled by the horizontal closure of the Birkeland currents.
This Supplement provides supporting material for Abbott et al. (2016a). We briefly summarize past electromagnetic (EM) follow-up efforts as well as the organization and policy of the current EM follow-up program. We compare the four probability sky maps produced for the gravitational-wave transient GW150914, and provide additional details of the EM follow-up observations that were performed in the different bands.
Swarm accelerometer data processing from raw accelerations to thermospheric neutral densities

The Swarm satellites were launched on November 22, 2013, and carry accelerometers and GPS receivers as part of their scientific payload. The GPS receivers do not only provide the position and time for the magnetic field measurements, but are also used for determining non-gravitational forces like drag and radiation pressure acting on the spacecraft. The accelerometers measure these forces directly, at much finer resolution than the GPS receivers, from which thermospheric neutral densities can be derived. Unfortunately, the acceleration measurements suffer from a variety of disturbances, the most prominent being slow temperature-induced bias variations and sudden bias changes. In this paper, we describe the new, improved four-stage processing that is applied for transforming the disturbed acceleration measurements into scientifically valuable thermospheric neutral densities. In the first stage, the sudden bias changes in the acceleration measurements are manually removed using a dedicated software tool. The second stage is the calibration of the accelerometer measurements against the non-gravitational accelerations derived from the GPS receiver, which includes the correction for the slow temperature-induced bias variations. The identification of validity periods for calibration and correction parameters is part of the second stage. In the third stage, the calibrated and corrected accelerations are merged with the non-gravitational accelerations derived from the observations of the GPS receiver by a weighted average in the spectral domain, where the weights depend on the frequency. The fourth stage consists of transforming the corrected and calibrated accelerations into thermospheric neutral densities. We present the first results of the processing of Swarm C acceleration measurements from June 2014 to May 2015. We started with Swarm C because its acceleration measurements contain much less disturbances than those of Swarm A and have a higher signal-to-noise ratio than those of Swarm B. The latter is caused by the higher altitude of Swarm B as well as larger noise in the acceleration measurements of Swarm B. We show the results of each processing stage, highlight the difficulties encountered, and comment on the quality of the thermospheric neutral density data set.
In the framework of the ESA Earth Observation Magnetic Mapping Mission Swarm, the Expert Support Laboratories (ESL) provides high quality Level 2 Products describing a.o. the magnetic fields of the Earth. This poster provides details of the Level 2 Products from the Comprehensive Inversion chain comprising models of the magnetic fields of Earth's core and lithosphere, ionosphere and magnetosphere.

**General information**

**State:** Published  
**Organisations:** National Space Institute, Geomagnetism, NASA Goddard Space Flight Center  
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**Event:** Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Swarm magnetic and GOCE gravity gradient grids for lithospheric modelling
We explore how Swarm magnetic gradient and GOCE gravity gradient data can improve modelling of the Earth's lithosphere and thereby contribute to a better understanding of Earth's dynamic processes. We study the use of gradient grids to provide improved information about the lithosphere and upper mantle in the well-surveyed North-East Atlantic Margin. In particular, we present the computation of magnetic and gravity gradient grids at satellite altitude (roughly 450 km and 250 km above the Earth for Swarm and GOCE respectively). It is shown that regional solutions based on a tesseroid approach may contain more signal content than global models do. The patchwork of regional grids is presented as well as the subsequent error reduction through iterative downward and upward continuation using the Poisson integral equation. The promises and pitfalls are discussed of using grids at mean satellite altitude.

General information
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Swarm Products and Space Weather Applications
The Swarm satellite constellation mission provides high precision magnetic field data and models and other observations that enable us to explore near Earth space for example in terms of in situ electron density and electric fields. On board GPS observables can be used for sounding ionospheric and plasmaspheric electron content and GPS and accelerometer data are used to derive information on thermospheric density. Continuous data sets from LEO satellites, such as Swarm, and often combined with ground observations have been useful in developing empirical models of the temporal occurrence and local distribution of typical structures, like the expansion of the auroral oval depending on magnetic activity; or the typical climatological behaviour of plasma structures in the F region ionosphere, such as equatorial depletions or polar enhancements. Among others, these three phenomena can harm, for example, continuous radio navigation and communication (e.g., Galileo, GPS) through the development of severe ionospheric plasma gradients, e.g., during geomagnetic storms. This paper will discuss opportunities from LEO satellites for imaging the actual state of the magnetosphere and upper atmosphere for applications in aeronomy and space weather. We will emphasize results from the Swarm mission.

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Swarm: Recent Progress in Analysis of the Sun Induced Magnetic Disturbance
The ESA Earth Observation Magnetic Mission Swarm carries high precision vector and scalar magnetometers. Careful analyses have revealed a smaller, Sun driven magnetic disturbance of the vector magnetometer. This disturbance have been imperically mapped and corrected since mid 2015. This work will show the recent developments in the modelling of this disturbance.
Synthetic SAR Image Generation using Sensor, Terrain and Target Models

A tool to generate synthetic SAR images of objects set on a clutter background is described. The purpose is to generate images for training Automatic Target Recognition and Identification algorithms. The tool employs a commercial electromagnetic simulation program to calculate radar cross sections of the object using a CAD-model. The raw measurements are input to a SAR system and terrain model, which models thermal noise, terrain clutter, and SAR focusing to produce synthetic SAR images. Examples of SAR images at 0.3m and 0.1m resolution, and a comparison with real SAR imagery from the MSTAR dataset is presented.

The absolute magnetometers on board Swarm, lessons learned from more than two years in space

ESA's Swarm satellites carry 4He absolute magnetometers (ASM), designed by CEA-Léti and developed in partnership with CNES. These instruments are the first-ever space-borne magnetometers to use a common sensor to simultaneously deliver 1Hz independent absolute scalar and vector readings of the magnetic field. They have provided the very high accuracy scalar field data nominally required by the mission (for both science and calibration purposes, since each satellite also carries a low noise high frequency fluxgate magnetometer designed by DTU), but also very useful experimental absolute vector data. They have also been run for short periods of time in a so-called burst mode to deliver absolute scalar data at 250 Hz. In this presentation, we will report on the various tests and investigations carried out using these data since launch in November 2013. In particular, we will illustrate the advantages of flying ASM instruments on space-borne magnetic missions for data quality checks, geomagnetic field modeling and science objectives.
The ATHENA Optics Development

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Number of pages: 8
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The Delta low-inclination satellite concept, an opportunity to enhance the science return of the Swarm mission

ESA's Swarm mission aims at studying all sources of Earth's magnetic field. It consists of two satellites (Alpha and Charlie), which fly side-by-side on near polar orbits at an altitude of slightly less than 500 km, and of a third satellite (Bravo) on a similar but slightly more polar and higher orbit, which progressively drifts with respect to that of Alpha and Charlie. This orbital configuration has proven extremely valuable, as evidenced by the many results already obtained from the first two years of the mission. These results, however, also reveal that geomagnetic field modeling and investigation efforts are now hampered by the still limited local time coverage provided by this constellation. This affects our ability to accurately characterize time changes in the ionospheric and magnetospheric field contributions, and to model the electrical conductivity of the Earth's mantle. It also indirectly limits our ability to model the core and lithospheric field. More generally, many of the "residual signals" detected in the very accurate magnetic data of the Swarm mission can still not fully be exploited. Further increasing the scientific return of the Swarm mission by squeezing more out of these data, however, would be possible if a fourth "Delta" satellite were to be launched soon enough to join the constellation at a similar altitude but much lower inclination orbit (such as 60°). Such a satellite would provide less geographical coverage but a much faster mapping of all local times over these latitudes. In this presentation we will present the rational for such a Delta mission and discuss the benefit it would bring.

General information
State: Published
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The Distribution of Radioactive 44Ti in Cassiopeia A

The distribution of elements produced in the innermost layers of a supernova explosion is a key diagnostic for studying the collapse of massive stars. Here we present the results of a 2.4 Ms NuSTAR observing campaign aimed at studying the supernova remnant Cassiopeia A (Cas A). We perform spatially resolved spectroscopic analyses of the 44Ti ejecta, which we use to determine the Doppler shift and thus the three-dimensional (3D) velocities of the 44Ti ejecta. We find an initial 44Ti mass of $(1.54 \pm 0.21) \times 10^{-4} M_\odot$, which has a present-day average momentum direction of $340^\circ \pm 15^\circ$ projected onto the plane of the sky (measured clockwise from celestial north) and is tilted by $58^\circ \pm 20^\circ$ into the plane of the sky away from the observer, roughly opposite to the inferred direction of motion of the central compact object. We find some 44Ti ejecta that are clearly interior to the reverse shock and some that are clearly exterior to it. Where we observe 44Ti ejecta exterior to the reverse shock we also see shock-heated iron; however, there are regions where we see iron but do not observe 44Ti. This suggests that the local conditions of the supernova shock during explosive nucleosynthesis varied enough to suppress the production of 44Ti by at least a factor of two in some regions, even in regions that are assumed to be the result of processes like α-rich freezeout that should produce both iron and titanium.

General information
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The DTU15 MSS (Mean Sea Surface) and DTU15LAT (Lowest Astronomical Tide) reference surface
The DTU15MSS is the latest release of the global high resolution mean sea surface from DTU Space. The major new advance leading up to the release of this DTU15MSS the use of an improved 4 years Cryosat-2 LRM, SAR and SAR-In data record and the downweighting of ICESat data used previously in the Arctic Ocean for DTU10MSS and DTU13MSS. A new reference surface for off-shore vertical referencing is introduced. This is called the DTU15LAT. The surface is derived from the DTU15MSS and the DTU10 Global ocean tide to give a 19 year Lowest Astronomical Tide referenced to either the Mean sea surface or to the reference Ellipsoid via the use of the DTU15MSS. The presentation will also focus on the difficult issues as consolidating Cryosat-2 onto a 20 year mean sea surface derived using multiple satellites (but only at low to medium latitude) as well as the importance of merging Cryosat-2 data from different operating modes like LRM, SAR and SAR-In as these requires different retrackers. Also the importance of downweighting the ICESat data is highlighted.

General information
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The electrical conductivity of the upper mantle and lithosphere from the magnetic signal due to ocean tidal flow
Oceans cover about seventy percent of the Earth and yet the overwhelming majority of seismological or electromagnetic (EM) observatories are found on continents. This provides a challenge for understanding composition, structure, and dynamics of Earth’s lithosphere and upper mantle in oceanic regions. The recent expansion in magnetic data from low-Earth orbiting satellite missions (Orsted, CHAMP, SAC-C, and Swarm) has led to a rising interest in probing Earth from space. The largest benefit of using satellite data is much improved spatial coverage. Additionally, and in contrast to
ground-based data, satellite data are overall uniform and very high quality. Probing the conductivity of the lithosphere and upper mantle requires EM variations with periods of a few hours. Electric currents generated by oceanic tides are a well-suited source within this period range. Ocean tides interact galvanically with Earth’s lithosphere (i.e. by direct coupling of the source currents in the ocean with the underlying substrate), enabling conductivity estimations at shallower depths. Here we present the results of determining a 1-D conductivity-depth profile of oceanic lithosphere and upper mantle using satellite and seafloor magnetic signals from the M2 ocean tide. With these data we also make an attempt to detect lateral variability of the Earth’s conductivity.

**General information**

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Organisations: National Space Institute, Geomagnetism, University of Colorado at Boulder, ETH Zurich, NASA Goddard Space Flight Center
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The First Focused Hard X-Ray Images of the Sun With NuSTAR

We present results from the first campaign of dedicated solar observations undertaken by the Nuclear Spectroscopic Telescope ARray (NuSTAR) hard X-ray (HXR) telescope. Designed as an astrophysics mission, NuSTAR nonetheless has the capability of directly imaging the Sun at HXR energies (>3 keV) with an increase in sensitivity of at least two magnitude compared to current non-focusing telescopes. In this paper we describe the scientific areas where NuSTAR will make major improvements on existing solar measurements. We report on the techniques used to observe the Sun with NuSTAR, their limitations and complications, and the procedures developed to optimize solar data quality derived from our experience with the initial solar observations. These first observations are briefly described, including the measurement of the Fe K-shell lines in a decaying X-class flare, HXR emission from high in the solar corona, and full-disk HXR images of the Sun.

**General information**

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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, California Institute of Technology, University of California at Berkeley, University of Glasgow, University of California, Santa Cruz, Lawrence Livermore National Laboratory, Air Force Research Laboratory, Southwest Research Institute, Harvard-Smithsonian Center for Astrophysics, NASA Goddard Space Flight Center, University of Applied Sciences and Arts Northwestern Switzerland, Columbia University
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We present the first observations of quiescent active regions (ARs) using the Nuclear Spectroscopic Telescope Array (NuSTAR), a focusing hard X-ray telescope capable of studying faint solar emission from high-temperature and non-thermal sources. We analyze the first directly imaged and spectrally resolved X-rays above 2 keV from non-flaring ARs, observed near the west limb on 2014 November 1. The NuSTAR X-ray images match bright features seen in extreme ultraviolet and soft X-rays. The NuSTAR imaging spectroscopy is consistent with isothermal emission of temperatures 3.1-4.4 MK and emission measures $1-8 \times 10^{46}$ cm$^{-3}$. We do not observe emission above 5 MK, but our short effective exposure times restrict the spectral dynamic range. With few counts above 6 keV, we can place constraints on the presence of an additional hotter component between 5 and 12 MK of $\sim 10^{46}$ cm$^{-3}$ and $\sim 10^{43}$ cm$^{-3}$, respectively, at least an order of magnitude stricter than previous limits. With longer duration observations and a weakening solar cycle (resulting in an increased livetime), future NuSTAR observations will have sensitivity to a wider range of temperatures as well as possible non-thermal emission.
We study the geometry of the active galactic nucleus (AGN) obscurer in IRAS 09104+4109, an IR-luminous, radio-intermediate FR-I source at z = 0.442, using infrared data from Spitzer and Herschel, X-ray data from NuSTAR, Swift, Suzaku, and Chandra, and an optical spectrum from Palomar. The infrared data imply a total rest-frame 1–1000 μm luminosity of $5.5 \times 10^{46}$ erg s$^{-1}$ and require both an AGN torus and a starburst model. The AGN torus has an anisotropy-corrected IR luminosity of $4.9 \times 10^{46}$ erg s$^{-1}$ and a viewing angle and half-opening angle both of approximately 36° from pole-on. The starburst has a star formation rate of $(110 \pm 34)$ $M_{\odot}$ yr$^{-1}$ and an age of $<50$ Myr. These results are consistent with two epochs of luminous activity in IRAS 09104+4109: one approximately 150 Myr ago, and one ongoing. The X-ray data suggest a photon index of Γ ≈ 1.8 and a line-of-sight column density of $N_{H} \approx 5 \times 10^{23}$ cm$^{-2}$. This argues against a reflection-dominated hard X-ray spectrum, which would have implied a much higher $N_{H}$ and luminosity. The X-ray and infrared data are consistent with a bolometric AGN luminosity of L$_{bol} \sim (0.5–2.5) \times 10^{47}$ erg s$^{-1}$. The X-ray and infrared data are further consistent with coaligned AGN obscurers in which the line of sight “skims” the torus. This is also consistent with the optical spectra, which show both coronal iron lines and broad lines in polarized but not direct light. Combining constraints from the X-ray, optical, and infrared data suggest that the AGN obscurer is within a vertical height of 20 pc, and a radius of 125 pc, of the nucleus.
The hard X-ray emission of the luminous infrared galaxy NGC 6240 as observed by NuSTAR

We present a broad-band (∼0.3–70 keV) spectral and temporal analysis of NuSTAR observations of the luminous infrared galaxy NGC6240, combined with archival Chandra, XMM–Newton and BeppoSAX data. NGC 6240 is a galaxy in a relatively early merger state with two distinct nuclei separated by ∼1′.5. Previous Chandra observations have resolved the two nuclei, showing that they are both active and obscured by Compton–thick material. Although they cannot be resolved by NuSTAR, thanks to the unprecedented quality of the NuSTAR data at energies >10 keV, we clearly detect, for the first time, both the primary and the reflection continuum components. The NuSTAR hard X–ray spectrum is dominated by the primary continuum piercing through an absorbing column density which is mildly optically thick to Compton scattering ($\sim$1.2, $N_{H} \sim 1.5 \times 10^{24}$ cm$^{-2}$). We detect moderate hard X–ray (> 10 keV) flux variability up to 20% on short (15 − 20 ksec) timescales. The amplitude of the variability is maximum at ∼30 keV and is likely to originate from the primary continuum of the southern nucleus. Nevertheless, the mean hard X–ray flux on longer timescales (years) is relatively constant. Moreover, the two nuclei remain Compton–thick, although we find evidence of variability of the material along the line of sight with column densities $N_{H} \ll 2 \times 10^{24}$ cm$^{-2}$ over long (∼3–15 years) timescales. The observed X–ray emission in the NuSTAR energy range is fully consistent with the sum of the best–fit models of the spatially resolved Chandra spectra of the two nuclei.

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Scopus rating (2015): SJR 2.545 SNIP 1.224 CiteScore 3.5
The Impact of DEM Resolution on Relocating Radar Altimetry Data Over Ice Sheets

Beam-limited footprints from conventional satellite radar altimeters have diameters of up to tens of kilometers. Topography within the footprint results in a displacement of the reflecting point from Nadir to the point of closest approach relative to the satellite. Several methods exist for correcting for such mispointing errors. Here, two techniques are applied to observations near Jakobshavn Isbrae, acquired with Envisat's Radar Altimeter (RA-2). The a priori knowledge on the surface topography is obtained from a digital elevation model. The methods relocate the measurement location...
horizontally to agree with the measured range. One method assumes a constant surface slope within the footprint and uses this and the surface aspect to estimate the displacement parameter; the other locates the optimal relocation point using local topography. The results of the two methods are evaluated against airborne laser-scanner data from the airborne topographic mapper. We find that the accuracy of the relocation depends on both the technique and the spatial resolution of the digital elevation model, and that this dependency varies with surface roughness. Thus, the relocation may be associated with significant errors, which will lower the accuracy of cryospheric studies based on radar altimetry data. We find that the most accurate results are obtained when assessing the full local topography. Furthermore, errors in data over the steep margin are minimized the most when using a spatial resolution of 2 km; the effect of the resolution over regions with a smoother topography is minor.

General information
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Organisations: National Space Institute, Geodynamics, Danish Ministry of Energy, Utilities and Climate
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.674 SNIP 2.399 CiteScore 3.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.573 SNIP 2.126 CiteScore 3.33
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.291 SNIP 2.187 CiteScore 2.97
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.963 SNIP 1.363 CiteScore 1.97
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.819 SNIP 2.238
BFI (2009): BFI-level 1
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Web of Science (2008): Indexed yes
Original language: English
Digital Elevation Models, Relocation errors, Satellite radar altimetry
DOIs: 10.1109/JSTARS.2016.2587684
The Impact of JWST Broadband Filter Choice on Photometric Redshift Estimation

The determination of galaxy redshifts in the James Webb Space Telescope's (JWST) blank-field surveys will mostly rely on photometric estimates, based on the data provided by JWST's Near-Infrared Camera (NIRCam) at 0.6–5.0 μm and Mid Infrared Instrument (MIRI) at λ 5.0 μm. In this work we analyze the impact of choosing different combinations of NIRCam and MIRI broadband filters (F070W to F770W), as well as having ancillary data at λ 0.6 μm, on the derived photometric redshifts (z_{phot}) of a total of 5921 real and simulated galaxies, with known input redshifts z = 0–10.

General information
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Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Groningen, Centro de Astrobiología, Aix Marseille Université, Universidad Complutense, University of Leicester, Leiden University, Space Telescope Science Institute
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 8.95
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 8.83
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 9
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 9.83
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 14.26
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 11.32
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
The impact of melt ponds on summertime microwave brightness temperatures and sea-ice concentrations

Sea-ice concentrations derived from satellite microwave brightness temperatures are less accurate during summer. In the Arctic Ocean the lack of accuracy is primarily caused by melt ponds, but also by changes in the properties of snow and the sea-ice surface itself. We investigate the sensitivity of eight sea-ice concentration retrieval algorithms to melt ponds by comparing sea-ice concentration with the melt-pond fraction. We derive gridded daily sea-ice concentrations from microwave brightness temperatures of summer 2009. We derive the daily fraction of melt ponds, open water between ice floes, and the ice-surface fraction from contemporary Moderate Resolution Spectroradiometer (MODIS) reflectance data. We only use grid cells where the MODIS sea ice concentration, which is the melt-pond fraction plus the ice-surface fraction, exceeds 90%. For one group of algorithms, e.g., Bristol and Comiso bootstrap frequency mode (Bootstrap_f), sea-ice concentrations are linearly related to the MODIS melt-pond fraction quite clearly after June. For other algorithms, e.g., Near9OGHz and Comiso bootstrap polarization mode (Bootstrap_p), this relationship is weaker and develops later in summer. We attribute the variation of the sensitivity to the melt-pond fraction across the algorithms to a different sensitivity of the brightness temperatures to snow-property variations. We find an underestimation of the sea-ice concentration by between 14% (Bootstrap_f) and 26% (Bootstrap_p) for 100% sea ice with a melt-pond fraction of 40%. The underestimation reduces to 0% for a melt pond fraction of 20%. In presence of real open water between ice floes, the sea-ice concentration is overestimated by between 26% (Bootstrap_f) and 14% (Bootstrap_p) at 60% sea-ice concentration and by 20% across all algorithms at 80% sea-ice concentration. None of the algorithms investigated performs best based on our investigation of data from summer 2009. We suggest that those algorithms which are more sensitive to melt ponds could be optimized more easily because the influence of unknown snow and sea-ice surface property variations is less pronounced.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Center for Climate System Analysis and Prediction, CliSAP, Norwegian Polar Institute, Danish Meteorological Institute, Nansen Environmental and Remote Sensing Center
Authors: Kern, S. (Ekstern), Rösel, A. (Ekstern), Pedersen, L. T. (Ekstern), Ivanova, N. (Ekstern), Saldo, R. (Intern), Tonboe, R. T. (Ekstern)
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Main Research Area: Technical/natural sciences

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Journal: The Cryosphere
Volume: 10
Issue number: 5
ISSN (Print): 1994-0416
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
The impact of using Jason-1 and Cryosat-2 geodetic mission altimetry for gravity field modeling
Since the release of the Danish Technical University DTU10 global marine gravity field in 2010, the amount of geodetic mission altimetry data has nearly tripled. The Cryosat-2 satellite have provided data along its 369 day near repeat since 2010 and as of May 2012 the Jason-1 satellite has been operating in a geodetic mission as part its end of life mission. In this presentation, we perform an investigation of the impact of the Cryosat-2 and Jason-1 geodetic missions on high resolution marine gravity field mapping through comparison with recent high quality marine gravity measured by the United States Naval Ship Bowditch in the Western Pacific Ocean in 2006. Comparisons of pre and post Cryosat-2/Jason-1 gravity fields illustrated the importance of these new geodetic missions for altimeter marine gravity field mapping. Altimetric gravity derived using 1 year of either Cryosat-2 or Jason-1 is nearly 10% better than gravity derived from retracted and reprocessed combined ERS-1 and Geosat in terms of lower standard deviation with marine gravity. The combination of data from all four geodetic mission data improves the agreement from around 4.1 mGal to around 3.1 mGal. Accounting for an error estimate of around 1 mGal in the marine gravity observations, it is concluded that for this particularly gravity survey region, the new gravity field from four geodetic missions has an accuracy of about 2 mGal.

The_impact_of_melt_ponds.pdf
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The NuSTAR Extragalactic Surveys: The Number Counts of Active Galactic Nuclei and the Resolved Fraction of the Cosmic X-Ray Background

We present the 3–8 keV and 8–24 keV number counts of active galactic nuclei (AGNs) identified in the NuclearSpectroscopic Telescope Array (NuSTAR) extragalactic surveys. NuSTAR has now resolved 33%–39% of the X-ray background in the 8–24 keV band, directly identifying AGNs with obscuring columns up to ~10^{25} cm^{-2}. In the softer 3–8 keV band the number counts are in general agreement with those measured by XMM-Newton and Chandra over the flux range 5 x 10^{-15} ≤ S(3–8 keV)/erg s^{-1} cm^{-2} ≤ 10^{-12} probed by NuSTAR. In the hard 8–24 keV band NuSTAR probes fluxes over the range 2 x 10^{-14} ≤ S(8–24 keV)/erg s^{-1} cm^{-2} ≤ 10^{-12}, a factor ~100 fainter than previous measurements. The 8–24 keV number counts match predictions from AGN populationsynthesis models, directly confirming the existence of a population of obscured and/or hard X-ray sources inferred from the shape of the integrated cosmic X-ray background. The measured NuSTAR counts lie significantly above simple extrapolation with a Euclidian slope to low flux of the Swift/BAT 15–55 keV number counts measured at higher fluxes (S(15–55 keV) ≤ 10^{-11} erg s^{-1} cm^{-2}), reflecting the evolution of the AGN population between the Swift/BAT local (z < 0.1) sample and NuSTAR’s z ~ 1 sample. CXB synthesis models, which account for AGN evolution, lie above the Swift/BAT measurements, suggesting that they do not fully capture the evolution of obscured AGNs at low redshifts.
The legacy of extreme sea levels for the assessment of future coastal flood risk – A review of methods applied in
Denmark, Germany and Norway

The coasts of Denmark, Germany and Norway face similar hazards from storm surges governed by eastward propagating
atmospheric lows. Surge and tide levels, as well as their corresponding impacts, vary between storms and location. The
exposure and physical vulnerability of the coastline is also not evenly distributed. National methodologies for assessing
extreme events generally differ in some way. For example, the statistical methods applied in extreme value analysis,
projections of future changes in extremes, and/or approaches for dealing with coastal flood risks. This includes local to
regional climate change projections for future sea extremes, and, for instance, variations due to location, morphodynamic
change, and glacio-isostatic adjustment. Next, the transformation of this knowledge to concrete impact and design
measures and its use in national and local governance adaptation schemes in the three countries is discussed. Here,
national approaches to deal with risk, risk acceptance and uncertainty vary, among other factors, as a result of the
different assessments of extreme events. In hazard and vulnerability assessments, for instance, where results are highly
dependent on the quality of the underlying observational data and statistical methods in use, it is necessary to gain a
deeper understanding of the physical processes (i.e. the atmospheric and oceanographic genesis of storms) in order to
make robust strategies for adaptation and risk reduction. Inasmuch as the countries bordering the northeast Atlantic
Ocean and the North Sea deal with similar coastal hazards and climate change challenges, the development of enhanced
scientific transnational collaboration to share knowledge and views regarding future impact from storm surges is
suggested. This will provide more robust measures of mitigation and adaptation and it will secure a wider dissemination of

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The LOFT mission concept: a status update

General information

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Geomagnetism
Spatial data are now collected and processed in larger amounts, and used by larger populations than ever before. While most geospatial data have traditionally been recorded as two-dimensional data, the evolution of data collection methods and user demands have led to data beyond the two dimensions describing complex multidimensional phenomena. An example of the relevance of multidimensional modelling is seen with the development of urban modelling where several dimensions have been added to the traditional 2D map representation (Sester et al., 2011). These include obviously the third spatial dimension (Biljecki et al., 2015) as well as the temporal, but also the scale dimension (Van Oosterom and Stoter, 2010) or, as mentioned by (Lu et al., 2016), multi-spectral and multi-sensor data. Such a view provides an organisation of multidimensional data around these different axes and it is time to explore each axis as the availability of unprecedented amounts of new data demands new solutions. The availability of such large amounts of data induces an acute need for developing new approaches to assist with their dissemination, visualisation, and analysis by end users. Several issues need to be considered in order to provide a meaningful representation and assist in data visualisation and mining, modelling and analysis; such as data structures allowing representation at different scales or in different contexts of thematic information. Such issues are of importance with regard to the mission of the ISPRS Commission II and, pertaining to both spatial data structuresand algorithms and to geovisualisation, more specifically to WorkingGroups II/2 and II/6. Hence, this special issue presents some recent developments and review papers covering various aspects of multidimensional data modelling and visualisation.
The Multiple Waveform Persistent Peak (MWaPP) Retracker for SAR waveforms

Here we present a new method for retracking of SAR waveforms over rivers and lakes. Satellite altimetry offers frequent and global sampling across borders, which can be used to validate and calibrate hydrological models in remote areas where in situ measurements are scarce.

The method was developed using CryoSat-2 20Hz SAR data, but due to the similarities between the Sentinel-3 SRAL altimeter and the SIRAL altimeter on-board CryoSat-2 an adaption of the method will be straightforward.

The MWaPP retracker is based on a sub-waveform retracker, but takes the shape of adjacent waveforms into account before selecting the sub-waveform belonging to nadir. This is new compared to primary peak retrackers, and alleviates a lot of snagging due to off-nadir bright targets, but also topography challenges.

The results from the MWaPP retracker show a significant decrease in the standard deviation of the mean of various lake and river crossings throughout the world. Results are presented for rivers and lakes, such as The Brahmaputra River, The Amazon River, The River Thames, and for Lake Vänern in Sweden and Lake Okeechobee in Florida, US.

General information

State: Published
Organisations: National Space Institute, Geodesy
Authors: Villadsen, H. (Intern), Andersen, O. B. (Intern), Stenseng, L. (Intern), Nielsen, K. (Intern), Knudsen, P. (Intern)
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Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
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The nature of the torus in the heavily obscured AGN Markarian 3: an X-ray study

In this paper, we report the results of an X-ray monitoring campaign on the heavily obscured Seyfert galaxy, Markarian 3, carried out between the fall of 2014 and the spring of 2015 with NuSTAR, Suzaku and XMM–Newton. The hard X-ray spectrum of Markarian 3 is variable on all the time-scales probed by our campaign, down to a few days. The observed continuum variability is due to an intrinsically variable primary continuum seen in transmission through a large, but still Compton-thin column density (NH ∼ 0.8–1.1 × 10²⁴ cm⁻²). If arranged in a spherical-toroidal geometry, the Compton scattering matter has an opening angle ≃66°, and is seen at a grazing angle through its upper rim (inclination angle ≃70°).

We report a possible occultation event during the 2014 campaign. If the torus is constituted by a system of clouds sharing the same column density, this event allows us to constrain their number (17 ± 5) and individual column density, ≃ (4.9 ± 1.5) × 10²² cm⁻². The comparison of IR and X-ray spectroscopic results with state-of-the art ‘torus’ models suggests that at least two-thirds of the X-ray obscuring gas volume might be located within the dust sublimation radius. We report also the discovery of an ionized absorber, characterized by variable resonant absorption lines due to He- and H-like iron. This discovery lends support to the idea that moderate column density absorbers could be due to clouds evaporated at the outer surface of the torus, possibly accelerated by the radiation pressure due to the central AGN emission leaking through the patchy absorber.
The Neutron star Interior Composition Explorer (NICER): design and development

During 2014 and 2015, NASA's Neutron star Interior Composition Explorer (NICER) mission proceeded successfully through Phase C, Design and Development. An X-ray (0.2-12 keV) astrophysics payload destined for the International Space Station, NICER is manifested for launch in early 2017 on the Commercial Resupply Services SpaceX-11 flight. Its scientific objectives are to investigate the internal structure, dynamics, and energetics of neutron stars, the densest objects in the universe. During Phase C, flight components including optics, detectors, the optical bench, pointing actuators, electronics, and others were subjected to environmental testing and integrated to form the flight payload. A custom-built facility was used to co-align and integrate the X-ray "concentrator" optics and silicon-drift detectors. Ground calibration provided robust performance measures of the optical (at NASA's Goddard Space Flight Center) and detector (at the Massachusetts Institute of Technology) subsystems, while comprehensive functional tests prior to payload-level environmental testing met all instrument performance requirements. We describe here the implementation of NICER's major subsystems, summarize their performance and calibration, and outline the component-level testing that was successfully applied.

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
The NuSTAR view of the non-thermal emission from PSR J0437-4715

We present a hard X-ray Nuclear Spectroscopic Telescope Array (NuSTAR) observation of PSR J0437-4715, the nearest millisecond pulsar. The known pulsations at the apparent pulse period similar to 5.76 ms are observed with a significance of 3.7 sigma, at energies up to 20 keV above which the NuSTAR background dominates. We measure a photon index $\Gamma = 1.50 \pm 0.25$ (90 per cent confidence) for the power-law fit to the non-thermal emission. It had been shown that spectral models with two or three thermal components fit the XMM-Newton spectrum of PSR J0437-4715, depending on the slope of the power-law component, and the amount of absorption of soft X-rays. The new constraint on the high-energy emission provided by NuSTAR removes ambiguities regarding the thermal components of the emission below 3 keV. We performed a simultaneous spectral analysis of the XMM-Newton and NuSTAR data to confirm that three thermal components and a power law are required to fit the 0.3-20 keV emission of PSR J0437-4715. Adding a ROSAT-PSPC spectrum further confirmed this result and allowed us to better constrain the temperatures of the three thermal components. A phase-resolved analysis of the NuSTAR data revealed no significant change in the photon index of the high-energy emission. This NuSTAR observation provides further impetus for future observations with the NICER mission (Neutron Star Interior Composition Explorer) whose sensitivity will provide much stricter constraints on the equation of state of nuclear matter by combining model fits to the pulsar's phase-folded light curve with the pulsar's well-defined mass and distance from radio timing observations.

General information

State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Pontificia Universidad Católica de Chile, McGill University, Osservatorio Astronomico di Cagliari, Swinburne University of Technology, University of California at Berkeley, Technical University of Denmark, Columbia University, California Institute of Technology, NASA Goddard Space Flight Center
Authors: Guillot, S. (Ekstern), Kaspi, V. M. (Ekstern), Archibald, R. F. (Ekstern), Bachetti, M. (Ekstern), Flynn, J. (Ekstern), Jankowski, F. (Ekstern), Bailes, M. (Ekstern), Boggs, S. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Hailey, C. A. (Ekstern), Harrison, F. A. (Ekstern), Stern, D. (Ekstern), Zhang, W. W. (Ekstern)
Pages: 2612-2622
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Main Research Area: Technical/natural sciences
The response of clouds and aerosols to cosmic ray decreases

A method is developed to rank Forbush Decreases (FDs) in the galactic cosmic ray radiation according to their expected impact on the ionization of the lower atmosphere. Then a Monte Carlo bootstrap based statistical test is formulated to estimate the significance of the apparent response in physical and micro-physical cloud parameters to FDs. The test is subsequently applied to one ground based and three satellite based datasets. Responses (> 95%) to FDs are found in the following parameters of the analyzed datasets. AERONET: Ångström exponent (cloud condensation nuclei changes), SSM/I: liquid water content, ISCCP: total, high and middle, IR detected clouds over the oceans, MODIS: cloud effective emissivity, cloud optical thickness, liquid water, cloud fraction, liquid water path, liquid cloud effective radius. Moreover, the responses in MODIS are found to correlate positively with the strength of the FDs, and the signs and magnitudes of the responses agree with model based expectations. The effect is mainly seen in liquid clouds. An impact through changes in UV driven photo chemistry is shown to be negligible and an impact via UV absorption in the stratosphere is found to have no effect on clouds. The total solar irradiance has a relative decrease in connection with FDs of the order of $10^{-3}$, which is too small to have a thermodynamic impact on timescales of a few days. The results demonstrate that there is a real influence of FDs on clouds probably through ions.
We present a multi-epoch X-ray spectral analysis of the Seyfert 1 galaxy Fairall 9. Our analysis shows that Fairall 9 displays unique spectral variability in that its ratio residuals to a simple absorbed power law in the 0.5–10 keV band remain constant with time in spite of large variations in flux. This behavior implies an unchanging source geometry and the same emission processes continuously at work at the timescale probed. With the constraints from NuSTAR on the broad-band spectral shape, it is clear that the soft excess in this source is a superposition of two different processes, one being blurred ionized reflection in the innermost parts of the accretion disk, and the other a continuum component such as a spatially distinct Comptonizing region. Alternatively, a more complex primary Comptonization component together with blurred ionized reflection could be responsible.

The Rhythm of Fairall 9. I. Observing the Spectral Variability with XMM-Newton and NuSTAR

State: Published

Organisations: National Space Institute, Astrophysics, NASA Goddard Space Flight Center, Università degli Studi Roma Tre, California Institute of Technology, University of Maryland, University of California at Berkeley, University of Cambridge


Number of pages: 11
Thermospheric neutral densities derived from Swarm accelerometer and GPS data

Over the past years, a lot of effort has been put into characterising and correcting the various disturbance signals that were found in the accelerometer data provided by the Swarm satellites. This effort was first and foremost aimed at the Swarm C along-track axis data, which seems to be the least affected and most promising data for scientific use. The goal to make the Swarm C accelerometer along-track axis data ready for further processing into level 2 thermosphere density data has now been accomplished, with the help of information on the satellite motion from the GPS tracking as well as on the attitude from the star trackers. This presentation looks into the features of scientific interest that are found in the currently available density data set, as well as makes an assessment of the density data accuracy. We assess how the current quality level of the data in combination with the correction approach, affects the possibility of determining densities from the accelerometer measurements of the Swarm A and B satellites. We also investigate the possibility of determining crosswind speeds from Swarm data. In the meantime, we have investigated the possibility of deriving thermosphere neutral density data from the Swarm GPS observations only, with a much lower temporal resolution. We analyse the differences in the data between the three Swarm satellites as well as between the accelerometer-derived and GPS-only-derived densities for Swarm C.

General information
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Organisations: National Space Institute, Geomagnetism, Delft University of Technology, ESTEC, German Research Centre for Geosciences, VZLU - Aeronautical Research & Testing Institute, Leibniz Universität Hannover
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Number of pages: 1
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Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Links: http://lps16.esa.int/page_session54.php#1711p

The Soft State of Cygnus X-1 Observed With NuSTAR: A Variable Corona and a Stable Inner Disk

We present a multi-epoch hard X-ray analysis of Cygnus X-1 in its soft state based on four observations with the Nuclear Spectroscopic Telescope Array (NuSTAR). Despite the basic similarity of the observed spectra, there is clear spectral variability between epochs. To investigate this variability, we construct a model incorporating both the standard disk-corona continuum and relativistic reflection from the accretion disk, based on prior work on Cygnus X-1, and apply this model to each epoch independently. We find excellent consistency for the black hole spin and the iron abundance of the accretion disk, which are expected to remain constant on observational timescales. In particular, we confirm that Cygnus X-1 hosts a rapidly rotating black hole, 0.93 less than or similar to a* less than or similar to 0.96, in broad agreement with the majority of prior studies of the relativistic disk reflection and constraints on the spin obtained through studies of the thermal accretion disk continuum. Our work also confirms the apparent misalignment between the inner disk and the orbital plane of the binary system reported previously, finding the magnitude of this warp to be similar to 10 degrees-15 degrees. This level of misalignment does not significantly change (and may even improve) the agreement between our reflection results and the thermal continuum results regarding the black hole spin. The spectral variability observed by NuSTAR is dominated by the primary continuum, implying variability in the temperature of the scattering electron plasma. Finally, we consistently observe absorption from ionized iron at similar to 6.7 keV, which varies in strength as a function of orbital phase in a manner consistent with the absorbing material being an ionized phase of the focused stellar wind from the supergiant companion star.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Universite de Toulouse, California Institute of Technology, University of California at Berkeley, Massachusetts Institute of Technology, University of Cambridge, Columbia University, Harvard University, Dr. Karl Remeis-Observatory and Erlangen Centre for Astroparticle Physics, NASA Goddard Space Flight Center, University of Michigan
Authors: Walton, D. J. (Ekstern), Tomsick, J. A. (Ekstern), Madsen, K. K. (Ekstern), Grinberg, V. (Ekstern), Barret, D. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Clavel, M. (Ekstern), Craig, W. W. (Ekstern), Fabian, A. C. (Ekstern), Fuerst, F. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Miller, J. M. (Ekstern), Parker, M. L. (Ekstern), Rahoui, F. (Ekstern), Stern, D. (Ekstern), Tao, L. (Ekstern), Wilms, J. (Ekstern), Zhang, W. (Ekstern)
Number of pages: 1
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Main Research Area: Technical/natural sciences
The updated geodetic mean dynamic topography model – DTU15MDT

An update to the global mean dynamic topography model DTU13MDT is presented. For DTU15MDT the newer gravity model EIGEN-6C4 has been combined with the DTU15MSS mean sea surface model to construct this global mean dynamic topography model. The EIGEN-6C4 is derived using the full series of GOCE data and provides a better resolution. The better resolution fixes a few problems related to geoid signals in the former model DTU13MDT. Slicing in the GOCO05S gravity model up to harmonic degree 150 has solved some issues related to striations. Compared to the DTU13MSS, the DTU15MSS has been derived by including re-tracked CRYOSAT-2 altimetry also, hence, increasing its resolution. Also, some issues in the Polar regions have been solved. Finally, the filtering was re-evaluated by adjusting the quasi-gaussian filter width to optimize the fit to drifter velocities. Subsequently, geostrophic surface currents were derived from the DTU15MDT. The results show that geostrophic surface currents associated with the mean circulation have been further improved and that currents having speeds down to below 4 cm/s have been recovered.

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Organisations: National Space Institute, Geodesy, University of Hawaii at Manoa
Authors: Knudsen, P. (Intern), Andersen, O. B. (Intern), Maximenko, N. (Ekstern)
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Main Research Area: Technical/natural sciences
Links: http://lps16.esa.int/page_session122.php#998p
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The X-ray luminosity-temperature relation of a complete sample of low-mass galaxy clusters

We present Chandra observations of 23 galaxy groups and low-mass galaxy clusters at 0.03 <z <0.15 with a median temperature of ∼2keV. The sample is a statistically complete flux-limited subset of the 400 deg2 survey. We investigated the scaling relation between X-ray luminosity (L) and temperature (T), taking selection biases fully into account. The logarithmic slope of the bolometric L-T relation was found to be 3.29 ± 0.33, consistent with values typically found for samples of more massive clusters. In combination with other recent studies of the L-T relation, we show that there is no evidence for the slope, normalization, or scatter of the L-T relation of galaxy groups being different than that of massive clusters. The exception to this is that in the special case of the most relaxed systems, the slope of the core-excised L-T relation appears to steepen from the self-similar value found for massive clusters to a steeper slope for the lower mass sample studied here. Thanks to our rigorous treatment of selection biases, these measurements provide a robust reference against which to compare predictions of models of the impact of feedback on the X-ray properties of galaxy groups.

General information
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, University of Bristol, Harvard-Smithsonian Center for Astrophysics, University of Bonn, Russian Academy of Sciences
Authors: Zou, S. (Ekstern), Maughan, B. J. (Ekstern), Giles, P. A. (Ekstern), Vikhlinin, A. (Ekstern), Pacaud, F. (Ekstern), Burenin, R. (Ekstern), Hornstrup, A. (Intern)
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.09 SJR 2.388 SNIP 1.134
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.701 SNIP 1.165 CiteScore 4
Toward more complete magnetic gradiometry with the Swarm mission

An analytical and numerical analysis of the spectral properties of the gradient tensor, initially performed by Rummel and van Gelderen (Geophys J Int 111(1):159–169, 1992) for the gravity potential, shows that when the tensor elements are grouped into sets of semi-tangential and pure-tangential parts, they produce almost identical signal content as the normal element. Moreover, simple eigenvalue relations can be derived between these sets and the spherical harmonic expansion.
of the potential. This theoretical development generally applies to any potential field. First, the analysis of Rummel and van Gelderen (1992) is adapted to the magnetic field case and then the elements of the magnetic gradient tensor are estimated by 2 years of Swarm data and grouped into $\Gamma(1) = [\nabla \nabla B]_{r\theta}, [\nabla \nabla B]_{r\phi}$ resp. $\Gamma(2) = [\nabla \nabla B]_{\theta\theta} - [\nabla \nabla B]_{\phi\phi}, 2[\nabla \nabla B]_{\theta\phi}$.

It is shown that the estimated combinations $\Gamma(1)$ and $\Gamma(2)$ produce similar signal content as the theoretical radial gradient $\Gamma(0) = [\nabla \nabla B]_r$. These results demonstrate the ability of multi-satellite missions such as Swarm, which cannot directly measure the radial gradient, to retrieve similar signal content by means of the horizontal gradients. Finally, lithospheric field models are derived using the gradient combinations $\Gamma(1)$ and $\Gamma(2)$ and compared with models derived from traditional vector and gradient data. The model resulting from $\Gamma(1)$ leads to a very similar, and in particular cases improved, model compared to models retrieved by using approximately three times more data, i.e., a full set of vector, North–South and East–West gradients. This demonstrates the high information content of $\Gamma(1)$.

**General information**
State: Published
Organisations: National Space Institute, Geomagnetism
Authors: Kotsiaros, S. (Intern)
Number of pages: 13
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
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Volume: 68
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ISSN (Print): 1343-8832
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.146 SJR 1.289
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.981 SNIP 0.89 CiteScore 1.79
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.969 SNIP 0.966 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.493 SNIP 1.081 CiteScore 2.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.063 SNIP 1.231 CiteScore 2.65
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.322 SNIP 0.987 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.677 SNIP 0.746 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.909 SNIP 0.73
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.878 SNIP 0.912
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.827 SNIP 0.775
Scopus rating (2007): SJR 1.114 SNIP 0.712
Scopus rating (2006): SJR 0.924 SNIP 1.011
Web of Science (2006): Indexed yes
Towards an improved determination of Earth’s lithospheric field from satellite observations

Perhaps one of the biggest difficulties in modelling the Earth’s lithospheric magnetic field is the separation of contributions from sources of internal and external origin. In particular, the determination of smaller-scale lithospheric magnetic field features is problematic because the lithospheric signal is contaminated by much larger and highly time-dependent contributions from sources in the ionosphere and magnetosphere. Simultaneous, high-quality measurements from different locations as well as gradient estimates provided by the three Swarm satellites open new possibilities in lithospheric field modeling. Field gradients can be approximated by employing along-track and across-track field differences which act as high-pass filters of the data and data kernel. We present improvements of conventional lithospheric field modeling approaches to better determine the small-scale lithospheric field by incorporating gradient information.

Towards improved knowledge of geology and global thermal regime from Swarm satellites magnetic gradient observations

Gradients of magnetic field have higher spatial resolution than the fields themselves and are helpful in improving the resolution of downward continued satellite magnetic anomaly maps (Kotsiaros et al., 2015, Geophys. J. Int.; Sabaka et al., 2015, Geophys. J. Int.). Higher spatial resolution and fidelity of the magnetic field downward continued to the Earth’s surface translate into improvements in the interpretation of anomalies for recognition of geologic variability and tectonic processes (e.g., recognizing details of geologic provinces, anomalous seafloor spreading patterns, etc., that can help understand the evolution of the Earth). Magnetic anomalies have sensitivity to thermal variations in the Earth’s lithosphere through the phenomenon of Curie temperature of ferromagnetic minerals. The response of the bottom of magnetization in the Earth’s crust/lithosphere is primarily observed in the long wavelength magnetic field up to at least 500 km (and sometimes longer). The Curie temperature depth can also be used to better map the thermal structure of the lithosphere because it is possible to theoretically include the Curie depth constraint in the derivation of the one dimensional geotherm (Ravat et al., 2015, in review). Despite having global set of observations from POGO, Magsat, Ørsted, CHAMP, and...
Swarm satellites (altitude > 400 km), preservation of intermediate wavelengths from about 100 to 375 km proves challenging (known as the “spectral gap”). Since the gradients of magnetic field have higher spatial resolution than the fields themselves, they are helpful in improving the coverage in the spectral gap. East-West and North-South (along orbit) gradients from Swarm magnetic field satellites provide an opportunity to examine the improvement in the anomaly coverage in the spectral gap and its effect on the interpretation, particularly the derived Curie depths and the thermal variation of the lithosphere. We examine the inaccuracies in anomalies and also their resulting interpretation using the U.S. aeromagnetic data where a full spectrum magnetic anomaly coverage is available (Ravat et al., 2009, USGS open files report OF09-1256) as a result of the availability of NURE data which were corrected with the comprehensive model of the magnetic field (CM4, Sabaka et al., 2004, Geophys. J. Int.). We specifically compare various levels and types of corrected data sets: uncorrected original North American Magnetic Anomaly Map compilation (ca. 2002), the original compilation corrected with satellite-altitude data sets, and Swarm constellation gradient corrected fields over the U.S. Using this U.S. study as a test, we examine the possibility of improving the spectral coverage in many regions of the world where anomalies and their interpretations are still affected by the spectral gap.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, University of Kentucky, NASA Goddard Space Flight Center
Authors: Ravat, D. (Ekstern), Olsen, N. (Intern), Sabaka, T. (Ekstern), Kother, L. K. (Intern), Kotsiaros, S. (Intern), Purucker, M. (Ekstern)
Number of pages: 1
Publication date: 2016
Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Links:
http://lps16.esa.int/page_session19.php#2422p
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Validation of CryoSat-2 based lake levels
In this study, which is part of the FP7 project Land and Ocean take up from Sentinel-3 (LOTUS), we demonstrate the potential SAR altimetry. We consider lakes at various sizes and evaluate the CryoSat-2 derived lake levels in terms of along-track precision and agreement with in-situ data. As a reference we compare our CryoSat based results with conventional altimetry such as Envisat.

We find that the precision of the along-track mean water level is a few cm, even for lakes with a surface of just 9 km2. The high precision makes it possible to detect water level variation below the decimeter level.

To derive lake level time series we apply a state-space model with a robust handling of erroneous data. Instead of attempting to identify and remove the polluted observations we use a mixture distribution to describe the observation noise, which prevents the polluted observations from biasing our final reconstructed time series.

These results demonstrate the promising possibilities of the upcoming mission Sentinel-3, which potentially will be able to provide accurate time series for small lakes.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Nielsen, K. (Intern), Stenseng, L. (Intern), Andersen, O. B. (Intern), Villadsen, H. (Intern), Knudsen, P. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from ESA Living Planet Symposium 2016, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Links:
http://lps16.esa.int/page_session187.php#740p
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Validation of CryoSat-2 Performance over Arctic Sea Ice
The main objective of this work is to validate CryoSat-2 (CS2) SARIn performance over sea ice by use of airborne laser altimetry data obtained during the CryoVEx 2012 campaign. A study by [1] has shown that the extra information from the CS2 SARIn mode increases the number of valid sea surface height estimates which are usually discarded in the SAR mode due to snagging of the radar signal. As the number of valid detected leads increases, the uncertainty of the freeboard heights decreases.

In this study, the snow freeboard heights estimated using data from the airborne laser scanner are used to validate the sea ice freeboard obtained by processing CS2 SARIn level 1b waveforms. The possible reduction in the random freeboard uncertainty is investigated comparing two scenarios, i.e. a SAR-like and a SARIn acquisition.

It is observed that using the extra phase information, CS2 is able to detect leads up to 2370 m off-nadir. A reduction in the the total random freeboard uncertainty of 40% is observed by taking advantage of the CS2 interferometric capabilities, which enable to include 35% of the waveforms discarded in the SAR-like scenario.
Verification of high-speed solar wind stream forecasts using operational solar wind models

High-speed solar wind streams emanating from coronal holes are frequently impinging on the Earth's magnetosphere causing recurrent, medium-level geomagnetic storm activity. Modeling high-speed solar wind streams is thus an essential element of successful space weather forecasting. Here we evaluate high-speed stream forecasts made by the empirical solar wind forecast (ESWF) and the semiempirical Wang-Sheeley-Arge (WSA) model based on the in situ plasma measurements from the Advanced Composition Explorer (ACE) spacecraft for the years 2011 to 2014. While the ESWF makes use of an empirical relation between the coronal hole area observed in Solar Dynamics Observatory (SDO)/Atmospheric Imaging Assembly (AIA) images and solar wind properties at the near-Earth environment, the WSA model establishes a link between properties of the open magnetic field lines extending from the photosphere to the corona and the background solar wind conditions. We found that both solar wind models are capable of predicting the large-scale features of the observed solar wind speed (root-mean-square error, RMSE ≈100 km/s) but tend to either overestimate (ESWF) or underestimate (WSA) the number of high-speed solar wind streams (threat score, TS ≈ 0.37). The predicted high-speed streams show typical uncertainties in the arrival time of about 1 day and uncertainties in the speed of about 100 km/s. General advantages and disadvantages of the investigated solar wind models are diagnosed and outlined.
Vertikale Landbevægelser - Nye Data Til Effektiv Forvaltning

General information
State: Published
Organisations: National Space Institute, Geodesy, Energi, Forsynings- og Klimaministeriet, GEO, Styrelsen for Dataforsyning og Effektivisering
Authors: Broge, N. (Ekstern), Sørensen, C. S. (Intern), Robenhagen Melgaard, M. (Ekstern), Fredenslund Levinsen, J. (Ekstern), Okkels, N. (Ekstern), Knudsen, P. (Intern)
Number of pages: 27
Publication date: 2016

Water NOT wanted - Coastal Floods and Flooding Protection in Denmark
For living and for leisure we see water as an asset. We are increasingly in favour of living close to water; be it a mountain stream, a tranquil lakeshore, a setting directly on the ocean foreshore or overlooking the ocean scenery. We use our proximity to water for many recreational purposes today. Water is nice!

There is a tendency for coastal migration, and a large part of the urbanisation and economic development is taking place in coastal regions throughout the world. This “coastal squeeze” means that we increasingly are exposing ourselves to the forces and hazards of nature in terms of coastal erosion, storm surges, coastal inundation, salination of aquifers etc. Whereas some regions already suffer today, challenges ahead seem immense with projections of sea level rise putting further pressure on our coasts. Although Denmark is normally perceived as a country with a limited vulnerability towards coastal flooding, the country has experienced severe storm surges throughout history, and hitherto safe areas will become increasingly at risk this century as the climate changes. Historically a seafarers’ nation, Denmark has always been connected with the sea. From medieval time ports and quays have hosted activities related to maritime trades and harbour workers’ quarters. For the past two or three decades these areas have in many towns been rapidly transformed into high-end market housing and office facilities. With this transformation, more values have been put at risk and the local acceptance of floods has decreased
from a “this is a natural consequence of living by the sea” to an explicit: Water Not Wanted!
This paper provides a brief overview of floods and flooding protection issues in Denmark (Ch. 2 & Ch. 3), the current legislation (Ch. 4), and discusses challenges in relation to climate change adaptation, risk reduction, and to potential ways of rethinking flooding protection in strategies that also incorporate other uses (Ch. 5).

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. S. (Intern)
Pages: 3-21
Publication date: 2016

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Title of host publication: Sicherung von Dämmen, Deichen und Stauanlagen : Handbuch für Theorie und Praxis
Volume: V
Place of publication: Siegen
Publisher: Universität Siegen
Editors: Hermann, R. A., Jensen, J.
ISBN (Print): 978-3-936533-67-5
Main Research Area: Technical/natural sciences
Electronic versions:
Water_NOT_wanted.pdf
Links:
Publication: Research - peer-review › Book chapter – Annual report year: 2016

Wave Optics Based LEO-LEO Radio Occultation Retrieval
This paper describes the theory for performing retrieval of radio occultations that use probing frequencies in the XK and KM band. Normally radio occultations use frequencies in the L band and GPS satellites are used as the transmitting source and the occultation signals are received by a GPS receiver on board a Low Earth Orbit (LEO) satellite. The technique is based on the Doppler shift imposed, by the atmosphere, on the signal emitted from the GPS satellite. Two LEO satellites are assumed in the occultations discussed in this paper and the retrieval is also dependent on the decrease in the signal amplitude caused by atmospheric absorption. The radio wave transmitter is placed on one of these satellites while the receiver is placed on the other LEO satellite. One of the drawbacks of normal GPS based radio occultations is that external information is needed to calculate some of the atmospheric products such as the correct water vapor content in the atmosphere. These limitations can be overcome when a proper selected range of high frequency waves are used to probe the atmosphere. Probing frequencies close to the absorption line of water vapor have been included, thus allowing the retrieval of the water vapor content. Selecting the correct probing frequencies would make it possible to retrieve other information such as the content of ozone. The retrieval is performed through a number of processing steps which are based on the Full Spectrum Inversion (FSI) technique. The retrieval chain is therefore a wave optics based retrieval chain and it is therefore possible to process measurements that include multipath. In this paper simulated LEO to LEO radio occultations based on 5 different frequencies are used. The 5 frequencies are placed in the XK or KM frequency band. This new wave optics based retrieval chain is used on a number of examples and the retrieved atmospheric parameters are compared to the parameters from a global ECMWF analysis model. This model is used in a forward propagator that simulates the electromagnetic field amplitudes and phases at the receiver on board the LEO satellite. LEO-LEO cross-links radio occultations using high frequencies are a relative new technique and the possibilities and advantages of the technique still needs to be investigated. The retrieval of this type of radio occultations is considerable more complicated than standard GPS to LEO radio occultations, because the attenuation of the probing radio waves is used in the retrieval and the atmospheric parameters are found using a least square solver. The best algorithms and the number of probing frequencies that is economical viable must also be determined. This paper intends to answer some of these questions using end to end simulations.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: von Benzon, H. (Intern), Høeg, P. (Intern)
Pages: 589–602
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Radio Science
Volume: 51
**X-ray mirror development and testing for the ATHENA mission**

**General information**
State: Published
Organisations: National Space Institute, Astrophysics and Atmospheric Physics, Danish Fundamental Metrology, Physikalisch-Technische Bundesanstalt, European Space Agency
Authors: Della Monica Ferreira, D. (Intern), Jakobsen, A. C. (Intern), Massahi, S. (Intern), Christensen, F. E. (Intern), Shortt, B. (Ekstern), Garnaes, J. (Ekstern), Torras-Rosell, A. (Ekstern), Krumrey, M. (Ekstern), Cibik, L. (Ekstern), Marggraf, S. (Ekstern)
Number of pages: 13
Publication date: 2016

**Host publication information**
Title of host publication: Proceedings of Space Telescopes and Instrumentation 2016: Ultraviolet to Gamma Ray
Volume: 9905
Publisher: SPIE - International Society for Optical Engineering
Editors: den Herder, J. A., Takahashi, T., Bautz, M.
Article number: 99055K
Main Research Area: Technical/natural sciences
Conference: Space Telescopes and Instrumentation 2016, Edinburgh, United Kingdom, 26/06/2016 - 26/06/2016
ATHENA, SPO, AFM, XRR, Coatings, Roughness, Ir/B4C, Pt/B4C, W/Si and W/B4C

**X-ray polarimetry with the Polarization Spectroscopic Telescope Array (PolSTAR)**
This paper describes the *Polarization Spectroscopic Telescope Array* (PolSTAR), a mission proposed to NASA's 2014 Small Explorer (SMEX) announcement of opportunity. PolSTAR measures the linear polarization of 3-50 keV (requirement; goal: 2.5-70 keV) X-rays probing the behavior of matter, radiation and the very fabric of spacetime under the extreme conditions close to the event horizons of black holes, as well as in and around magnetars and neutron stars. The PolSTAR design is based on the technology developed for the *Nuclear Spectroscopic Telescope Array* (NuSTAR) mission launched in June 2012. In particular, it uses the same X-ray optics, extendable telescope boom, optical bench, and CdZnTe detectors as NuSTAR. The mission has the sensitivity to measure ~1% linear polarization fractions for X-ray sources with fluxes down to ~5 mCrab. This paper describes the PolSTAR design as well as the science drivers and the potential science return.

**General information**
State: Published
Organisations: National Space Institute, Astrophysics, Washington University in St. Louis, California Institute of Technology, University of Amsterdam
Authors: Krawczynski, H. S. (Ekstern), Stern, D. (Ekstern), Harrison, F. A. (Ekstern), Kislat, F. F. (Ekstern), Zajczyk, A. (Ekstern), Bellicke, M. (Ekstern), Hoormann, J. (Ekstern), Guo, Q. (Ekstern), Endsley, R. (Ekstern), Ingram, A. R. (Ekstern), Christensen, F. E. (Intern)
Number of pages: 21
Pages: 8-28
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Astroparticle Physics
Volume: 75
ISSN (Print): 0927-6505
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
I røg og damp
Skov- og steppebrande udgør en helt naturlig del af kloakens kredsløb, men store menneskeskabte skovbrande i blandt andet Indonesien forstyrer kredsløbet.

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 5
Publication date: 27 Nov 2015

Publication information
Pages (from-to): 5
Newspaper: Weekendavisen
Volume: 48
No.: Ideer
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 118448275
Publication: Communication › Feature article – Annual report year: 2015

Bogen til Spørge-Jørgen
y bog svarer på 50 af de mest umulige spørgsmål, som nysgerrige børn kan finde på at stille

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 13
Publication date: 6 Nov 2015

Publication information
Pages (from-to): 13
Newspaper: Weekendavisen
Volume: 45
No.: Faktisk
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 118058289
Publication: Communication › Review – Annual report year: 2015
Opfindelser, der ændrede verden
Meget af det, vi opfatter som nye opfindelser, har lange rødder. Dem følger forfatterne i en ny bog, som fortæller om 50 teknologiske højdepunkter fra de tidlige civilisationer til i dag.

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 5-6
Publication date: 30 Oct 2015

Publication information
Pages (from-to): 5-6
Newspaper: Weekendavisen
Volume: 44
No.: Ideer
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 118058274
Publication: Communication › Review – Annual report year: 2015

Varme hilsener fra Jordens indre
Vulkaner. Mere end 40 vulkaner om året går i udbrud og minder os om de voldsomme kræfter, der konstant rumler inde i vores klode.

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 12-13
Publication date: 2 Oct 2015

Publication information
Pages (from-to): 12-13
Newspaper: Weekendavisen
Volume: Ideer
No.: 40
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Review – Annual report year: 2015

Historisk vejr
Når klimamodellerne er indbyrdes uenige eller lange i spyttet, kan man se på det historiske vejr. Her viser det sig, at opvarmning sjældent giver vildere vejr.

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 11
Publication date: 21 Aug 2015

Publication information
Pages (from-to): 11
Newspaper: Weekendavisen
Volume: Ideer
No.: 34
Tro og Viden

Tro og Viden

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 13
Publication date: 7 Aug 2015

Publication information
Pages (from-to): 13
Newspaper: Weekendavisen
Volume: Ideer
No.: 32
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Comment/debate – Annual report year: 2015
Videnskabsmanden og Gud

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 4-5
Publication date: 17 Jul 2015

Publication information
Pages (from-to): 4-5
Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 112699962
Publication: Communication › Newspaper article – Annual report year: 2015

Heksekunster og voldsomt vejr
Klimasynd. Vejret kunne også vise sig fra sin voldsomme side i Middelalderen og blev betragtet som Guds straf over syndige mennesker. De skyldige blev ofte henrettet som hekse på bålet.

General information
State: Published
Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
Pages: 3
Publication date: 26 Jun 2015

Publication information
Pages (from-to): 3
Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 111906569
Publication: Communication › Newspaper article – Annual report year: 2015

X-Ray and Gamma-Ray Radiation Detector
Disclosed is a semiconductor radiation detector for detecting X-ray and / or gamma-ray radiation. The detector comprises a converter element for converting incident X-ray and gamma-ray photons into electron-hole pairs, at least one cathode, a plurality of detector electrodes arranged with a pitch (P) along a first axis, a plurality of drift electrodes, a readout circuitry being configured to read out signals from the plurality of detector electrodes and a processing unit connected to the readout circuitry and being configured to detect an event in the converter element. The readout circuitry is further configured to read out signals from the plurality of drift electrodes, and the processing unit is further configured to estimate a location of the event along the first axis by processing signals obtained from both the detector electrodes and the drift electrodes, the location of the event along said first axis is estimated with a precision being greater than the pitch (P).

General information
State: Published
Organisations: National Space Institute, Astrophysics
Authors: Kuvvetli, I. (Intern), Budtz-Jørgensen, C. (Intern)
Publication date: 4 Jun 2015

Publication information
Hele vejen til himlen?
Rumgrænser. Hvorlæn er man ude i rummet? Og hvor langt ud rækker en stats luftterritorium? Et latinsk ordsprog siger, at den, som ejer jorden, også ejer området hele vejen op til himlen og helt ned til helvede.

Kristendom og naturvidenskab
Det er et paradoks, hvis man forlanger håndfaste beviser for at kunne tro. Tro kan netop ikke begrundes rationelt, og derfor kan man heller ikke argumentere sig frem til, at man skal tro. Hvis man som kristen har et problem med påskens opstandelse, så har man da et endnu større problem med Guds eksistens
Lysets år

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 11
Publication date: 6 Feb 2015

Publication information
Pages (from-to): 11
Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

Hvem trykkede på pauseknappen?

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 4
Publication date: 23 Jan 2015

Publication information
Pages (from-to): 4
Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

Virkelighedens klima er temmelig komplekst

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Iver Dahl-Madsen, K. (Ekstern), Kristensen, O. P. (Ekstern), Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 9
Publication date: 5 Jan 2015

Publication information
Pages (from-to): 9
Newspaper: Kristeligt Dagblad
Volume: 119
No.: 79
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015
3C 273 with NuSTAR: Unveiling the Active Galactic Nucleus

We present results from a 244 ks NuSTAR observation of 3C 273 obtained during a cross-calibration campaign with the Chandra, INTEGRAL, Suzaku, Swift, and XMM-Newton observatories. We show that the spectrum, when fit with a power-law model using data from all observatories except INTEGRAL over the 1-78 keV band, leaves significant residuals in the NuSTAR data between 30 and 78 keV. The NuSTAR 3-78 keV spectrum is well described by an exponentially cutoff power law (Γ = 1.646 ± 0.006, E_{cutoff} = 202^{+34}_{-29} keV) with a weak reflection component from cold, dense material. There is also evidence for a weak (EW = 23 ± 11 eV) neutral iron line. We interpret these features as arising from coronal emission plus reflection off an accretion disk or distant material. Beyond 80 keV INTEGRAL data show clear excess flux relative to an extrapolation of the active galactic nucleus model fit to NuSTAR. This high-energy power law is consistent with the presence of a beamed jet, which begins to dominate over emission from the inner accretion flow at 30-40 keV. Modeling the jet locally (in the NuSTAR + INTEGRAL band) as a power law, we find that the coronal component is fit by Γ_{AGN} = 1.638 ± 0.045, E_{cutoff} = 47 ± 15 keV, and jet photon index by Γ_{jet} = 1.05 ± 0.4. We also consider Fermi/LAT observations of 3C 273, and here the broadband spectrum of the jet can be described by a log-parabolic model, peaking at ~ 2 MeV. Finally, we investigate the spectral variability in the NuSTAR band and find an inverse correlation between flux and Gamma.

General information
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Organisations: National Space Institute, Astrophysics, California Institute of Technology, SLAC National Accelerator Laboratory, University of California at Berkeley, Harvard-Smithsonian Center for Astrophysics, University of Cambridge, European Space Astronomy Centre and European Space Agency, Columbia University, Università degli Studi Roma Tre, University of Geneva, NASA Goddard Space Flight Center, Georgia Institute of Technology
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Scopus rating (2015): CiteScore 4.8
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.51
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ISI indexed (2011): ISI indexed yes
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Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
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10.1088/0004-637x/812/1/14
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3D Crisp Clustering of Geo-Urban Data

General information
State: Published
Organisations: National Space Institute, Geodesy, Universiti Teknologi Malaysia
Authors: Azri, S. (Ekstern), Rahman, A. A. (Ekstern), Ujang, U. (Ekstern), Antón Castro, F. (Intern), Mioc, D. (Intern)
Pages: 1-9
3D Indoor Building Environment Reconstruction using calibration of Range finder Data

Nowadays, municipalities intend to have 3D city models for facility management, disaster management and architectural planning. 3D data acquisition can be done by laser scanning for indoor environment which is a costly and time consuming process. Currently, for indoor surveying, Electronic Distance Measurement (EDM) and Terrestrial Laser Scanner (TLS) are mostly used. In this paper, several techniques for indoor 3D building data acquisition have been investigated. For reducing the time and cost of indoor building data acquisition process, the Trimble LaserAce 1000 range finder is used. The accuracy of the rangefinder is evaluated and a simple spatial model is reconstructed from real data. This technique is rapid (it requires a shorter time as compared to others), but the results show inconsistencies in horizontal angles for short distances in indoor environments. The range finder was calibrated using a least square adjustment algorithm. To control the uncertainty of the calibration and of the reconstruction of the building from the measurements, interval analysis and homotopy continuation are used.

General information
State: Published
Organisations: National Space Institute, Geodesy, University of the West of England, University of Technology Malaysia
Authors: Jamali, A. (Ekstern), Anton, F. (Intern), Rahman, A. A. (Ekstern), Boguslawski, P. (Ekstern), Gold, C. M. (Ekstern)
Pages: 29-34
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Indoor surveying, Least square adjustment, Interval analysis, Laser scanning, Calibration, Homotopy continuation
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3D object-oriented image analysis in 3D geophysical modelling: Analysing the central part of the East African Rift System

Non-uniqueness of satellite gravity interpretation has traditionally been reduced by using a priori information from seismic tomography models. This reduction in the non-uniqueness has been based on velocity-density conversion formulas or user interpretation of the 3D subsurface structures (objects) based on the seismic tomography models and then forward modelling these objects. However, this form of object-based approach has been done without a standardized methodology on how to extract the subsurface structures from the 3D models. In this research, a 3D object-oriented image analysis (3D OOA) approach was implemented to extract the 3D subsurface structures from geophysical data. The approach was applied on a 3D shear wave seismic tomography model of the central part of the East African Rift System. Subsequently, the extracted 3D objects from the tomography model were reconstructed in the 3D interactive modelling environment IGMAS+, and their density contrast values were calculated using an object-based inversion technique to calculate the forward signal of the objects and compare it with the measured satellite gravity. Thus, a new object-based approach was implemented to interpret and extract the 3D subsurface objects from 3D geophysical data. We also introduce a new
approach to constrain the interpretation of the satellite gravity measurements that can be applied using any 3D
geophysical model.

**General information**

State: Published
Organisations: National Space Institute, Geomagnetism, University of Twente
Authors: Fadel, I. (Ekstern), van der Meijde, M. (Ekstern), Kerle, N. (Ekstern), Lauritsen, N. L. B. (Intern)
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- Scopus rating (2013): SJR 1.074 SNIP 1.778 CiteScore 2.5
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- Scopus rating (2011): SJR 0.968 SNIP 1.687 CiteScore 2.49
- ISI indexed (2011): ISI indexed no
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- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.963 SNIP 1.871
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.913 SNIP 1.596
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- Scopus rating (2006): SJR 0.707 SNIP 1.474
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Satellite gravity, 3D gravity model, Object-oriented image analysis, Inversion, Tanzania Craton, Seismic tomography

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3D Partition-Based Clustering for Supply Chain Data Management

Supply Chain Management (SCM) is the management of the products and goods flow from its origin point to point of consumption. During the process of SCM, information and dataset gathered for this application is massive and complex. This is due to its several processes such as procurement, product development and commercialization, physical distribution, outsourcing and partnerships. For a practical application, SCM datasets need to be managed and maintained to serve a better service to its three main categories; distributor, customer and supplier. To manage these datasets, a structure of data constellation is used to accommodate the data into the spatial database. However, the situation in geospatial database creates few problems, for example the performance of the database deteriorate especially during the query operation. We strongly believe that a more practical hierarchical tree structure is required for efficient process of SCM. Besides that, three-dimensional approach is required for the management of SCM datasets since it involve with the multi-level location such as shop lots and residential apartments. 3D R-Tree has been increasingly used for 3D geospatial database management due to its simplicity and extendibility. However, it suffers from serious overlaps between nodes. In this paper, we proposed a partition-based clustering for the construction of a hierarchical tree structure. Several datasets are tested using the proposed method and the percentage of the overlapping nodes and volume coverage are computed and compared with the original 3D R-Tree and other practical approaches. The experiments demonstrated in this paper substantiated that the hierarchical structure of the proposed partition-based clustering is capable of preserving minimal overlap and coverage. The query performance was tested using 300,000 points of a SCM dataset and the results are presented in this paper. This paper also discusses the outlook of the structure for future reference.

General information
State: Published
Organisations: National Space Institute, Geodesy, Universiti Teknologi Malaysia
Authors: Suhaibah, A. (Ekstern), Uznir, U. (Ekstern), Anton, F. (Intern), Mioc, D. (Intern), Rahman, A. A. (Ekstern)
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60-year Nordic and arctic sea level reconstruction based on a reprocessed two decade altimetric sea level record and tide gauges

Due to the sparsity and often poor quality of data, reconstructing Arctic sea level is highly challenging. We present a reconstruction of Arctic sea level covering 1950 to 2010, using the approaches from Church et al. (2004) and Ray and Douglas (2011). This involves decomposition of an altimetry calibration record into EOFs, and fitting these patterns to a historical tide gauge record.

General information
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Organisations: National Space Institute, Geodesy, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
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A 2015 International Geomagnetic Reference Field (IGRF) candidate model based on Swarm’s experimental absolute magnetometer vector mode data

Each of the three satellites of the European Space Agency Swarm mission carries an absolute scalar magnetometer (ASM) that provides the nominal 1-Hz scalar data of the mission for both science and calibration purposes. These ASM instruments, however, also deliver autonomous 1-Hz experimental vector data. Here, we report on how ASM-only scalar and vector data from the Alpha and Bravo satellites between November 29, 2013 (a week after launch) and September 25, 2014 (for on-time delivery of the model on October 1, 2014) could be used to build a very valuable candidate model for the 2015.0 International Geomagnetic Reference Field (IGRF). A parent model was first computed, describing the geomagnetic field of internal origin up to degree and order 40 in a spherical harmonic representation and including a constant secular variation up to degree and order 8. This model was next simply forwarded to epoch 2015.0 and truncated at degree and order 13. The resulting ASM-only 2015.0 IGRF candidate model is compared to analogous models derived from the mission’s nominal data and to the now-published final 2015.0 IGRF model. Differences among models mainly highlight uncertainties enhanced by the limited geographical distribution of the selected data set (essentially due to a lack of availability of data at high northern latitude satisfying nighttime conditions at the end of the time period considered). These appear to be comparable to differences classically observed among IGRF candidate models. These positive results led the ASM-only 2015.0 IGRF candidate model to contribute to the construction of the final 2015.0 IGRF model.

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Organisations: National Space Institute, Geomagnetism, LETI, University Paris Diderot - Paris 7, University of Colorado, Centre National d’Etudes Spatiales
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.322 SNIP 0.987 CiteScore 2.08
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A flight test of the strapdown airborne gravimeter SGA-WZ in Greenland

An airborne gravimeter is one of the most important tools for gravity data collection over large areas with mGal accuracy and a spatial resolution of several kilometers. In August 2012, a flight test was carried out to determine the feasibility and to assess the accuracy of the new Chinese SGA-WZ strapdown airborne gravimeter in Greenland, in an area with good gravity coverage from earlier marine and airborne surveys. An overview of this new system SGA-WZ is given, including system design, sensor performance and data processing. The processing of the SGA-WZ includes a 160 s length finite impulse response filter, corresponding to a spatial resolution of 6 km. For the primary repeated line, a mean r.m.s. deviation of the differences was less than 1.5 mGal, with the error estimate confirmed from ground truth data. This implies that the SGA-WZ could meet standard geophysical survey requirements at the 1 mGal level.

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Organisations: National Space Institute, Geodynamics, National University of Defense Technology
Authors: Zhao, L. (Ekstern), Forsberg, R. (Intern), Wu, M. (Ekstern), Olesen, A. V. (Intern), Zhang, K. (Ekstern), Cao, J. (Ekstern)
Pages: 13258-13269
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Main Research Area: Technical/natural sciences

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A focused, hard X-ray look at ARP 299 with NuSTAR

We report on simultaneous observations of the local starburst system Arp 299 with NuSTAR and Chandra, which provides the first resolved images of this galaxy up to energies of ~45 keV. Fitting the 3-40 keV spectrum reveals a column density of $N_H \sim 4 \times 10^{24}$ cm$^{-2}$, characteristic of a Compton-thick active galactic nucleus (AGN), and a 10-30 keV luminosity of $1.2 \times 10^{43}$ erg s$^{-1}$. The hard X-rays detected by NuSTAR above 10 keV are centered on the western nucleus, Arp 299-B, which previous X-ray observations have shown to be the primary source of neutral Fe-K emission. Other X-ray sources, including Arp 299-A, the eastern nucleus also thought to harbor an AGN, as well as X-ray binaries, contribute $\lesssim 10\%$ to the 10-20 keV emission from the Arp 299 system. The lack of significant emission above 10 keV other than that attributed to Arp 299-B suggests that: (1) any AGN in Arp 299-A must be heavily obscured ($N_H > 10^{24}$ cm$^{-2}$) or have a much lower luminosity than Arp 299-B and (2) the extranuclear X-ray binaries have spectra that cut-off above $\sim$10 keV. Such soft spectra are characteristic of ultraluminous X-ray sources observed to date by NuSTAR.
A Hard X-Ray Power-Law Spectral Cutoff in Centaurus X-4

The low-mass X-ray binary Cen X-4 is the brightest and closest (<1.2 kpc) quiescent neutron star transient. Previous 0.5-10 keV X-ray observations of Cen X-4 in quiescence identified two spectral components: soft thermal emission from the neutron star atmosphere and a hard power-law tail of unknown origin. We report here on a simultaneous observation of Cen X-4 with NuSTAR (3-79 keV) and XMM-Newton (0.3-10 keV) in 2013 January, providing the first sensitive hard X-ray spectrum of a quiescent neutron star transient. The 0.3-79 keV luminosity was 1.1 x 10^33 erg/s (for D=1kpc), with around 60 percent in the thermal component. We clearly detect a cutoff of the hard spectral tail above 10 keV, the first time such a feature has been detected in this source class. Comptonization and synchrotron shock origins for the hard X-ray emission are ruled out on physical grounds. However, the hard X-ray spectrum is well fit by a thermal bremsstrahlung model with an 18 keV electron temperature, which can be understood as arising in a radiatively-inefficient accretion flow (RIAF) if only a small fraction of the mass flow reaches the neutron star. We suggest that most of the accretion flow is centrifugally inhibited by the magnetic propeller effect. The power-law cutoff energy is set by the degree of Compton cooling of the RIAF electrons by thermal seed photons from the neutron star atmosphere. Lower thermal luminosities should lead to higher (possibly undetectable) cutoff energies. We compare Cen~X-4’s behavior with PSR J1023+0038, IGR J18245-2452, and XSS J12270-4859, which have shown transitions between LMXB and radio pulsar modes at a similar X-ray luminosity.
We present the results from coordinated X-ray observations of the ultraluminous X-ray source NGC 5204 X-1 performed by the Nuclear Spectroscopic Telescope Array and XMM-Newton in early 2013. These observations provide the first detection of NGC 5204 X-1 above 10 keV, extending the broadband coverage to 0.3-20 keV. The observations were carried out in two epochs separated by approximately 10 days, and showed little spectral variation with an observed luminosity of $L_X = (4.95 \pm 0.11) \times 10^{39}$ erg s$^{-1}$. The broadband spectrum robustly confirms the presence of a clear
spectral downturn above 10 keV seen in some previous observations. This cutoff is inconsistent with the standard low/hard state seen in Galactic black hole binaries, as would be expected from an intermediate-mass black hole accreting at significantly sub-Eddington rates given the observed luminosity. The continuum is apparently dominated by two optically thick thermal-like components, potentially accompanied by a faint high-energy tail. The broadband spectrum is likely associated with an accretion disk that differs from a standard Shakura & Sunyaev thin disk.
A NuSTAR observation of the center of the Coma cluster

We present the results of a 55 ks NuSTAR observation of the core of the Coma Cluster. The global spectrum can be explained by thermal gas emission, with a conservative 90% upper limit to non-thermal inverse Compton (IC) emission of $5.1 \times 10^{-12}$ erg cm$^{-2}$ s$^{-1}$ in a 12' × 12' field of view. The brightness of the thermal component in this central region does not allow more stringent upper limits on the IC component when compared with non-imaging instruments with much larger fields of view where claims of detections have been made. Future mosaic NuSTAR observations of Coma will further address this issue. The temperature map shows a relatively uniform temperature distribution with a gradient from the hot northwest side to the cooler southeast, in agreement with previous measurements. The temperature determination is robust given the flat effective area and low background in the 3-20 keV band, making NuSTAR an ideal instrument to measure high temperatures in the intracluster medium.
Airborne gravimetry for geoid determination with Lacoste Romberg and Chekan gravimeters

Airborne gravimetry for geodetic purposes such as geoid determination and global geopotential models requires good bias stability, as well as good performance in turbulence for large-scale national projects. DTU-Space has since many years carried out large area airborne surveys over polar, tropical and temperate regions. Recently we have started flying two gravimeters (L&R and Chekan-AM) side by side for increased reliability and redundancy in several surveys. In the paper we will give some examples of recent survey results, confirming accuracies in the 1 mGal range for a well-controlled Danish flight test, and around 3 mGal for intercomparisons of Chekan and L&R results in Nepal, one of the most challenging field survey regions on the Earth. We also indicate the good agreement between airborne gravity and GOCE data in Nepal, and outline the use for improved geoid determination.

General information
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Organisations: National Space Institute, Geodynamics
Authors: Forsberg, R. (Intern), Olesen, A. V. (Intern), Einarsson, I. (Intern)
Pages: 265-270
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Main Research Area: Technical/natural sciences

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Scopus rating (2016): SJR 0.252 SNIP 0.851 CiteScore 0.99
Airborne Gravity Data Denoising Based on Empirical Mode Decomposition: A Case Study for SGA-WZ Greenland Test Data

Surveying the Earth's gravity field refers to an important domain of Geodesy, involving deep connections with Earth Sciences and Geo-information. Airborne gravimetry is an effective tool for collecting gravity data with mGal accuracy and a spatial resolution of several kilometers. The main obstacle of airborne gravimetry is extracting gravity disturbance from the extremely low signal to noise ratio measuring data. In general, the power of noise concentrates on the higher frequency of measuring data, and a low pass filter can be used to eliminate it. However, the noise could distribute in a broad range of frequency while low pass filter cannot deal with it in pass band of the low pass filter. In order to improve the accuracy of the airborne gravimetry, Empirical Mode Decomposition (EMD) is employed to denoise the measuring data of two primary repeated flights of the strapdown airborne gravimetry system SGA-WZ carried out in Greenland. Comparing to the solutions of using finite impulse response filter (FIR), the new results are improved by 40% and 10% of root mean square (RMS) of internal consistency and external accuracy, respectively.

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Authors: Zhao, L. (Ekstern), Wu, M. (Ekstern), Forsberg, R. (Intern), Olesen, A. V. (Intern), Zhang, K. (Ekstern), Cao, J. (Ekstern)
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BFI (2015): BFI-level 1
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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Earth's gravity field, Airborne gravimetry, Finite impulse response filter (FIR), SGA-WZ, Empirical mode decomposition (EMD)

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Airborne L-band radiometer mapping of the dome-C area in Antarctica

A 350 km × 350 km area near the Concordia station on the high plateau of Dome-C in Antarctica has been mapped by an airborne L-band radiometer system. The area was expected to display a rather uniform brightness temperature (TB) close to the yearly mean temperature—well suited for calibration checks for spaceborne instruments like SMOS, Aquarius, and SMAP. The measured TBs show unexpected variations like 8-K variation over 240 km on an east-west profile through Concordia, and in certain local cases, a slope of about 0.7 K/km. Comparing the measured TB map with bottom topography reveals a convincing correlation. Simulations show that variations in bedrock topography can indeed modulate the TB appropriately to explain the observed variations. It is concluded that use of the Dome-C area for calibration check of spaceborne radiometers is indeed viable, but with caution—especially when comparing instruments with different spatial resolutions.
A method to derive maps of ionospheric conductances, currents, and convection from the Swarm multisatellite mission

The European Space Agency (ESA) Swarm spacecraft mission is the first multisatellite ionospheric mission with two low-orbiting spacecraft that are flying in parallel at a distance of ~100–140 km, thus allowing derivation of spatial gradients of ionospheric parameters not only along the orbits but also in the direction perpendicular to them. A third satellite with a higher orbit regularly crosses the paths of the lower spacecraft. Using the Swarm magnetic and electric field instruments, we present a novel technique that allows derivation of two-dimensional (2-D) maps of ionospheric conductances, currents, and electric field in the area between the trajectories of the two lower spacecraft, and even to some extent outside of it. This technique is based on Spherical Elementary Current Systems. We present test cases of modeled situations from which we calculate virtual Swarm data and show that the technique is able to reconstruct the model electric field, horizontal currents, and conductances with a very good accuracy. Larger errors arise for the reconstruction of the 2-D field-aligned currents (FAC), especially in the area outside of the spacecraft orbits. However, even in this case the general pattern of FAC is recovered, and the magnitudes are valid in an integrated sense. Finally, using an MHD model run, we show how our technique allows estimation of the ionosphere-magnetosphere coupling parameter K, if conjugate observations of the magnetospheric magnetic and electric field are available. In the case of a magnetospheric multisatellite mission (e.g., the ESA Cluster mission) several K estimates at nearby points can be generated.

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Organisations: National Space Institute, Astrophysics, Finnish Meteorological Institute, European Space Agency
Authors: Amm, O. (Ekstern), Vanhamäki, H. (Ekstern), Kauristie, K. (Ekstern), Stolle, C. (Intern), Christiansen, F. (Intern), Haagmans, R. (Ekstern), Masson, A. (Ekstern), Taylor, M. G. G. T. (Ekstern), Floberghagen, R. (Ekstern), Escoubet, C. P. (Ekstern)
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Scopus rating (2017): SJR 2.272 SNIP 1.475
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
A Micromegas-based low-background x-ray detector coupled to a slumped-glass telescope for axion research

We report on the design, construction and operation of a low background x-ray detection line composed of a shielded Micromegas detector of the microbulk technology. The detector is made from radiopure materials and is placed at the focal point of a ~ 5 cm diameter, 1.5 m focal-length, cone-approximation Wolter I x-ray telescope (XRT) assembled from thermally-formed (or "slumped") glass substrates deposited with multilayer coatings. The system has been conceived as a technological pathfinder for the future International Axion Observatory (IAXO), as it combines two of the techniques (optic and detector) proposed in the conceptual design of the project. It is innovative for two reasons: it is the first time an x-ray optic has been designed and fabricated specifically for axion research, and the first time a Micromegas detector has been operated with an x-ray optic. The line has been installed at one end of the CERN Axion Solar Telescope (CAST) magnet and is currently looking for solar axions. The combination of the XRT and Micromegas detector provides the best signal-to-noise ratio obtained so far by any detection system of the CAST experiment with a background rate of 5.4×10−3 counts per hour in the energy region-of-interest and signal spot area.
A model for electric field enhancement in lightning leader tips to levels allowing X-ray and γ ray emissions

A model is proposed capable of accounting for the local electric field increase in front of the lightning stepped leader up to magnitudes allowing front electrons to overcome the runaway energy threshold and thus to initiate relativistic runaway electron avalanches capable of generating X-ray and ray bursts observed in negative lightning leader. The model is based on an idea that an ionization wave, propagating in a preionized channel, is being focused, such that its front remains narrow and the front electric field is being enhanced. It is proposed that when a space leader segment, formed ahead of a negative lightning leader, connects to the leader, the electric potential of the leader is transferred through the space leader in an ionizing wave that continues into the partly ionized channels of preexisting streamers of the space leader. It is shown with numerical simulations that the ionization channels of streamers limit the lateral expansion of the ionization wave, thereby enhancing the peak electric field to values allowing an acceleration of low-energy electrons into the runaway regime where electrons efficiently generate bremsstrahlung. The results suggest that the inhomogeneous ionization environment at the new leader tip amplifies the production rate of energetic electrons relative to a homogeneous environment considered in the past studies.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Russian Federal Nuclear Center
Authors: Babich, L. P. (Ekstern), Bochkov, E. I. (Ekstern), Kutsyk, I. M. (Ekstern), Neubert, T. (Intern), Chanrion, O. A. (Intern)
Pages: 5087-5100
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Main Research Area: Technical/natural sciences

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Journal: Journal of Geophysical Research: Space Physics
Volume: 120
Issue number: 6
ISSN (Print): 2169-9380
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 2.272 SNIP 1.475
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.056 SNIP 1.753
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
An amalgamation of 3D city models in urban air quality modelling for improving visual impact analysis

Geographical Information Systems (GISs) can be seen as a common tool to map and visualize the air quality index based on geographical locations. However, in urban areas, the area resolution for air quality models is less than 2 kilometres. Since the main emissions agent in urban areas is predominantly vehicular engines, the situation will become worse when pollutants are trapped between buildings and disperse inside the street canyon and move vertically to create a recirculation vortex. Studying and visualizing the recirculation zone in 3D visualization is conceivable by using 3D city models as physical data input. The Level of Details (LoD) in 3D city models (i.e. LoD1 and LoD2) ascertains the potentials of implementing air quality modelling for urban areas. Therefore, this research is focused towards investigating the integration of 3D city models in air quality modelling for urban areas. The results presented show the simplicity of using 3D city models as a physical data input in air quality modelling and the 3D air quality will improve insight for visual impact analysis (i.e. analysing the immersion of are circulation zone). The results are advantageous for city planners, architects, engineers and policy makers to design the street geometry (building height and width, green areas, pedestrian walks, roads width, etc.).

General information
State: Published
Organisations: National Space Institute, Geodesy, University of Technology Malaysia
Authors: Ujang, U. (Ekstern), Anton, F. (Intern), Ariffin, A. (Ekstern), Mioc, D. (Intern), Azri, S. (Ekstern)
Pages: 51-60
Publication date: 2015

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Editors: Longhurst, J., Brebbia, C., Barnes, J.
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ISBN (Electronic): 978-1-84564-965-4
Series: W I T Transactions on Ecology and the Environment
Volume: 198
ISSN: 1746-448X
An Equivalent Source Method for Modelling the Global Lithospheric Magnetic Field

We present a new technique for modelling the global lithospheric magnetic field at Earth's surface based on the estimation of equivalent potential field sources. As a demonstration we show an application to magnetic field measurements made by the CHAMP satellite during the period 2009–2010 when it was at its lowest altitude and solar activity was quiet. All three components of the vector field data are utilized at all available latitudes. Estimates of core and large-scale magnetospheric sources are removed from the measurements using the CHAOS-4 model. Quiet-time and night-side data selection criteria are also employed to minimize the influence of the ionospheric field. The model for the remaining lithospheric magnetic field consists of magnetic equivalent potential field sources (monopoles) arranged in an icosahedron grid at a depth of 100 km below the surface. The corresponding model parameters are estimated using an iteratively reweighted least-squares algorithm that includes model regularization (either quadratic or maximum entropy) and Huber weighting. Data error covariance matrices are implemented, accounting for the dependence of data variances on quasi-dipole latitude. The resulting equivalent source lithospheric field models show a degree correlation to MF7 greater than 0.7 out to spherical harmonic degree 100. Compared to the quadratic regularization approach, the entropy regularized model possesses notably lower power above degree 70 and a lower number of degrees of freedom despite fitting the observations to a very similar level. Advantages of our equivalent source method include its local nature, the possibility for regional grid refinement and the production of local power spectra, the ability to implement constraints and regularization depending on geographical position, and the ease of transforming the equivalent source values into spherical harmonics.

General information

State: Published
Organisations: National Space Institute, Geomagnetism
Authors: Kother, L. K. (Intern), Hammer, M. D. (Intern), Finlay, C. (Intern), Olsen, N. (Intern)
Pages: 553-566
Publication date: 2015
Main Research Area: Technical/natural sciences

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Volume: 203
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Web of Science (2018): Indexed yes
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Scopus rating (2017): SNIP 1.195 SJR 1.506
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.61 SJR 1.749 SNIP 1.465
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 1.796 SNIP 1.354 CiteScore 2.46
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.901 SNIP 1.473 CiteScore 2.63
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.376 SNIP 1.677 CiteScore 3.15
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.367 SNIP 1.43 CiteScore 2.78
ISI indexed (2012): ISI indexed yes
A new model of Earth's radial conductivity structure derived from over 10 yr of satellite and observatory magnetic data

We present a new model of the radial (1-D) conductivity structure of Earth's mantle. This model is derived from more than 10 yr of magnetic measurements from the satellites Ørsted, CHAMP, SAC-C and the Swarm trio as well as the global network of geomagnetic observatories. After removal of core and crustal field as predicted by a recent field model, we fit the magnetic data with spherical harmonic coefficients describing ring current activity and associated induction effects and estimate global C-responses at periods between 1.5 and 150 d. The C-responses are corrected for 3-D effects due to induction in the oceans and inverted for a 1-D model of mantle conductivity using both probabilistic and deterministic methods. Very similar results are obtained, consisting of a highly resistive upper mantle, an increase in conductivity in and beneath the transition zone and a conductive lower mantle. Analysis of the Hessian of the cost function reveals that the data are most sensitive to structures at depths between 800 and 1200 km, in agreement with the results obtained from the probabilistic approach. Preliminary interpretation of the inverted conductivity structure based on laboratory-based conductivity profiles shows that the recovered structure in the lower mantle either requires higher temperatures or the presence of material of high conductivity related to ponding of carbonate melts below the transition zone.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, ETH Zurich
Authors: Püthe, C. (Ekstern), Kuvshinov, A. (Ekstern), Khan, A. (Ekstern), Olsen, N. (Intern)
Pages: 1864-1872
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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Scopus rating (2017): SNIP 1.195 SJR 1.506
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.61 SJR 1.749 SNIP 1.465
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.796 SNIP 1.354 CiteScore 2.46
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.901 SNIP 1.473 CiteScore 2.63
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.376 SNIP 1.677 CiteScore 3.15
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.367 SNIP 1.43 CiteScore 2.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.241 SNIP 1.248 CiteScore 2.52
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
An Improved 20-Year Arctic Ocean Altimetric Sea Level Data Record

For ocean and climate research, it is essential to get long-term altimetric sea level data that is as accurate as possible. However, the accuracy of the altimetric data is frequently degraded in the interior of the Arctic Ocean due to the presence of seasonal or permanent sea ice. We have reprocessed ERS-1/2/Envisat satellite altimetry to develop an improved 20-year sea level dataset for the Arctic Ocean. We have developed both an along-track dataset and three-day gridded sea level anomaly (SLA) maps from September 1992 to April 2012. A major improvement in data coverage was gained by tailoring the standard altimetric editing criteria to Arctic conditions. The new reprocessed data has significant increased data coverage with between 4 and 10 times the amount of data in regions such as the Beaufort Gyre region compared with AVISO and RADS datasets. This allows for a more accurate estimation of sea level changes from satellite altimetry in the Arctic Ocean. The reprocessed dataset exhibit a mean sea level trend of 2.1 +/- 1.3 mm/year (without Glacial Isostatic Adjustment correction) covering the Arctic Ocean between 66 degrees N and 82 degrees N with significant higher spatial coherency in the ice-covered regions than the RADS and DUACS datasets.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Cheng, Y. (Intern), Andersen, O. B. (Intern), Knudsen, P. (Intern)
Number of pages: 17
Pages: 146-162
Publication date: 2015
Main Research Area: Technical/natural sciences
An Optimal Beamforming Algorithm for Phased-Array Antennas Used in Multi-Beam Spaceborne Radiometers

Strict requirements for future spaceborne ocean missions using multi-beam radiometers call for new antenna technologies, such as digital beamforming phased arrays. In this paper, we present an optimal beamforming algorithm for phased-array antenna systems designed to operate as focal plane arrays (FPA) in push-broom radiometers. This
algorithm is formulated as an optimization procedure that maximizes the beam efficiency, while minimizing the side-lobe and cross-polarization power in the area of Earth, subject to a constraint on the beamformer dynamic range. The proposed algorithm is applied to a FPA feeding a torus reflector antenna (designed under the contract with the European Space Agency) and tested for multiple beams. The results demonstrate an improved performance in terms of the optimized beam characteristics, yielding much higher spatial and radiometric resolution as well as much closer distance to coast, as compared to the present-day systems.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Chalmers University of Technology, TICRA, HPS GmbH, ESTEC
Authors: Iupikov, O. A. (Ekstern), Ivashina, M. V. (Ekstern), Pontoppidan, K. (Ekstern), Nielsen, P. H. (Ekstern), Cappellin, C. (Ekstern), Skou, N. (Intern), Seibjaerg, S. S. (Intern), Ihle, A. (Ekstern), Hartmann, D. (Ekstern), 't Klooster, K. V. (Ekstern), Nielsen, P. H. (Ekstern)
Number of pages: 5
Publication date: 2015

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Publisher: IEEE
ISBN (Print): 788890701856
BFI conference series: European Conference on Antennas and Propagation (5010932)
Main Research Area: Technical/natural sciences
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Radiometers, Reflector antenna, Phase array feed
Source: Findit
Source-ID: 276097548
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

An overview of a highly versatile forward and stable inverse algorithm for airborne, ground-based and borehole electromagnetic and electric data
We present an overview of a mature, robust and general algorithm providing a single framework for the inversion of most electromagnetic and electrical data types and instrument geometries. The implementation mainly uses a 1D earth formulation for electromagnetics and magnetic resonance sounding (MRS) responses, while the geoelectric responses are both 1D and 2D and the sheet's response models a 3D conductive sheet in a conductive host with an overburden of varying thickness and resistivity. In all cases, the focus is placed on delivering full system forward modelling across all supported types of data. Our implementation is modular, meaning that the bulk of the algorithm is independent of data type, making it easy to add support for new types. Having implemented forward response routines and file I/O for a given data type provides access to a robust and general inversion engine. This engine includes support for mixed data types, arbitrary model parameter constraints, integration of prior information and calculation of both model parameter sensitivity analysis and depth of investigation. We present a review of our implementation and methodology and show four different examples illustrating the versatility of the algorithm. The first example is a laterally constrained joint inversion (LCI) of surface time domain induced polarisation (TDIP) data and borehole TDIP data. The second example shows a spatially constrained inversion (SCI) of airborne transient electromagnetic (AEM) data. The third example is an inversion and sensitivity analysis of MRS data, where the electrical structure is constrained with AEM data. The fourth example is an inversion of AEM data, where the model is described by a 3D sheet in a layered conductive host.

General information
State: Published
Organisations: National Space Institute, Geodynamics, Aarhus University, Sorbonne Universités, Lancaster University, SkyTEM Surveys
Authors: Auken, E. (Ekstern), Christiansen, A. V. (Ekstern), Kirkegaard, C. (Ekstern), Fiandaca, G. (Ekstern), Schamper, C. (Ekstern), Behroozmand, A. A. (Ekstern), Binley, A. (Ekstern), Nielsen, J. E. (Intern), Efferso, F. (Ekstern), Christensen, N. B. (Ekstern), Sørensen, K. (Ekstern), Foged, N. (Ekstern), Vignoli, G. (Ekstern)
Pages: 223-235
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Exploration Geophysics
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ISSN (Print): 0812-3985
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BFI (2018): BFI-level 1
A NuSTAR survey of nearby ultraluminous infrared galaxies

We present a Nuclear Spectroscopic Telescope Array (NuSTAR), Chandra, and XMM-Newton survey of nine of the nearest ultraluminous infrared galaxies (ULIRGs). The unprecedented sensitivity of NuSTAR at energies above 10 keV enables spectral modeling with far better precision than was previously possible. Six of the nine sources observed were detected sufficiently well by NuSTAR to model in detail their broadband X-ray spectra, and recover the levels of obscuration and intrinsic X-ray luminosities. Only one source (IRAS 13120-5453) has a spectrum consistent with a Compton-thick active galactic nucleus (AGN), but we cannot rule out that a second source (Arp 220) harbors an extremely highly obscured AGN as well. Variability in column density (reduction by a factor of a few compared to older observations) is seen in IRAS 05189-2524 and Mrk 273, altering the classification of these borderline sources from Compton-thick to Compton-thin. The ULIRGs in our sample have surprisingly low observed fluxes in high-energy (>10 keV) X-rays, especially compared to their bolometric luminosities. They have lower ratios of unabsorbed 2-10 keV to bolometric luminosity, and unabsorbed 2-10 keV to mid-IR [O IV] line luminosity than do Seyfert 1 galaxies. We identify IRAS 08572+3915 as another candidate intrinsically X-ray weak source, similar to Mrk 231. We speculate that the X-ray weakness of IRAS 08572+3915 is related to its powerful outflow observed at other wavelengths.
Arctic Region Space Weather Customers and SSA Services

Arctic inhabitants, authorities, and companies rely strongly on precise localization information and communication covering vast areas with low infrastructure and population density. Thus modern technology is crucial for establishing knowledge that can lead to growth in the region. At the same time it is crucial for the development of the industrial sectors and transportation systems in the Arctic that the digital infrastructure for higher-level information are operating at the standards for modern industrial societies. This can only be done if the precision of the localization information and communication can be established without errors resulting from Space Weather effects. An ESA project have identified and clarified, how the products of the four ESA Space Weather Expert Service Centres (SWE) in the ESA Space Situational Awareness Programme (SSA), can contribute to the requirements of SSA services in Arctic, and how new products and services need to be developed and implemented in the roadmap of SWE for Arctic region network services. An important element in the project is the end-user requirements and needs in the public and commercial sector. A detailed user-survey and interviews with key-companies in the region have been performed. The outcome has been analysed in view of the present SWE system, and products and suggestions to a roadmap for the development of coming Arctic region SSA services, have been established.

Arctic Sea Level Change over the altimetry era and reconstructed over the last 60 years

The Arctic Ocean process severe limitations on the use of altimetry and tide gauge data for sea level studies and prediction due to the presence of seasonal or permanent sea ice. In order to overcome this issue we reprocessed all altimetry data with editing tailored to Arctic conditions, hereby more than doubling the amount of altimetry in the Arctic Ocean with up to 10 times the amount of data in regions like the Beaufort Gyre region compared with AVISO and RADS datasets. With recent data from the Cryosat-2 SAR altimetry the time-series now runs from 1991-2015 a total of nearly 25 years.

Good altimetric data is seen to crucial for sea level studies and profoundly for sea level reconstruction where we present a 60 years sea level reconstruction based on this new data set. We here present a new multi-decade altimetric dataset and a 60 year reconstruction of sea level based on this together with tide gauge information. From our reconstruction, we found that the Arctic mean sea level trend is around 1.5 mm +/- 0.3 mm/y for the period 1950 to 2010, between 68ºN and 82ºN. This value is in good agreement with the global mean trend of 1.8 +/- 0.3 mm/y over the same period as found by Church and White (2004). We also find significant higher trend in the Beaufort Gyre region showing an increase in sea level over the last decade up to 2011.

General information
State: Published
Organisations: National Space Institute, Geodesy, Finnish Meteorological Institute, Swedish Institute of Space Physics, German Aerospace Center
Authors: Høeg, P. (Intern), Kauristi, K. (Ekstern), Wintoft, P. (Ekstern), Borries, C. (Ekstern)
Number of pages: 1
Publication date: 2015
Event: Abstract from 12th European Space Weather Week, Oostende, Belgium.
Main Research Area: Technical/natural sciences
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Source: PublicationPreSubmission
Source-ID: 117432830
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2015

General information
State: Published
Organisations: National Space Institute, Geodesy, Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics
Authors: Andersen, O. B. (Intern), Svendsen, P. L. (Intern), Nielsen, A. A. (Intern), Knudsen, P. (Intern)
Arctic Sea Level Reconstruction

Reconstruction of historical Arctic sea level is very difficult due to the limited coverage and quality of tide gauge and altimetry data in the area. This thesis addresses many of these issues, and discusses strategies to help achieve a stable and plausible reconstruction of Arctic sea level from 1950 to today. The primary record of historical sea level, on the order of several decades to a few centuries, is tide gauges. Tide gauge records from around the world are collected in the Permanent Service for Mean Sea Level (PSMSL) database, and includes data along the Arctic coasts. A reasonable amount of data is available along the Norwegian and Russian coasts since 1950, and most published research on Arctic sea level extends cautiously from these areas. Very little tide gauge data is available elsewhere in the Arctic, and records of a length of several decades, as generally recommended for sea-level reconstruction, are completely absent outside the Norwegian and Russian sectors. Since the early 1990s, altimetric satellite missions have provided more spatially complete observations of sea level. This allows extraction of the primary variation patterns, which can be used as calibration for a reconstruction method. For oceanographic purposes, the altimetric record over the Arctic Ocean is inferior in quality to that of moderate latitudes, but nonetheless an invaluable set of observations. During this project, newly processed Arctic altimetry from the ERS-1/-2 and Envisat missions has become available, allowing analysis in greater detail, though much early progress on the project was based on ocean model data. Like other published sea level reconstructions, this project is based on the combination of tide gauge records and altimetry patterns. It is found that while it is possible to reconstruct the timestep differences and cumulate these to obtain a reconstructed sea-level record, this approach may yield widely variable results and is difficult to stabilize due to the many gaps in the data. A more robust approach, as described by Ray and Douglas (2011), takes into account the entirety of each tide gauge record and makes the reconstruction much less prone to drifting away over time. Unfortunately, many of the Russian-sector tide gauge records end around 1990, leaving a fairly sparse record after this. This project examines the effect of introducing a subset of the altimetric dataset as “virtual tide gauges” to remedy this sparsity, and appears to further stabilize the reconstruction. As Arctic sea level changes are primarily driven by the Beaufort Gyre area, this also introduces observations in an important area. However, this approach to some extent relies on relatively stationary conditions before the altimetric era, though previous research indicates largely stationary amounts of freshwater until the 1980s. This project initially aimed to obtain a robust reconstruction through the use of alternative decompositions, rather than the commonly used empirical orthogonal functions (EOFs), for the calibration. While one alternative decomposition, maximum autocorrelation factors (MAFs), is investigated, it is found that preprocessing and handling of gaps (through appropriate method choice) in the tide gauge record is the primary concern for obtaining robust sea level reconstructions in the Arctic area. The reconstructions obtained in this project concern the period 1950 to 2010 using monthly data. The spatial coverage is all ocean areas above 68°N, limited to the north depending on the calibration dataset used (90°N for Drakkar calibrated reconstructions, 82°N for altimetry-based reconstructions).
A satellite based low power low volume receiver system for tracking of migrating birds

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
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Main Research Area: Technical/natural sciences
Conference: 66th International Astronautical Congress (IAC 2015), Jerusalem, Israel, 12/10/2015 - 12/10/2015
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A Space Weather mission concept: Observatories of the Solar Corona and Active Regions (OSCAR)
Coronal Mass Ejections (CMEs) and Corotating Interaction Regions (CIRs) are major sources of magnetic storms on Earth and are therefore considered to be the most dangerous space weather events. The Observatories of Solar Corona and Active Regions (OSCAR) mission is designed to identify the 3D structure of coronal loops and to study the trigger mechanisms of CMEs in solar Active Regions (ARs) as well as their evolution and propagation processes in the inner heliosphere. It also aims to provide monitoring and forecasting of geo-effective CMEs and CIRs. OSCAR would contribute to significant advancements in the field of solar physics, improvements of the current CME prediction models, and provide data for reliable space weather forecasting. These objectives are achieved by utilising two spacecraft with identical instrumentation, located at a heliocentric orbital distance of 1 AU from the Sun. The spacecraft will be separated by an angle of 68 degrees to provide optimum stereoscopic view of the solar corona. We study the feasibility of such a mission and propose a preliminary design for OSCAR.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Free University of Berlin, University Paris Diderot - Paris 7, Kiel University, University College London, University of Vienna, FOTEC GmbH, University of Helsinki, Royal Observatory of Belgium, German Aerospace Center, Universite de Toulouse, La Sapienza - Università di Roma
Authors: Strugarek, A. (Ekstern), Janitzek, N. (Ekstern), Lee, A. (Ekstern), Loeschl, P. (Ekstern), Seifert, B. (Ekstern), Holijoki, S. (Ekstern), Kraaikamp, E. (Ekstern), Mrigakshi, A. I. (Ekstern), Philippe, T. (Ekstern), Spina, S. (Ekstern), Broese, M. (Ekstern), Massahi, S. (Intern)
Number of pages: 14
Publication date: 2015
Main Research Area: Technical/natural sciences

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Web of Science (2015): Indexed yes
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Scopus rating (2013): SJR 0.728 SNIP 1.751 CiteScore 2.8
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Scopus rating (2012): SJR 0.253 SNIP 3.253
ISI indexed (2012): ISI indexed no
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swsc140008.pdf
A spatially resolved study of the synchrotron emission and titanium in Tycho's supernova remnant using NuSTAR

We report results from deep observations (~750 ks) of Tycho's supernova remnant (SNR) with NuSTAR. Using these data, we produce narrow-band images over several energy bands to identify the regions producing the hardest X-rays and to search for radioactive decay line emission from 44Ti. We find that the hardest (>10 keV) X-rays are concentrated in the southwest of Tycho, where recent Chandra observations have revealed high emissivity “stripes” associated with particles accelerated to the knee of the cosmic-ray spectrum. We do not find evidence of 44Ti, and we set limits on its presence and distribution within the SNR. These limits correspond to an upper-limit 44Ti mass of M44 < 2.4 x 10^{-4} M⊙ for a distance of 2.3 kpc. We perform a spatially resolved spectroscopic analysis of 66 regions across Tycho. We map the best-fit rolloff frequency of the hard X-ray spectra, and we compare these results to measurements of the shock expansion and ambient density. We find that the highest energy electrons are accelerated at the lowest densities and in the fastest shocks, with a steep dependence of the rolloff frequency with shock velocity. Such a dependence is predicted by models where the maximum energy of accelerated electrons is limited by the age of the SNR rather than by synchrotron losses, but this scenario requires far lower magnetic field strengths than those derived from observations in Tycho. One way to reconcile these discrepant findings is through shock obliquity effects, and future observational work is necessary to explore the role of obliquity in the particle acceleration process.
Assessing GOCE Gravity Models using Altimetry and In-situ Ocean Current Observation

The Gravity and steady state Ocean Circulation Explorer (GOCE) satellite mission measures Earth's gravity field with an unprecedented accuracy at short spatial scales. Previous results have demonstrated a significant advance in our ability to determine the ocean's general circulation. The improved gravity models provided by the GOCE mission have enhanced the resolution and sharpened the boundaries of those features and the associated geostrophic surface currents reveal improvements for all of the ocean's current systems. In this study, a series of 23 newer gravity models including observations from GOCE are combined with the DTU13MSS mean sea surface to derive models for the Mean Dynamic Topography (MDT). The series of GOCE based MDT models are compared in regional analyses to identify differences and to quantify quality measures associated with the models. By using Fourier techniques the spectral characteristics are obtained as well as their anisotropic patterns. Then, regional analyses are carried out using in-situ observations of the geostrophic surface currents. This is done to analyse correlations and to derive resolution capacities of the MDT models. Also this information is used as quantified quality measures associated with the 23 GOCE gravity models.

General information
State: Published
Organisations: National Space Institute, Geodesy, Technische Universität München, University of Hawaii at Manoa
Authors: Knudsen, P. (Intern), Andersen, O. B. (Intern), Honecker, J. (Ekstern), Maximenko, N. (Ekstern)
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Automatic integration of airborne EM and borehole data into regional groundwater models

General information
The current deficit in Greenland ice sheet mass balance is due to both a decrease in surface mass balance (SMB) input and an increase in ice discharge (D) output. While SMB processes are beginning to be well captured by observationally-constrained climate modeling, insight into D is relatively limited. We use InSAR-derived velocities, in combination with ice thickness observations, to quantify the mass flux (F) across a flux perimeter around the ice sheet at ~1700 m elevation. To quantify D, we correct F for SMB, as well as changes in volume due to ice dynamics, in the area downstream of the gate. Using a 1961-1990 reference climatology SMB field from the MAR regional climate model, we quantify ice sheet mass balance within eighteen basins. We find a 2007-2011 mean D of 515±57 Gtyr⁻¹. We find a 2007-2011 mean total mass balance of -262±21 Gtyr⁻¹, which is equal to a 0.73 mm yr⁻¹ global sea level rise contribution. This mass loss is dominated by SMB, which accounts for 61% of mass loss in the basins where partitioning is possible.
Greenland’s main outlet glaciers have more than doubled their contribution to global sea-level rise over the past decade through acceleration of ice discharge. Jakobshavn Isbræ (JI) in west Greenland is the largest outlet glacier in terms of drainage area. Here we use a 3-D modeling approach to study the mechanisms controlling dynamic changes at the terminus of JI over a period of 220 years. Over 100 simulations are performed with different sets of parameters where the calving fronts and the grounding lines are free to evolve in time under atmospheric and oceanic forcing. We find that the thinning and the retreat that starts at the calving front and then propagates upstream is mostly controlled by a loss of resistive stresses at the terminus through glacier dynamics induced calving rather than by changes in oceanic temperatures. Three major accelerations are identified in 1928, 1998 and in the summer of 2003. The acceleration which started in 1928 slowly faded by 1948, while the accelerations in 1998 and 2003 sustain the high velocities observed at JI in the last decade. Furthermore, we find that under atmospheric RCP 4.5 and RCP 8.5 forcing (no RCP ocean forcing included), an increase in ocean temperatures of just 0.7 °C (relative to 1880-2012) is enough to trigger a collapse of the JI’s southern tributary by 2050 which further destabilizes JI and unleashes a major glacial collapse of ~25 km. JI’s contribution to SLR is found to be ~2.8 mm (~1014 Gt) for the period 1880 to 2014, from which the contribution between 1997 to 2014 represents 27 %. By the end of the century contributions to SLR as high as ~11 mm (~4000 Gt under RCP 8.5 and almost 300% increase relative to 1880-2014) can be expected from Jakobshavn Isbræ only. Our choice of ice sheet model comprises the Parallel Ice Sheet Model (PISM).
Black hole feedback in the luminous quasar PDS 456

The evolution of galaxies is connected to the growth of supermassive black holes in their centers. During the quasar phase, a huge luminosity is released as matter falls onto the black hole, and radiation-driven winds can transfer most of this energy back to the host galaxy. Over five different epochs, we detected the signatures of a nearly spherical stream of highly ionized gas in the broadband x-ray spectra of the luminous quasar PDS 456. This persistent wind is expelled at relativistic speeds from the inner accretion disk, and its wide aperture suggests an effective coupling with the ambient gas. The outflow’s kinetic power larger than 10^{46} ergs per second is enough to provide the feedback required by models of black hole and host galaxy coevolution.
Boundary Layer Ducting of Low-elevation GNSS Ocean Reflected Signals

GNSS reflected signals are able to derive parameters as sea surface roughness, winds, waves, and heights from the spectral measurements. Coming satellite missions as, CYGNSS and GEROS, are focusing on GNSS ocean reflected measurements. Thus, simulation studies, highlighting the assumptions for the data retrievals and the precision and the accuracy, are of interest for assessing the observational data content. Simulations of the low-elevation ocean reflected GNSS signal reveal a ducting of the signal when applying a model of the boundary layer. This effect is presented during varying conditions of the sea surface roughness, ocean wind and temperature, density and gradient of the water vapor profile in the boundary layer. The model for the sea surface roughness impedance, wind speed, and rms ocean wave-heights show a stronger signal damping for a smoother ocean surfaces (sea state 0) compared to a rough sea (sea state 4). While the real part of the signal shows the reverse effect. At the same time the reflection zone enhances for smooth sea states. Simulations, including a standard atmosphere and a boundary layer, give a significant ducting of the received signal, leading to a much larger reflection zone (and broader received power spectra). The spectral analysis of the simulated surface reflected signals shows spectral structures that could be used for the extraction of parameters as, boundary layer height and atmosphere water vapor density, sea surface roughness, ocean wave heights, and surface wind speed. The presented simulations will quantify how these parameters are derived from the observations. Our simulator uses a finite difference solution to the parabolic wave equation using the split stepsine transformation. The ocean surface is modeled through the use of an impedance model, which gives an accurate lower boundary condition in the determination of the electromagnetic field. A semi-isotropic Philips spectrum is used to represent the air-sea interaction.
Broadband x-ray imaging and spectroscopy of the Crab nebula and pulsar with NuSTAR

We present broadband (3-78 keV) NuSTAR X-ray imaging and spectroscopy of the Crab nebula and pulsar. We show that while the phase-averaged and spatially integrated nebula + pulsar spectrum is a power law in this energy band, spatially resolved spectroscopy of the nebula finds a break at ~9 keV in the spectral photon index of the torus structure with a steepening characterized by ΔΓ ~ 0.25. We also confirm a previously reported steepening in the pulsed spectrum, and quantify it with a broken power law with break energy at ~12 keV and ΔΓ ~ 0.27. We present spectral maps of the inner 100" of the remnant and measure the size of the nebula as a function of energy in seven bands. These results find that the rate of shrinkage with energy of the torus size can be fitted by a power law with an index of γ = 0.094 ± 0.018, consistent with the predictions of Kennel and Coroniti. The change in size is more rapid in the NW direction, coinciding with the counter-jet where we find the index to be a factor of two larger. NuSTAR observed the Crab during the latter part of a γ-ray flare, but found no increase in flux in the 3-78 keV energy band.
We report on NuSTAR, XMM-Newton, and Swift observations of the gamma-ray binary 1FGL J1018.6-5856. We measure the orbital period to be 16.544 ± 0.008 days using Swift data spanning 1900 days. The orbital period is different from the 2011 gamma-ray measurement which was used in the previous X-ray study of An et al. using ~400 days of Swift data, but is consistent with a new gamma-ray solution reported in 2014. The light curve folded on the new period is qualitatively similar to that reported previously, having a spike at phase 0 and broad sinusoidal modulation. The X-ray flux enhancement at phase 0 occurs more regularly in time than was previously suggested. A spiky structure at this phase seems to be a persistent feature, although there is some variability. Furthermore, we find that the source flux clearly correlates with the spectral hardness throughout all orbital phases, and that the broadband X-ray spectra measured with NuSTAR, XMM-Newton, and Swift are well fit with an unbroken power-law model. This spectrum suggests that the system may not be accretion-powered.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics, Stanford University, California Institute of Technology, Inter-University Center for Astronomy and Astrophysics, University of California at Berkeley, Columbia University, McGill University

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**Ratings:**
We present the calibration of the Nuclear Spectroscopic Telescope Array (NuSTAR) X-ray satellite. We used the Crab as the primary effective area calibrator and constructed a piece-wise linear spline function to modify the vignetting response. The achieved residuals for all off-axis angles and energies, compared to the assumed spectrum, are typically better than +/- 2% up to 40 keV and 5%-10% above due to limited counting statistics. An empirical adjustment to the theoretical two-dimensional point-spread function (PSF) was found using several strong point sources, and no increase of the PSF half-power diameter has been observed since the beginning of the mission. We report on the detector gain calibration, good to 60 eV for all grades, and discuss the timing capabilities of the observatory, which has an absolute timing of +/- 3 ms. Finally, we present cross-calibration results from two campaigns between all the major concurrent X-ray observatories (
Chandra, Swift, Suzaku, and XMM-Newton), conducted in 2012 and 2013 on the sources 3C 273 and PKS 2155-304, and show that the differences in measured flux is within ~ 10% for all instruments with respect to NuSTAR.
Chandra position of IGR J17454-2919 and discovery of a possible NIR counterpart
On 2014 November 3, we observed the recently discovered INTEGRAL source IGR J17454-2919 (ATels #6530, #6574 and #6602) with Chandra HETGS for 20ks. The J2000.0 Chandra position we obtain is:
RA: 17 45 27.689
DEC: -29 19 53.83
(90% uncertainty of 0.6")
This position (2.4" away from the Swift position, ATel #6530), is consistent with the source 2MASS J17452768-2919534 (J=16.227, H=13.038+-0.06, Ks=11.365+-0.024). This candidate counterpart is also consistent with the Swift error circle of ATel #6530.
We encourage follow-up multi-wavelength observations.

Change detection in a time series of polarimetric SAR images
A test statistic for the equality of two or several variance-covariance matrices following the real (as opposed to the complex) Wishart distribution with an associated probability of finding a smaller value of the test statistic is described in the literature [1]. In 2003 we introduced a test statistic for the equality of two variance-covariance matrices following the complex Wishart distribution with an associated probability measure [2]. In that paper we also demonstrated the use of the test statistic to change detection over time in both fully polarimetric and azimuthal symmetric SAR data. To detect change in a series of $k > 2$ complex variance-covariance matrices the pairwise test described in [2] may be applied to either consecutive pairs or to all possible pairs. The former would lead to a lack of ability to detect weak trends over time, the latter to an increase in the probability of false positives (postulating a change when there actually is none) and/or false negatives (missing an actual change). Therefore we need to test for equality for all time points simultaneously. In this paper we demonstrate a new test statistic for the equality of several variance-covariance matrices from the real to the complex Wishart distribution and demonstrate its application to change detection in truly multi-temporal, polarimetric SAR data. Results will be shown that demonstrate the difference between applying to time series of polarimetric SAR images, pairwise comparisons or the new omnibus test statistic, where changes are clearly detected with the omnibus test, on the contrary to the pairwise comparisons, where no changes are detected. We also demonstrate how a factorization of the likelihood ratio statistic into a product of test statistics that each test simpler hypotheses of homogeneity up to a certain
point can be used to detect at which points changes occur in the time series. [1] T. W. Anderson, An Introduction to
H. Skriver, “A test statistic in the complex Wishart distribution and its application to change detection in polarimetric SAR

General information
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Organisations: National Space Institute, Microwaves and Remote Sensing, Department of Applied Mathematics and
Computer Science, Image Analysis & Computer Graphics
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Change Detection in Full and Dual Polarization, Single- and Multifrequency SAR Data
When the covariance matrix formulation is used for multilook polarimetric synthetic aperture radar (SAR) data, the
complex Wishart distribution applies. Based on this distribution, a test statistic for equality of two complex
variance–covariance matrices and an associated asymptotic probability of obtaining a smaller value of the test statistic are
given. In a case study, airborne EMISAR C- and L-band SAR images from the spring of 1998 covering agricultural fields
and wooded areas near Foulum, Denmark, are used in single- and bifrequency, bitemporal change detection with full and
dual polarimetry data.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics,
National Space Institute, Microwaves and Remote Sensing
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Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 1.573 SNIP 2.126 CiteScore 3.33
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Change detection in polarimetric SAR images using complex Wishart distributed matrices

In surveillance it is important to be able to detect natural or man-made changes e.g. based on sequences of satellite or airborne images of the same area taken at different times. The mapping capability of synthetic aperture radar (SAR) is independent of e.g. cloud cover, and thus this technology holds a strong potential for change detection studies in remote sensing. In polarimetric synthetic aperture radar we measure the amplitude and phase of backscattered signals in four combinations of the linear horizontal and vertical receive and transmit polarizations. These signals form a complex scattering matrix, and after suitable preprocessing the outcome at each picture element (pixel) may be represented as a 3 by 3 Hermitian matrix following a complex Wishart distribution.

One approach to solving the change detection problem based on SAR images is therefore to apply suitable statistical tests in the complex Wishart distribution. We propose a set-up for a systematic solution to the (practical) problems using the likelihood ratio test statistics. We show some examples based on a time series of images with 1024 by 1024 pixels.

Change detection in quad and dual pol, single- and bi-frequency SAR data

When the covariance matrix representation is used for multi-look polarimetric synthetic aperture radar (SAR) data, the complex Wishart distribution applies. Based on this distribution a likelihood ratio test statistic for equality of two complex variance-covariance matrices and an associated p-value are given. In a case study airborne EMISAR C- and L-band SAR images covering agricultural fields and wooded areas near Foulum, Denmark, are used in single- and bi-frequency, bi-temporal change detection with full and dual polarimetry data. © (2015) COPYRIGHT Society of Photo-Optical
**Characterization of spectral compression of OFDM symbols using optical time lenses**

We present a detailed investigation of a double-time-lens subsystem for spectral compression of OFDM symbols. We derive optimized parameter settings by simulations and experimental characterization. The required chirp for OFDM spectral compression is very large.

**General information**

State: Published
Organisations: Department of Photonics Engineering, High-Speed Optical Communication, DTU Admission Course, National Space Institute, Department of Micro- and Nanotechnology
Authors: Rage, K. M. (Intern), Guan, P. (Intern), Kjeller, N. (Intern), Lillieholm, M. (Intern), Galili, M. (Intern), Morioka, T. (Intern), Oxenløwe, L. K. (Intern)
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Characterization of the zero-dispersion wavelength variation in a strained highly nonlinear fiber

We present an experimental characterization of longitudinal zero-dispersion wavelength variations in a novel, strained, highly nonlinear fiber, by simple four-wave mixing spectrum analysis, and provide new insights to the analysis supported by detailed numerical simulations.

General information
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CM5, a pre-Swarm comprehensive geomagnetic field model derived from over 12 yr of CHAMP, Ørsted, SAC-C and observatory data

A comprehensive magnetic field model named CM5 has been derived from CHAMP, Ørsted and SAC-C satellite and observatory hourly-means data from 2000 August to 2013 January using the Swarm Level-2 Comprehensive Inversion (CI) algorithm. Swarm is a recently launched constellation of three satellites to map the Earth's magnetic field. The CI technique includes several interesting features such as the bias mitigation scheme known as Selective Infinite Variance Weighting (SIVW), a new treatment for attitude error in satellite vector measurements, and the inclusion of 3-D conductivity for ionospheric induction. SIVW has allowed for a much improved lithospheric field recovery over CM4 by exploiting CHAMP along-track difference data yielding resolution levels up to spherical harmonic degree 107, and has allowed for the successful extraction of the oceanic $M_2$ tidal magnetic field from quiet, nightside data. The 3-D induction now captures anomalous Solar-quiet features in coastal observatory daily records. CM5 provides a satisfactory, continuous description of the major magnetic fields in the near-Earth region over this time span, and its lithospheric, ionospheric and oceanic $M_2$ tidal constituents may be used as validation tools for future Swarm Level-2 products coming from the CI algorithm and other dedicated product algorithms.

General information
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Organisations: National Space Institute, Geomagnetism, NASA Goddard Space Flight Center, Swiss Federal Institute of Technology
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Coastal sea level from inland CryoSat-2 interferometric SAR altimetry

The European Space Agency's CryoSat-2 satellite can operate in a novel synthetic aperture radar interferometric (SARIn) mode where its nominal footprint (swath) is observed by two antennas and the phase difference between the signals is used to determine the exact location of the scatterer through an off-nadir correction. The potential of SARIn for sea level determination is investigated over the fjords of Eastern Greenland. In principle the satellite should only track sea level within its nominal footprint of 7km across track, but we observe that scattering targets (fjords) within twice its nominal footprint are frequently observed but mislocated in CryoSat-2 due to phase wrapping. We devised a way to relocate the observations and correct the range accordingly. When CryoSat-2 is flying inland we consequently observed that the satellite occasionally provide valid sea level in fjords up to 13km away in the across-track direction.

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Organisations: National Space Institute, Geodesy, Microwaves and Remote Sensing
Authors: Abulaitijiang, A. (Intern), Andersen, O. B. (Intern), Stenseng, L. (Intern)
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 3.144 SNIP 1.496 CiteScore 4.27
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Scopus rating (2014): SJR 3.135 SNIP 1.552 CiteScore 4.26
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Web of Science (2012): Indexed yes
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Scopus rating (2011): SJR 2.935 SNIP 1.556 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.742 SNIP 1.387
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.573 SNIP 1.325
Combining Envisat type and CryoSat-2 altimetry to inform hydrodynamic models

Hydrological models are developed and used for flood forecasting and water resources management. Such models rely on a variety of input and calibration data. In general, and especially in data scarce areas, remote sensing provides valuable data for the parameterization and updating of such models. Satellite radar altimeters provide water level measurements of inland water bodies. So far, many studies making use of satellite altimeters have been based on data from repeat-orbit missions such as Envisat, ERS or Jason or on synthetic wide-swath altimetry data as expected from the SWOT mission. This work represents one of the first hydrologic applications of altimetry data from a drifting orbit satellite mission, using data from CryoSat-2. We present an application where CryoSat-2 data is used to improve a hydrodynamic model of the Ganges and Brahmaputra river basins in South Asia set up in the DHI MIKE 11 software. The model’s parameterization and forcing is mainly based on remote sensing data, for example the TRMM 3B42 precipitation product and the SRTM DEM for river and subcatchment delineation. CryoSat-2 water levels were extracted over a river mask derived from Landsat 7 and 8 imagery. After calibrating the hydrological-hydrodynamic model against observed discharge, simulated water levels were fitted to the CryoSat-2 data, with a focus on the Brahmaputra river in the Assam valley: The average simulated water level in the hydrodynamic model was fitted to the average water level along the river’s course as observed by CryoSat-2 over the years 2011-2013 by adjusting the river bed elevation. In a second step, the cross section shapes were adjusted so that the simulated water level dynamics matched those obtained from Envisat virtual station time series. The discharge calibration resulted in Nash-Sutcliffe coefficients of 0.86 and 0.94 for the Ganges and Brahmaputra. Using the Landsat river mask, the CryoSat-2 water levels show consistency along the river and are in good accordance with other products, such as the SRTM DEM. The adjusted hydrodynamic model reproduced the average water level profile along the river channel with a higher accuracy than a model based on the SRTM DEM. Furthermore, the amplitudes as observed in Envisat virtual station time series could be reproduced fitting simple triangular cross section shapes. A hydrodynamic model prepared in such a way provides water levels at any point along the river and any point in time, which are consistent with the multi-mission altimetric dataset. This means it can for example be updated by assimilation of near real-time water level measurements from CryoSat-2 improving its flood forecasting capability.
Combining sea state and land subsidence rates in an assessment of flooding hazards at the Danish North Sea coast

Sand nourishments (2-3 M3/y) counteract erosion on the central North Sea coast of Denmark and dikes and artificial dunes protect the low-lying hinterland from flooding. The fisheries towns of Thyboron, Thorsminde and Hvide Sande are all liable to flooding during storm surges. Tide gauge series from the coast are presented and the town of Thyboron is used as a case where, in addition to SLR and extremes, analyses of land movement and ocean-groundwater interactions are included in an integrated method for assessing future coastal flooding hazards.

Comparison of delay-interferometer and time-lens-based all-optical OFDM demultiplexers

In this paper we present the first detailed numerical comparison of two promising all-optical schemes to demultiplex orthogonal frequency-division multiplexing (OFDM) signals. The investigated schemes are the optical discrete Fourier transformation (O-DFT) and the optical spectral magnification (SM) based on time lenses. In the former scheme, cascaded delay-interferometers (DIs) are used to perform the O-DFT, with subsequent active optical gating to remove the intercarrier interference (ICI). Here a reduced-complexity partial O-DFT, realized by replacing a number of DIs with optical bandpass filters, is investigated. In the latter scheme the OFDM spectrum is magnified, allowing for simple optical bandpass filtering of the individual subcarriers with reduced ICI. Ideally only a single unit consisting of two time lenses is needed, reducing the complexity and potentially the energy consumption compared to the type of O-DFT scheme relying on many active gates. The bit-error-rate is estimated down to ∼10⁻⁶ by Monte Carlo bit-error counting for a 32-subcarrier OFDM input signal, showing that a performance close to the ideal O-DFT is achievable for both the reduced-complexity O-DFT and the SM scheme.
Comparison of Delay-Interferometer and Time-Lens-Based All-Optical OFDM Demultiplexers

In this letter, we present the first detailed numerical comparison of two promising all-optical schemes to demultiplex orthogonal frequency-division multiplexing (OFDM) signals. The investigated schemes are the optical discrete Fourier transformation (O-DFT) and the optical spectral magnification (SM) based on time lenses. In the former scheme, cascaded delay-interferometers (DIs) are used to perform the O-DFT, with subsequent active optical gating to remove the intercarrier interference (ICI). Here, a reduced-complexity partial O-DFT, realized by replacing a number of DIs with optical bandpass filters, is investigated. In the latter scheme, the OFDM spectrum is magnified, allowing for simple optical bandpass filtering of the individual subcarriers with reduced ICI. Ideally, only a single unit consisting of two time lenses is needed, reducing the complexity and potentially the energy consumption compared with the type of O-DFT scheme relying on many active gates. The bit-error-rate is estimated down to ~10^-6 by Monte Carlo bit-error counting for a 32-subcarrier OFDM input signal, showing that a performance close to the ideal O-DFT is achievable for both the reduced-complexity O-DFT and the SM scheme.
Coronal Properties of the Seyfert 1.9 Galaxy MCG-05-23-016 Determined from Hard X-Ray Spectroscopy with NuSTAR

Measurements of the high-energy cut-off in the coronal continuum of active galactic nuclei have long been elusive for all but a small number of the brightest examples. We present a direct measurement of the cut-off energy in the nuclear continuum of the nearby Seyfert 1.9 galaxy MCG-05-23-016 with unprecedented precision. The high sensitivity of NuSTAR up to 79 keV allows us to clearly disentangle the spectral curvature of the primary continuum from that of its
reflection component. Using a simple phenomenological model for the hard X-ray spectrum, we constrain the cut-off energy to keV with 90% confidence. Testing for more complex models and nuisance parameters that could potentially influence the measurement, we find that the cut-off is detected robustly. We further use simple Comptonized plasma models to provide independent constraints for both the kinetic temperature of the electrons in the corona and its optical depth. At the 90% confidence level, we find $kT_e = 29 \pm 2$ keV and $\tau_e = 1.23 \pm 0.08$ assuming a slab (disk-like) geometry, and $kT_e = 25 \pm 2$ keV and $\tau_e = 3.5 \pm 0.2$ assuming a spherical geometry. Both geometries are found to fit the data equally well and their two principal physical parameters are correlated in both cases. With the optical depth in the $\tau_e \gtrsim 1$ regime, the data are pushing the currently available theoretical models of the Comptonized plasma to the limits of their validity. Since the spectral features and variability arising from the inner accretion disk have been observed previously in MCG-05-23-016, the inferred high optical depth implies that a spherical or disk-like corona cannot be homogeneous.

**General information**

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Correlated optical, X-ray, and γ-ray flaring activity seen with INTEGRAL during the 2015 outburst of V404 Cygni

After 25 years of quiescence, the microquasar V404 Cyg entered a new period of activity in June 2015. This X-ray source is known to undergo extremely bright and variable outbursts seen at all wavelengths. It is therefore an object of prime interest to understand the accretion-ejection connections. These can, however, only be probed through simultaneous observations at several wavelengths. We made use of the INTEGRAL instruments to obtain long, almost uninterrupted observations from 2015 June 20, 15:50 UTC to June 25, 4:05 UTC, from the optical V band up to the soft γ-rays. V404 Cyg was extremely variable in all bands, with the detection of 18 flares with fluxes exceeding 6 Crab (20-40 keV) within three days. The flare recurrence can be as short as ~20 min from peak to peak. A model-independent analysis shows that the >6 Crab flares have a hard spectrum. A simple 10-400 keV spectral analysis of the off-flare and flare periods shows that the variation in intensity is likely to be only due to variations of a cut-off power-law component. The optical flares seem to be at least of two different types: one occurring in simultaneity with the X-ray flares, the other showing a delay greater than 10 min. The former could be associated with X-ray reprocessing by either an accretion disk or the companion star. We suggest that the latter are associated with plasma ejections that have also been seen in radio.
Cosmic rays, clouds and climate

The most profound questions with the most surprising answers are often the simplest to ask. One is: Why is the climate always changing? Historical and archaeological evidence of global warming and cooling that occurred long before the Industrial Revolution, require natural explanations.

Crisp Clustering Algorithm for 3D Geospatial Vector Data Quantization

In the next few years, 3D data is expected to be an intrinsic part of geospatial data. However, issues on 3D spatial data management are still in the research stage. One of the issues is performance deterioration during 3D data retrieval. Thus, a practical 3D index structure is required for efficient data constellation. Due to its reputation and simplicity, R-Tree has been received increasing attention for 3D geospatial database management. However, the transition of its structure from 2D to 3D had caused a serious overlapping among nodes. Overlapping nodes also occur during splitting operation of the overflowed node N of M + 1 entry. Splitting operation is the most critical process of 3D R-Tree. The produced tree should satisfy the condition of minimal overlap and minimal volume coverage in addition with preserving a minimal tree height. Based on these concerns, in this paper, we proposed a crisp clustering algorithm for the construction of a 3D R-Tree. Several datasets are tested using the proposed method and the percentage of the overlapping parallelepipeds and volume coverage are computed and compared with the original R-Tree and other practical approaches. The experiments demonstrated in this research substantiated that the proposed crisp clustering is capable to preserve minimal overlap, coverage and tree height, which is advantageous for 3D geospatial data implementations. Another advantage of this approach is that the properties of this crisp clustering algorithm are analogous to the original R-Tree splitting procedure, which makes the implementation of this approach straightforward.
CryoSat-2 altimetry for river level monitoring - Evaluation in the Ganges-Brahmaputra River basin

The performance of CryoSat-2/SIRAL altimetry for river level monitoring is investigated by using river levels retrieved from Ganges and Brahmaputra. A key concern for the CryoSat-2 orbit has been its long repeat period of 369 days, which is usually undesirable for river and lake monitoring. However, the results from the method developed in this study involving virtual stations show that the CryoSat-2 data can indeed be used for such monitoring by utilizing the high spatial coverage and the sub-cycle period of 30 days. The results show that it is possible to capture the peak flow occurring during late summer due to monsoonal precipitation and the melting of snow in the Himalayas. The evaluation of CryoSat-2 river levels is performed by comparing with Envisat data in terms of annual signals and amplitudes. The obtained annual amplitudes agree well with the Envisat data, although CryoSat-2 exhibit larger differences. For five virtual stations in the Brahmaputra River, the mean difference between the obtained amplitudes is similar to 10 cm, whereas the mean phase difference is less than 2.7 days. A virtual station in the Ganges River shows a phase difference of around 5 days and a difference in amplitude of 2 cm. (C) 2015 Elsevier Inc. All rights reserved.
Cryosphere Monitoring from Satellites and Aircrafts

The cryosphere is collective term for all the components containing frozen water on the Earth’s surface. These components are highly sensitive to changes in the air temperature and precipitation, and hence to climate change. The major components of frozen water in the cryosphere are the ice sheet, ice caps and glaciers. The Greenland and Antarctic ice sheets alone store a total of 77% of the world’s freshwater in a frozen state, and has the capabilities of increasing the global sea-level with 6 and 65 m respectively. Understanding the changes of the ice sheets in response to climate change is of vital importance to gain insight into the behaviour of these systems and how they affect the global sea level. Satellite altimetry has for the last two decades been used to monitor the changes of the worlds ice sheets, allowing for the determination of their mass balance. In recent years this has been expanded to both ice caps and glaciers using satellite and airborne altimetry. The research topic of this Ph.D thesis has been to determine and improve the estimation of present-day elevation changes of the ice covered land regions in the Arctic and the North Atlantic by the use of satellite altimetry, such as the ICESat and CryoSat-2 missions, with a specific focus on Cryosat-2. An central part of the Ph.D study has gone into developing software and algorithms for the utilization of CryoSat-2 data. The investigations has
included both development of practical methods for data processing of the ESA level-1 product (L1b) for the estimation of surface elevations and elevation changes over both smooth and complex glacial terrain. The retrieved surface elevations and elevation changes have been fully validated by comparison with airborne results from ongoing airborne laser campaigns over several types of glacial terrain in the Arctic region. The results from this validation study was then inter-compared with results derived from the ESA L2 baseline-B product to judge the quality of both products. From this inter-comparison it was shown that the new processing chains, developed in this thesis, performed better than the current ESA L2 baseline-B processing setup. The processing chains developed in this thesis for the CryoSat-2 LRM and SARin-mode showed and average improvement in both accuracy and precision of 50% and 30% respectively, compared to the current ESA L2 baseline-B product. The development of new surface elevation change algorithms have provided unprecedented coverage of the Greenland Ice Sheet, consisting of more than 17 million surface elevations and elevation change observations. The estimated elevation changes where validated using airborne laser derived elevation changes which showed a correlation of higher than 0.9. The estimated elevation changes were used to determine the total volume change of the Greenland Ice Sheet, producing an estimate of \(-224\pm25\) km\(^3\) a\(^{-1}\) for the period of 2010-2014, which is in good agreement with other studies. This effectively proves that with enhanced processing the CryoSat-2 mission can be used for both large and small scale mass balance studies of ice sheets, ice caps and glaciers. In the end, the work outlined in this thesis provides many possibilities for improving the current ESA L2 product available to the scientific user.

Dark matter line emission constraints from NuSTAR observations of the Bullet Cluster

Some dark matter candidates, e.g., sterile neutrinos, provide observable signatures in the form of mono-energetic line emission. We present the first search for dark matter line emission in the range in a pointed observation of the Bullet Cluster with NuSTAR. We do not detect any significant line emission and instead we derive upper limits (95% CL) on the flux, and interpret these constraints in the context of sterile neutrinos and more generic dark matter candidates. NuSTAR does not have the sensitivity to constrain the recently claimed line detection at \(\sqrt{10}\) keV, but improves on the constraints for energies of 10–25 keV.

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Data Use and Complexity in Coastal Climate Adaptation and Planning

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Deep NuSTAR and Swift monitoring observations of the magnetar 1E 1841-045

We report on a 350 ks NuSTAR observation of the magnetar 1E 1841-045 taken in 2013 September. During the observation, NuSTAR detected six bursts of short duration, with $T_{90} \lesssim 1$ s. An elevated level of emission tail is detected after the brightest burst, persisting for $\sim 1$ ks. The emission showed a power-law decay with a temporal index of 0.5 before returning to the persistent emission level. The long observation also provided detailed phase-resolved spectra of the persistent X-ray emission of the source. By comparing the persistent spectrum with that previously reported, we find that the source hard-band emission has been stable for over approximately 10 yr. The persistent hard-X-ray emission is well fitted by a coronal outflow model, where $e^+e^-$ pairs in the magnetosphere upscatter thermal X-rays. Our fit of phase-resolved spectra allowed us to estimate the angle between the rotational and magnetic dipole axes of the magnetar $\alpha_{\text{mag}}$, the twisted magnetic flux, $2.5 \times 10^{26}$ G cm$^2$, and the power released in the twisted magnetosphere, $= 6 \times 10^{36}$ erg s$^{-1}$. Assuming this model for the hard-X-ray spectrum, the soft-X-ray component is well fit by a two-black body model, with the hotter blackbody consistent with the footprint of the twisted magnetic field lines on the star. We also report on the 3 yr Swift monitoring observations obtained since 2011 July. The soft-X-ray spectrum remained stable during this period, and the timing behavior was noisy, with large timing residuals.

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Deep rest-frame far-UV spectroscopy of the giant Lyman $\alpha$ emitter 'Himiko'

We present deep 10 h VLT/XSHOOTER spectroscopy for an extraordinarily luminous and extended Ly alpha emitter at $z = 6.595$ referred to as Himiko and first discussed by Ouchi et al., with the purpose of constraining the mechanisms powering its strong emission. Complementary to the spectrum, we discuss near-infrared imaging data from the CANDELS survey. We find neither for He II nor any metal line a significant excess, with $3\sigma$ upper limits of $6.8 \times 10^{-18}$ erg s$^{-1}$ cm$^{-2}$ for C IV $\lambda 1549$, He II $\lambda 1640$, C III$\alpha \lambda 1909$, respectively, assuming apertures with 200 km s$^{-1}$ widths and offset by $-250$ km s$^{-1}$ w.r.t. to the peak Ly $\alpha$ redshift. These limits provide strong evidence that an AGN is not a major contribution to Himiko's Ly $\alpha$ flux. Strong conclusions about the presence of Pop III star formation or gravitational cooling radiation are not possible based on the obtained He II upper limit. Our Ly alpha spectrum confirms both spatial extent and flux ($8.8 \pm 0.5 \times 10^{-17}$ erg s$^{-1}$ cm$^{-2}$) of previous measurements. In addition, we can unambiguously exclude any remaining chance of it being a lower redshift interloper by significantly detecting a continuum redwards of Ly $\alpha$, while being undetected bluewards.

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Den magnetiske misvisning i Danmark, Grønland og Færøerne 2015: Geomagnetisme og misvisningskort for Danmark

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Authors: Finlay, C. (Intern), Olsen, N. (Intern)
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Design of a Push-Broom Multi-Beam Radiometer for Future Ocean Observations
The design of a push-broom multi-beam radiometer for future ocean observations is described. The radiometer provides a sensitivity one order of magnitude higher than a traditional conical scanning radiometer, and has the big advantage of being fully stationary relative to the satellite platform. Thanks to a dense focal plane array and a dedicated optimization procedure, the instrument can accurately measure in C, X and Ku band and as close as 15 km to the coast line.

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Determining the covering factor of Compton-thick active galactic nuclei with NuSTAR
The covering factor of Compton-thick (CT) obscuring material associated with the torus in active galactic nuclei (AGNs) is at present best understood through the fraction of sources exhibiting CT absorption along the line of sight ($NH > 1.5 \times 10^{24} \text{ cm}^{-2}$) in the X-ray band, which reveals the average covering factor. Determining this CT fraction is difficult, however, due to the extreme obscuration. With its spectral coverage at hard X-rays (>10 keV), Nuclear Spectroscopic Telescope Array (NuSTAR) is sensitive to the AGNs covering factor since Compton scattering of X-rays off optically thick material dominates at these energies. We present a spectral analysis of 10 AGNs observed with NuSTAR where the obscuring medium is optically thick to Compton scattering, so-called CT AGNs. We use the torus models of Brightman & Nandra that predict the X-ray spectrum from reprocessing in a torus and include the torus opening angle as a free parameter and aim to determine the covering factor of the CT gas in these sources individually. Across the sample we find mild to heavy CT columns, with $NH$ measured from $10^{24}$ to $10^{26} \text{ cm}^{-2}$, and a wide range of covering factors, where individual measurements range from 0.2 to 0.9. We find that the covering factor, $f_c$, is a strongly decreasing function of the intrinsic 2-10 keV luminosity, $L_X$, where $f_c = (0.41 \pm 0.13) \log_{10}(L_X/\text{erg s}^{-1}) + 18.31 \pm 5.33$, across more than two orders of magnitude in $L_X$ ($10^{41.5}$ to $10^{44}$ erg s$^{-1}$). The covering factors measured here agree well with the obscured fraction as a function of $L_X$ as determined by studies of local AGNs with $L_X > 10^{42.5}$ erg s$^{-1}$.

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Development of Ni-based multilayers for future focusing soft gamma ray telescopes

Ni-based multilayers are a possible solution to extend the upper energy range of hard X-ray focusing telescopes currently limited at ≈79.4 keV by the Pt-K absorption edge. In this study 10 bilayers multilayers with a constant bilayer thickness were coated with the DC magnetron sputtering facility at DTU Space, characterized at 8 keV using X-ray reflectometry and fitted using the IMD software. Ni/C multilayers were found to have a mean interface roughness ≈ 1.5 times lower than Ni/B4C multilayers. Reactive sputtering with ≈ 76% of Ar and ≈ 24% of N2 reduced the mean interface roughness by a factor of ≈ 1.7. It also increased the coating rate of C by a factor of ≈ 3.1 and lead to a coating process going ≈ 1.6 times faster. Honeycomb collimation proved to limit the increase in mean interface roughness when the bilayer thickness increases at the price of a coating process going ≈ 1.9 times longer than with separator plates. Finally a Ni/C 150 bilayers depth-graded multilayer was coated with reactive sputtering and honeycomb collimation and then characterized from 10 keV to 150 keV. It showed 10% reflectance up to 85 keV.
We present spectral analysis of NuSTAR and Swift observations of Cep X-4 during its outburst in 2014. We observed the source once during the peak of the outburst and once during the decay, finding good agreement in the spectral shape between the observations. We describe the continuum using a powerlaw with a Fermi-Dirac cutoff at high energies. Cep X-4 has a very strong cyclotron resonant scattering feature (CRSF) around 30 keV. A simple absorption-like line with a Gaussian optical depth or a pseudo-Lorentzian profile both fail to describe the shape of the CRSF accurately, leaving significant deviations at the red side of the line. We characterize this asymmetry with a second absorption feature around 19 keV. The line energy of the CRSF, which is not influenced by the addition of this feature, shows a small but significant positive luminosity dependence. With luminosities between (1-6)e36 erg/s, Cep X-4 is below the theoretical limit where such a correlation is expected. This behavior is similar to Vela X-1 and we discuss parallels between the two systems.
Drainage of the ice-dammed Lake Tinninilik, West Greenland; implication on bedrock uplift

Drainage of ice-dammed lakes is regularly observed along the margin of the Greenland Ice Sheet. However, the speed of the drainage events and implications can vary depending on the size of the lakes and the local settings. Here, we assess the drainage pattern of Lake Tinninilik, dammed by Sarqardliup sermia in West Greenland, using air- and satellite-borne laser- and radar altimetry supplemented with Landsat imagery. We combine the observations with DEMs from aerial imagery to derive lake volume changes which we compare against GPS data used to monitor crustal uplift caused by mass loss close to the site. Our results suggest that the previous pattern of drainage every 10th year has changed to every ~7th year, likely a result of enhanced melting over the last decade in the region. Furthermore, the lake drainage, resulting in a c. 70 m elevation change of the lake level, can occur in less than two months. Preliminary GPS results suggest instantaneous motion of a few centimeters of the solid bedrock in response the rapid drainage of the lake and thus support previous findings derived from radar interferograms that attribute vertical land motion to lake drainage.

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Drift reduction in strapdown airborne gravimetry using a simple thermal correction

Previous work has shown that strapdown airborne gravimeters can have a comparable or even superior performance in the higher frequency domain (resolution of few kilometres), compared to classical stable-platform air gravimeters using springs, such as the LaCoste and Romberg (LCR) S-gravimeter. However, the longer wavelengths (tens of kilometres and more) usually suffer from drifts of the accelerometers of the strapdown inertial measurement unit (IMU). In this paper, we analyse the drift characteristics of the QA2000 accelerometers, which are the most widely used navigation-grade IMU accelerometers. A large portion of these drifts is shown to come from thermal effects. A lab calibration procedure is used to derive a thermal correction, which is then applied to data from 18 out of 19 flights from an airborne gravity campaign carried out in Chile in October 2013. The IMU-derived gravity closure error can be reduced by 91% on average, from 3.72 mGal/h to only 0.33 mGal/h (RMS), which is an excellent long-term performance for strapdown gravimetry. Also, the IMU results are compared to the LCR S-gravimeter, which is known to have an excellent long-term stability. Again, the thermal correction yields a significant reduction of errors, with IMU and LCR aerogravity results being consistent at the 2 mGal level.

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DTU candidate field models for IGRF-12 and the CHAOS-5 geomagnetic field model

We present DTU’s candidate field models for IGRF-12 and the parent field model from which they were derived, CHAOS-5. Ten months of magnetic field observations from ESA’s Swarm mission, together with up-to-date ground observatory monthly means, were used to supplement the data sources previously used to construct CHAOS-4. The internal field part of CHAOS-5, from which our IGRF-12 candidate models were extracted, is time-dependent up to spherical harmonic degree 20 and involves sixth-order splines with a 0.5 year knot spacing. In CHAOS-5, compared with CHAOS-4, we update only the low-degree internal field model (degrees 1 to 24) and the associated external field model. The high-degree internal field (degrees 25 to 90) is taken from the same model CHAOS-4h, based on low-altitude CHAMP data, which was used in CHAOS-4. We find that CHAOS-5 is able to consistently fit magnetic field data from six independent low Earth orbit satellites: Ørsted, CHAMP, SAC-C and the three Swarm satellites (A, B and C). It also adequately describes the secular variation measured at ground observatories. CHAOS-5 thus contributes to an initial validation of the quality of the Swarm magnetic data, in particular demonstrating that Huber weighted rms model residuals to Swarm vector field data are lower than those to Ørsted and CHAMP vector data (when either one or two star cameras were operating). CHAOS-5 shows three pulses of secular acceleration at the core surface over the past decade; the 2006 and 2009 pulses have previously been documented, but the 2013 pulse has only recently been identified. The spatial signature of the 2013 pulse at the core surface, under the Atlantic sector where it is strongest, is well correlated with the 2006 pulse, but anti-correlated with the 2009 pulse.
Ecosystem properties of semi-arid savanna grassland in West Africa and its relationship to environmental variability

The Dahra field site in Senegal, West Africa, was established in 2002 to monitor ecosystem properties of semi-arid savanna grassland and their responses to climatic and environmental change. This article describes the environment and the ecosystem properties of the site using a unique set of in situ data. The studied variables include hydroclimatic variables, species composition, albedo, normalized difference vegetation index (NDVI), hyperspectral characteristics (350-1800 nm), surface reflectance anisotropy, brightness temperature, fraction of absorbed photosynthetic active radiation (FAPAR), biomass, vegetation water content, and land-atmosphere exchanges of carbon (NEE) and energy. The Dahra field site experiences a typical Sahelian climate and is covered by coexisting trees (~3% canopy cover) and grass species, characterizing large parts of the Sahel. This makes the site suitable for investigating relationships between ecosystem properties and hydroclimatic variables for semi-arid savanna ecosystems of the region. There were strong interannual, seasonal and diurnal dynamics in NEE, with high values of ~7.5 g C m⁻² day⁻¹ during the peak of the growing season. We found neither browning nor greening NDVI trends from 2002 to 2012. Interannual variation in species composition was strongly related to rainfall distribution. NDVI and FAPAR were strongly related to species composition, especially for years dominated by the species Zornia glochidiata. This influence was not observed in interannual variation in biomass and vegetation productivity, thus challenging dryland productivity models based on remote sensing. Surface reflectance anisotropy (350-1800 nm) at the peak of the growing season varied strongly depending on wavelength and viewing angle thereby having implications for the design of remotely sensed spectral vegetation indices covering different wavelength regions. The presented time series of in situ data have great potential for dryland dynamics studies, global climate change related research and evaluation and parameterization of remote sensing products and dynamic vegetation models.

General information
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Organisations: Department of Environmental Engineering, Water Resources Engineering, National Space Institute, Microwaves and Remote Sensing, Department of Applied Mathematics and Computer Science, Université Cheikh Anta Diop de Dakar, University of Copenhagen, Karlsruhe Institute of Technology KIT, DHI Denmark, Lund University
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Authors: Sørensen, C. S. (Intern)
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Energy-Efficient Optical Signal Processing Using Optical Time Lenses: Data Communication and Storage Applications

This chapter describes advanced functionalities for optical signal processing using optical time lenses. A special focus is devoted to functionalities that allow for energy-savings. In particular, we find that optical signal processing, where the processing is broadband and capable of handling many bits in a single operation allows for sharing the processing energy by the many bits, and hence the energy per bit is reduced. Such functionalities include serial-to-parallel conversion in a single time lens, where a large number of parallel demultiplexers may be substituted by a single time lens. Combining time lenses into telescopic arrangements allows for more advanced signal processing, such as temporal or spectral compression or magnification. A spectral telescope may for instance allow for conversion of OFDM signals to DWDM-like signals, which can be separated passively, i.e. without additional energy. This is opposed to the DFT OFDM receivers otherwise suggested, where a temporal active gate is required for each tributary. With the spectral telescope, only two active time lenses are required, irrespective of how many tributaries are used. This chapter describes how optical time lenses function and by showing examples of some advanced functionalities points to future scenarios where energy consumption may be considerably reduced.

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Envisat-derived elevation changes of the Greenland ice sheet, and a comparison with ICESat results in the accumulation area

We show, for the first time over the Greenland ice sheet, that an along track method for deriving rates of elevation change can successfully be applied to Envisat radar altimetry data (2002–2010). The results provide improved resolution and coverage compared to previous results obtained from cross-over methods. Also, we find that temporal changes in the elevation change rate can be derived from Envisat data, and show clear examples of this by generating five-year running means for selected areas of the Greenland ice sheet. For a period between 2003 and 2009, the elevation of the ice sheet was measured by both the laser altimeter on board ICESat and the radar altimeter on board Envisat. We compare rates of elevation change derived from ICESat and Envisat for this time span in which both sensors were operating. We focus on the area above the equilibrium line altitude, in order to specifically derive information on snow parameters. A comparison of the elevation changes observed by the two sensors shows a complex pattern, which can be explained regionally by model output describing the changes in both firn air content and accumulation rates.

General information
State: Published
Organisations: National Space Institute, Geodynamics, Laboratoire d'Études en Géophysique et Océanographie Spatiales
Erosion Pressure on the Danish Coasts

Coastlines around the world are receding due to coastal erosion. With rising sea levels and a potential climatic deterioration due to climate change, erosion rates are likely to increase at many locations in the future. Together with the current preference of people to settle near or directly by the ocean, coastal erosion issues become increasingly more important to the human values at risk. Along many Danish coastlines, hard structures already act as coastal protection in the form of groins, breakwaters, revetments etc. These eroding coasts however still lack sand and where the public, in general, neglects the need for sand replenishment i.e. in the form of repeated sand nourishments.

Here we present a conceptual model and method for dividing coastal erosion into acute and chronic erosion pressure, respectively. We focus on the model use for management and climate change adaptation purposes and on how to make coastal processes and the impacts of climate change on the coasts more comprehensible to the public.

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ESA CryoVEx 2014 - Airborne ASIRAS radar and laser scanner measurements during 2014 CryoVEx campaign in the Arctic

This report outlines the airborne field operations with the ESA airborne Ku-band interferometric radar (ASIRAS), coincident airborne laser scanner (ALS) and vertical photography to acquire data over sea- and land ice along validation sites and CryoSat-2 ground tracks. The airborne campaign was coordinated by DTU Space using the Norlandair Twin Otter (TF-POF). The campaign consisted of two experiment periods: Mid-march to early April and late April to mid-May with focus on sea ice and land ice, respectively. The sea ice measurements covered several validation sites with sea ice camps located in the Beaufort Sea lead by US office of Naval Research (ONR) and north of Greenland as a dedicated ESA CryoVEx initiative. In addition, selected CryoSat-2 ground tracks were under-flown in the Lincoln Sea from CFS Alert, North of Greenland and Svalbard from St. Nord and Longyearbyen. Several of the flights in the Beaufort and Lincoln Sea were coordinated with Uni. of York (UY) lead Basler aircraft towing an electromagnetic (AEM/EM bird) sounder to obtain sea ice thickness and Operation IceBridge (OIB) NASA P-3 carrying a variety of instruments for sea ice and snow retrievals. Land ice measurements were acquired over the Greenland ice sheet (the EGIQ line and selected CryoSat-2 ground tracks), together with Austfonna and Devon ice caps. At Austfonna and Devon ice caps ground teams measured ice and snow properties, and raised corner reflectors acting as a surface reference point in order to estimate the penetration depth of the ASIRAS radar. An opportunity site on the Greenland Ice Sheet was surveyed near Jakobshavn Isbræ. No other ground experiments were coordinated with the CryoVEx campaign on the Greenland Ice Sheet. The CryoVEx 2014 campaign was a success and the processed data is of high quality. The data set includes 13 CryoSat underflights covering distances from 25-560 km. The preliminary comparisons to CryoSat-2 data show the potential of the extensive dataset.

General information
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Organisations: National Space Institute, Geodynamics, Alfred Wegener Institute for Polar and Marine Research
Authors: Hvidegaard, S. M. (Intern), Nielsen, J. E. (Intern), Sørensen, L. S. (Intern), Simonsen, S. B. (Intern), Skourup, H. (Intern), Forsberg, R. (Intern), Helm, V. (Ekstern), Bjerg, T. (Ekstern)
For more than two decades, radar altimetry missions have provided continuous elevation estimates of the Greenland ice sheet (GrIS). Here, we propose a method for using such data to estimate ice-sheet-wide surface elevation changes (SECs). The final data set will be based on observations acquired from the European Space Agency’s Environmental Satellite (ENVISAT), European Remote Sensing (ERS)-1 and -2, CryoSat-2, and, in the longer term, Sentinel-3 satellites. In order to find the best-performing method, an intercomparison exercise has been carried out in which the scientific community was asked to provide their best SEC estimates as well as feedback sheets describing the applied method. Due to the hitherto few radar-based SEC analyses as well as the higher accuracy of laser data, the participants were asked to use either ENVISAT radar or ICESat (Ice, Cloud, and land Elevation Satellite) laser altimetry over the Jakobshavn Isbræ drainage basin. The submissions were validated against airborne laser-scanner data, and intercomparisons were carried out to analyse the potential of the applied methods and to find whether the two altimeters were capable of resolving the same signal. The analyses found great potential of the applied repeat-track and cross-over techniques, and, for the first time over Greenland, that repeat-track analyses from radar altimetry agreed well with laser data. Since topography-related errors can be neglected in cross-over analyses, it is expected that the most accurate, ice-sheet-wide SEC estimates are obtained by combining the cross-over and repeat-track techniques. It is thus possible to exploit the high accuracy of the former and the large spatial data coverage of the latter. Based on CryoSat's different operation modes, and the increased spatial and temporal data coverage, this shows good potential for a future inclusion of CryoSat-2 and Sentinel-3 data to continuously obtain accurate SEC estimates both in the interior and margin ice sheet.
Essential Climate Variables for the Ice Sheets from Space and Airborne measurements

The Greenland Ice Sheet is the largest ice mass in the northern hemisphere. Over the past decade, it has undergone substantial changes in e.g. mass balance, surface velocity, and ice thickness. The latter is reflected by surface elevation changes, which are detectable with altimetry. Therefore, this study exploits the advantages of radar and laser altimetry to analyze surface elevation changes and build a Digital Elevation Model of the ice sheet. Selected advantages are radar data’s continuity in time and laser data’s higher horizontal and vertical accuracy. Therefore, ESA Envisat and CryoSat-2 radar altimetry data are used in conjunction with laser data from NASA’s ICESat and airborne ATM and LVIS instruments, and from ESA’s airborne CryoVEx campaign. The study is part of the ESA Ice Sheets CCI project. With the release of REAPER data, one goal is to use the more than two decades of ESA radar altimetry to develop a long-term surface elevation change product from 1992 to present. The optimal method is found by comparing ten different solutions submitted by the scientific community across the choice of altimeter and method: A combination of repeat-tracks and cross-overs. The former produces estimates along repeat ground-tracks while the latter exploits intersecting ground-tracks. The combination increases the spatial data coverage and reduces topographic errors. Two results based on Envisat data are presented here: The first repeat track solution (2002 – 2010) of the Greenland Ice Sheet and a merged repeat track and cross-over result from 2006 – 2010. A 2 × 2 km Digital Elevation Model is built from combined radar and laser data. It is applicable for elevation change detection and correction of topographic errors. Current models have limitations as they are based on short observation periods from one sensor, limiting the spatial data coverage, or multiple
years of data from various sensors, inheriting errors from intermediate elevation changes. The model here consists of Envisat and CryoSat-2 data from 2010 merged with ICESat, ATM, and LVIS data. Vertical radar errors are corrected with laser data. Thus, the Digital Elevation Model is referenced to a specific epoch in time and exploits the high spatial coverage of input data. An important finding in the study is disagreeing relocations of radar data depending on the method. Validation shows the preferred method to be the Point of Closest Approach with an a-priori Digital Elevation Model to extract the surface topography. The preferred spatial resolution of the model is $2 \times 2$ km for Envisat and CryoSat-2 LRM data near Jakobshavn Isbrae, i.e. over regions with both steep and smooth topography.

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Evaluation of candidate geomagnetic field models for IGRF-12
Background: The 12th revision of the International Geomagnetic Reference Field (IGRF) was issued in December 2014 by the International Association of Geomagnetism and Aeronomy (IAGA) Division V Working Group V-MOD (http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html). This revision comprises new spherical harmonic main field models for epochs 2010.0 (DGRF-2010) and 2015.0 (IGRF-2015) and predictive linear secular variation for the interval 2015.0-2020.0 (SV-2015-2020). Findings: The models were derived from weighted averages of candidate models submitted by ten international teams. Teams were led by the British Geological Survey (UK), DTU Space (Denmark), ISTERRE (France), IZMIRAN (Russia), NOAA/NGDC (USA), GFZ Potsdam (Germany), NASA/GSFC (USA), IPGP (France), LPG Nantes (France), and ETH Zurich (Switzerland). Each candidate model was carefully evaluated and compared to all other models and a mean model using well-defined statistical criteria in the spectral domain and maps in the physical space. These analyses were made to pinpoint both troublesome coefficients and the geographical regions where the candidate models most significantly differ. Some models showed clear deviation from other candidate models. However, a majority of the task force members appointed by IAGA thought that the differences were not sufficient to exclude models that were well documented and based on different techniques. Conclusions: The task force thus voted for and applied an iterative robust estimation scheme in space. In this paper, we report on the evaluations of the candidate models and provide details of the algorithm that was used to derive the IGRF-12 product.

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Evaluation of different water surface ranging technologies for lightweight UAVs
Evidence for a new geomagnetic jerk in 2014

The production of quasi-definitive data at Ebre observatory has enabled us to detect a new geomagnetic jerk in early 2014. This has been confirmed by analyzing data at several observatories in the European-African and Western Pacific-Australian sectors in the classical fashion of looking for the characteristic V shape of the geomagnetic secular variation trend. A global model produced with the latest available satellite and observatory data supports these findings, giving a global perspective on both the jerk and a related secular acceleration pulse at the core-mantle boundary. We conclude that the jerk was most visible in the Atlantic and European sectors.
Extended hard-X-ray emission in the inner few parsecs of the Galaxy

The Galactic Centre hosts a puzzling stellar population in its inner few parsecs, with a high abundance of surprisingly young, relatively massive stars bound within the deep potential well of the central supermassive black hole, Sagittarius A* (ref. 1). Previous studies suggest that the population of objects emitting soft X-rays (less than 10 kiloelectronvolts) within the surrounding hundreds of parsecs, as well as the population responsible for unresolved X-ray emission extending along the Galactic plane, is dominated by accreting white dwarf systems. Observations of diffuse hard-X-ray (more than 10 kiloelectronvolts) emission in the inner 10 parsecs, however, have been hampered by the limited spatial resolution of previous instruments. Here we report the presence of a distinct hard-X-ray component within the central 4 × 8 parsecs, as revealed by subarcminute-resolution images in the 20-40 kiloelectronvolt range. This emission is more sharply peaked towards the Galactic Centre than is the surface brightness of the soft-X-ray population. This could indicate a significantly more massive population of accreting white dwarfs, large populations of low-mass X-ray binaries or millisecond pulsars, or particle outflows interacting with the surrounding radiation field, dense molecular material or magnetic fields. However, all these interpretations pose significant challenges to our understanding of stellar evolution, binary formation, and cosmic-ray production in the Galactic Centre.

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Organisations: National Space Institute, Astrophysics, Columbia University, Pontifícia Universidade Católica, University of California at Berkeley
Field-aligned currents' scale analysis performed with the Swarm constellation

We present a statistical study of the temporal- and spatial-scale characteristics of different field-aligned current (FAC) types derived with the Swarm satellite formation. We divide FACs into two classes: small-scale, up to some 10 km, which are carried predominantly by kinetic Alfvén waves, and large-scale FACs with sizes of more than 150 km. For determining temporal variability we consider measurements at the same point, the orbital crossovers near the poles, but at different times. From correlation analysis we obtain a persistent period of small-scale FACs of order 10 s, while large-scale FACs can be regarded stationary for more than 60 s. For the first time we investigate the longitudinal scales. Large-scale FACs are different on dayside and nightside. On the nightside the longitudinal extension is on average 4 times the latitudinal width, while on the dayside, particularly in the cusp region, latitudinal and longitudinal scales are comparable.

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Organisations: National Space Institute, Measurement and Instrumentation Systems, German Research Centre for Geosciences, University of Bergen
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ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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First NuSTAR Observations of Mrk 501 Within a Radio to TeV Multi-Instrument Campaign

We report on simultaneous broadband observations of the TeV-emitting blazar Markarian 501 between 2013 April 1 and August 10, including the first detailed characterization of the synchrotron peak with Swift and NuSTAR. During the campaign, the nearby BL Lac object was observed in both a quiescent and an elevated state. The broadband campaign includes observations with NuSTAR, MAGIC, VERITAS, the Fermi Large Area Telescope, Swift X-ray Telescope and UV Optical Telescope, various ground-based optical instruments, including the GASP-WEBT program, as well as radio observations by OVRO, Metsähovi, and the F-Gamma consortium. Some of the MAGIC observations were affected by a sand layer from the Saharan desert, and had to be corrected using event-by-event corrections derived with a Light Detection and Ranging (LIDAR) facility. This is the first time that LIDAR information is used to produce a physics result with Cherenkov Telescope data taken during adverse atmospheric conditions, and hence sets a precedent for the current and future ground-based gamma-ray instruments. The NuSTAR instrument provides unprecedented sensitivity in hard X-rays, showing the source to display a spectral energy distribution (SED) between 3 and 79 keV consistent with a log-parabolic spectrum and hard X-ray variability on hour timescales. None (of the four extended NuSTAR observations) show evidence of the onset of inverse-Compton emission at hard X-ray energies. We apply a single-zone equilibrium synchrotron self-Compton (SSC) model to five simultaneous broadband SEDs. We find that the SSC model can reproduce the observed broadband states through a decrease in the magnetic field strength coinciding with an increase in the luminosity and hardness of the relativistic leptons responsible for the high-energy emission.

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Organisations: National Space Institute, Astrophysics
Flight demonstration of formation flying capabilities for future missions (NEAT Pathfinder)

PRISMA is a demonstration mission for formation-flying and on-orbit-servicing critical technologies that involves two spacecraft launched in low Earth orbit in June 2010 and still in operation. Funded by the Swedish National Space Board, PRISMA mission has been developed by OHB Sweden with important contributions from the German Aerospace Centre (DLR/GSOC), the French Space Agency (CNES), and the Technical University of Denmark (DTU). The paper focuses on the last CNES experiment achieved in September 2012 that was devoted to the preparation of future astrometry missions illustrated by the NEAT and microNEAT mission concepts. The experiment consisted in performing the type of formation maneuvers required to point the two-satellite axis to a celestial target and maintain it fixed during the observation period. Achieving inertial pointing for a LEO formation represented a new challenge given the numerous constraints from propellant usage to star tracker blinding. The paper presents the experiment objectives in relation with the NEAT/microNEAT mission concept, describes its main design features along with the guidance and control algorithms evolutions and discusses the results in terms of performances achieved during the two rehearsals.

General information
Flooding hazards from sea extremes and subsidence

If we do not understand the effects of climate change and sea level rise (SLR) we cannot live in low-lying coastal areas in the future. Permanent inundation may become a prevalent issue but more often floods relate to extreme events have the largest damage potential, and the management of flooding hazards needs to integrate the water loading from various sources. Furthermore, local subsidence must be accounted for in order to evaluate current and future flooding hazards and management options. We present the methodology (Figure) and preliminary results from the research project “Coastal Flooding Hazards due to Storm Surges and Subsidence” (2014-2017) with the objective to develop and test a practice oriented methodology for combining extreme water level statistics and land movement in coastal flooding hazard mapping and in climate change adaptation schemes in Denmark. From extreme value analysis of tide gauge records, statistics that allow also for projections of SLR, meteorological variability, and extremes with a very low probability of occurrence are provided. Land movement is researched with a focus on short term surface height variability in the groundwater-ocean interface that, together with longer term processes, may cause substantial subsidence and impact future water management and adaptation strategies in flood prone coastal areas. Field studies' results from repeated precise levelling, GPS setups, and ocean and groundwater level monitoring in Thyborøn and Aarhus are integrated into geological and geophysical data and modelling work to explore the nature and causes of the subsidence encountered, and to explore new ways of utilizing data in relation to coastal flooding hazard mapping. Here, preliminary results from the study sites show local subsidence in the order of up to 5-10 mm/y; rates that thus currently exceed SLR by far. The combined effects of storm surges and subsidence may then e.g. be projected in a Digital Elevation Model (DEM) to give more realistic future surface and flooding level representations.

Formation of Nanodroplets in N₂/H₂O/SO₂ under Irradiation of Fast Proton Beams

The droplet formation induced by cosmic ray in the terrestrial atmosphere attract certain attention in recent decades because this process could be important to understand the possible relationship between cosmic ray and climate on the earth. The role of energetic ions for the droplet formation would be in both the ion production and oxidation of SO₂ in the air. Attractive polarization forces between ions and molecules decrease energy barrier in droplet growth. On the other hand, the oxidation of SO₂ by radical species in ion irradiation result in the production of H₂SO₄, which also decrease energy barrier of the droplet growth in the binary nucleation process of water and H₂SO₄. We have performed irradiation of proton beam on the gas mixture of N₂/H₂O/SO₂ and Air/H₂O/SO₂. The reduction of SO₂ concentration by beam irradiation was monitored using an SO₂ meter and the size distributions of generated droplets were measured with adifferential mobility analyzer. We found that the mass yield of generated droplets showed linear dependence on the amount of SO₂ oxidation. This behavior is different from binary nucleation theory of water and H₂SO₄. The difference might indicates importance of considering the droplet formation to be a kind of cooperative phenomena by ion processes and oxidation of SO₂.
G359.97-0.038: A Hard X-Ray Filament Associated with a Supernova Shell-Molecular Cloud Interaction

We present the first high-energy X-ray (>10 keV) observations of the non-thermal filament G359.97-0.038 using the Nuclear Spectroscopic Telescope Array (NuSTAR). This filament is one of approximately 20 X-ray filaments of unknown origin located in the central 20 pc region in the Galactic Center near Sgr A*. Its NuSTAR and Chandra broadband spectrum is characterized by a single power law with \( \Gamma = 1.3 \pm 0.3 \) that extends from 2 to 50 keV, with an unabsorbed luminosity of \( 1.3 \times 10^{33} \) erg s\(^{-1}\) (d/8 kpc)\(^2\) in the 2-8 keV band. Despite possessing a cometary X-ray morphology that is typical of a pulsar wind nebula (PWN) in high-resolution Chandra imaging, our spatially resolved Chandra spectral analysis found no significant spectral softening along the filament as would be expected from particle synchrotron cooling. Coincident radio emission is detected using the Very Large Array at 5.5 and 8.3 GHz. We examine and subsequently discard a PWN or magnetic flux tube as the origin of G359.97-0.038. We use broadband spectral characteristics and a morphological analysis to show that G359.97-0.038 is likely an interaction site between the shell of Sgr A East and an adjacent molecular cloud. This is supported by CS molecular line spectroscopy and the presence of an OH maser.

General information

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Geomagnetic Secular Variation and Its Applications to the Core

We review the observational constraints on the morphology and evolution of the magnetic field of the Earth over the last few centuries; these changes are referred to as the secular variation. Starting with a description of the available sources of original observations of the field, we then discuss the mathematical models of the field’s evolution that can be derived from them. We discuss the prominent features of the field’s evolution, both at the Earth’s surface and at the surface of the liquid core. The final section concerns itself with a discussion of the interpretation of the field’s evolution, in terms of physical core processes. These divide themselves into processes associated with movement of core fluid, which is capable of advecting the field, and processes associated with the finite resistivity of the core, commonly termed diffusive processes. We lay the foundations for some of the more theoretical subjects covered in Volume Eight.

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GNSS-based Observations and Simulations of Spectral Scintillation Indices in the Arctic Ionosphere

During disturbed times, ionospheric scintillations can be severe and adversely impact satellite-based positioning and radio transmissions. The scintillation occurs in the amplitude, phase, polarization, and angle of arrival of the signal. Precise observation, classification, modeling, forecasting, and development of data-driven methodologies to accurately localize ionospheric irregularities and simulate GNSS scintillation signals are highly desired. Ionospheric scintillations have traditionally been quantified by amplitude (S4) and phase scintillations (σφ). Our study focuses on the Arctic, where scintillations, especially phase scintillations, are prominent. We will present observations acquired from a network of Greenlandic GNSS stations, including 2D amplitude and phase scintillation index maps for representative calm and storm periods. In addition to the traditional indices described above, we are exploring a set of indices derived from the power spectra of the signals. The observed corner frequency of the power spectrum is a function of the Fresnel radius and the drift speed of the irregularities, while the slope of the power spectrum is related to the Fresnel oscillations. We will demonstrate how spectral characteristics of the scintillations act under large total electron content (TEC) gradients and how physical parameters can be extracted from the power spectra, and will present how these parameters of the corner frequencies and power spectra slopes vary during ionospheric storms. The observations will then be compared to properties of simulated GNSS signals computed by the Fast Scintillation Mode (FSM). The FSM was developed to simulate ionospheric scintillations under different geophysical conditions, and is used to simulate GNSS signals with known scintillation characteristics. This comparison could lead to a better understanding of the observed ionospheric state.

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Organisations: National Space Institute, Geodesy, NASA Jet Propulsion Laboratory
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GNSS-Reflectometry with GEROS-ISS: Overview and recent results
GEROS-ISS (GEROS hereafter) stands for GNSS REFlectometry, Radio Occultation and Scatterometry onboard the International Space Station. It is a scientific experiment, proposed to the European Space Agency (ESA) in 2011 for installation aboard the ISS. The main focus of GEROS is the dedicated use of signals from the currently available Global Navigation Satellite Systems (GNSS) for remote sensing of the System Earth with focus to Climate Change characterisation. The GEROS mission idea and the current status are briefly reviewed.

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Greenland 2012 melt event effects on CryoSat-2 radar altimetry

CryoSat-2 data are used to study elevation changes over an area in the interior part of the Greenland Ice Sheet during the extreme melt event in July 2012. The penetration of the radar signal into dry snow depends heavily on the snow stratigraphy, and the rapid formation of refrozen ice layers can bias the surface elevations obtained from radar altimetry. We investigate the change in CryoSat-2 waveforms and elevation estimates over the melt event and interpret the findings by comparing in situ surface and snow pit observations from the North Greenland Eemian Ice Drilling Project camp. The investigation shows a major transition of scattering properties around the area, and an apparent elevation increase of 56±26 cm is observed in reprocessed CryoSat-2 data. We suggest that this jump in elevation can be explained by the formation of a refrozen melt layer that raised the reflective surface, introducing a positive elevation bias.
Greenland ice sheet mass balance: a review

Over the past quarter of a century the Arctic has warmed more than any other region on Earth, causing a profound impact on the Greenland ice sheet (GrIS) and its contribution to the rise in global sea level. The loss of ice can be partitioned into processes related to surface mass balance and to ice discharge, which are forced by internal or external (atmospheric/oceanic/basal) fluctuations. Regardless of the measurement method, observations over the last two decades show an increase in ice loss rate, associated with speeding up of glaciers and enhanced melting. However, both ice discharge and melt-induced mass losses exhibit rapid short-term fluctuations that, when extrapolated into the future, could yield erroneous long-term trends. In this paper we review the GrIS mass loss over more than a century by combining satellite altimetry, airborne altimetry, interferometry, aerial photographs and gravimetry data sets together with modelling studies. We revisit the mass loss of different sectors and show that they manifest quite different sensitivities to atmospheric and oceanic forcing. In addition, we discuss recent progress in constructing coupled ice-ocean-atmosphere models required to project realistic future sea-level changes.
kan anvendes til mange formål og gerne i kombination med andre data som luftfotos, in situ målinger af sedimenttransport, on-site validering af bundforhold, satellitdata mv. Detaljeret kortlægning af kystzonen er vigtig i forhold til morfologi, sedimenter og geologi, især i forhold til den fremtidige kystudvikling set i lyset af klimaændringer og et potentielt ændret stormklima. Et godt kendskab til de faktiske dybe- og bundforhold vil give bedre mulighed for fremskrivning af erosion/kystlinjeændringer, for modellering af oversvømmelsesfaren langs kysterne og optimering af nuværende og fremtidige kystbeskyttelses tiltag langs kysterne. Endvidere vil teknologien styrke forvaltning og montering i relation til eksempelvis sandfodring/-bypass og habitatkortlægning. Anvendelse af grøn laser giver mulighed for ”sømløse” kortlægning af hele kystzonen, inklusiv overgangszonen land-hav; en forbedret og mere effektiv søopmåling; at favne små- og storskala morfologi i tidl uset detaljeringsgrad og nøjagtighed, og mulighed for at efterleve EU-målsætninger om integreret, ekosystembaseret kystzoneforvaltning. Et fortsat og udvidet samarbejde omkring anvendelse af grøn laser vil bidrage til en effektiv og bæredygtig udnyttelse og beskyttelse af landets naturressourcer især indenfor kystzonen, hvor informationsniveauet indtil videre er utilstrækkeligt. Fremadrettet ses desuden store perspektiver i anvendelse af civile droner (UAV’s) til grøn lasermåling. Dette kræver dog endnu udvikling bl.a. i at mindske vægten af måleudstyr.

Handling complex source structures in global EM induction studies: from C-responses to new arrays of transfer functions

The C-response is a conventional transfer function in global electromagnetic induction research and is traditionally determined from observations of magnetic variations in the vertical and horizontal components. Its interpretation relies on the assumption that the source of the variations is well approximated by a large-scale symmetric (magnetospheric) ring current, described by a single spherical harmonic. However, there is growing evidence for a more complex structure of this source. In this paper, we investigate the variability of C-responses due to sources different from the dominating large-scale symmetric ring current. We show that the effect is significant and persists at all periods. Describing the magnetospheric source by a single spherical harmonic coefficient thus injects substantial errors into the estimated responses. To overcome the problem, we introduce arrays of alternative transfer functions that relate the components of the magnetic variation to different spherical harmonic coefficients. These transfer functions can handle a complex spatial structure of the magnetospheric source. Compared to C-responses, we observe a significant increase in the coherencies relating input and output quantities of the new transfer functions, especially at high latitudes. This increases the usability of observatory magnetic data for the recovery of global 3-D mantle conductivity structure.
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In 2013, NuSTAR observed the Sgr B2 region and for the first time resolved its hard X-ray emission on subarcminute scales. Two prominent features are detected above 10 keV: a newly emerging cloud, G0.66-0.13, and the central 90'' radius region containing two compact cores, Sgr B2(M) and Sgr B2(N), surrounded by diffuse emission. It is inconclusive whether the remaining level of Sgr. B2 emission is still decreasing or has reached a constant background level. A decreasing X-ray emission can be best explained by the X-ray reflection nebula scenario, where the cloud reprocesses a past giant outburst from Sgr A*. In the X-ray reflection nebula (XRN) scenario, the 3-79 keV Sgr. B2 spectrum allows us to self-consistently test the XRN model using both the Fe K alpha line and the continuum emission. The peak luminosity of the past Sgr A* outburst is constrained to $L_{X,3-79keV} \sim 5 \times 10^{38} \text{ ergs s}^{-1}$. A newly discovered cloud feature, G0.66-0.13, shows different timing variability. We suggest that it could be a molecular clump located in the Sgr B2 envelope reflecting the same Sgr A* outburst. In contrast, if the Sgr. B2 X-ray emission has reached a constant background level, it would imply an origin of low-energy cosmic-ray (CR) proton bombardment. In this scenario, from the NuSTAR measurements we infer a CR ion power of $dW/dt = (1 - 4) \times 10^{39} \text{ ergs s}^{-1}$ and a CR ionization rate of $\zeta_H = (6 - 10) \times 10^{-15} \text{ H}^{-1} \text{ s}^{-1}$. Measurements can become powerful tools to constrain the GC CR population.
High Accuracy Tracking of Space-Borne Non-Cooperative Targets

This dissertation is focused on the subject of tracking non-cooperative targets, by the use of a vision based sensor. The main goal of navigating a spacecraft or a rover. The main objective of the dissertation is to apply image processing methods to facilitate accurate and robust measurements for the spacecraft to navigate safely and autonomously towards the target. These methods are applied on three distinct study cases, which are based on the platform of the microASC instrument.

In relation to the Mars2020 rover, a structured light system is used to navigate the PIXL instrument towards the Martian surface, whose objective is to seek evidence of ancient life in the form of chemical biosignatures. The structured light is a subsystem of the PIXL instrument consisting of two active lasers and an imager. The structured light makes use of active triangulation to support a safe approach towards the surface and to enhance the PIXL instrument's capabilities with highly accurate distance measurements. Optical observations of planetary bodies and satellites are utilized to determine the inertial position of a spacecraft. A software module is developed, tested and verified by both ground based and in-flight observations, where the performance over the complete operational envelope is characterized by simulations. The in-flight observations were captured onboard Juno, during the Earth flyby, by the microASC instrument, operating as an inertially controlled imager. The involvement in Juno's Earth Fly By operational team and processing of the captured data was recognized with two Group Achievement Awards from the National Aeronautics and Space Administration.

With today's advancement in autonomy, the focus is set on in-flight tracking of a non-cooperative artificial satellite with the end goal of capturing the target. The objective is to facilitate a sensor technology that enables fully autonomous relative navigation between a target and chaser. A novel method is designed, tested and verified to comply with the requirements for the final phase of a rendezvous scenario, applicable to servicing and sample return missions.
High-energy radiation from thunderstorms and lightning with LOFT. White Paper in Support of the Mission Concept of the Large Observatory for X-ray Timing.

The Large Observatory for X-ray Timing, LOFT, is designed to perform fast X-ray timing and spectroscopy with uniquely large throughput (Feroci et al., 2014). LOFT focuses on two fundamental questions of ESA’s Cosmic Vision Theme “Matter under extreme conditions”: what is the equation of state of ultradense matter in neutron stars? Does matter orbiting close to the event horizon follow the predictions of general relativity? These goals are elaborated in the mission Yellow Book (http://sci.esa.int/loft/53447-loft-yellow-book/) describing the LOFT mission as proposed in M3, which closely resembles the LOFT mission now being proposed for M4. The extensive assessment study of LOFT as ESA’s M3 mission candidate demonstrates the high level of maturity and the technical feasibility of the mission, as well as the scientific importance of its unique core science goals. For this reason, the LOFT development has been continued, aiming at the new M4 launch opportunity, for which the M3 science goals have been confirmed. The unprecedentedly large effective area, large grasp, and spectroscopic capabilities of LOFT’s instruments make the mission capable of state-of-the-art science not only for its core science case, but also for many other open questions in astrophysics. LOFT’s primary instrument is the Large Area Detector (LAD), a 8.5m² instrument operating in the 2–30 keV energy range, which will revolutionise studies of Galactic and extragalactic X-ray sources down to their fundamental time scales. The mission also features a Wide Field Monitor (WFM), which in the 2–50 keV range simultaneously observes more than a third of the sky at any time, detecting objects down to mCrab fluxes and providing data with excellent timing and spectral resolution. Additionally, the mission is equipped with an on-board alert system for the detection and rapid broadcasting to the ground of celestial bright and fast outbursts of X-rays (particularly, Gamma-ray Bursts). This paper is one of twelve White Papers that illustrate the unique potential of LOFT as an X-ray observatory in a variety of astrophysical fields in addition to the core science.

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How can awareness in civil society and in governance be raised? Reducing risks from coastal hazards

Risks to human life, the economy and the environment are increasing globally in coastal areas. There is therefore a strong need to implement holistic and highly developed flood risk management systems which incorporate both risk mitigation and climate change adaptation. Based on the implementation of the EU Floods Directive and of municipal level climate adaptation plans in Denmark, we explore shortcomings in the ways we coordinate disaster risk management (DRM) and climate change adaptation (CCA) between scientists, decision- and policymakers, and the public in relation to coastal flooding and erosion. From top-down approaches to law enforcement at European and national levels on DRM and CCA, respectively, to the local bottom-up approaches and actual implementation of plans, we investigate and pinpoint areas where major improvement is needed to deal with current and future risks and vulnerabilities in the coastal zone. Major topics are: i) No political and financial links between DRM, where budgets are reduced for preparedness etc, and CCA where there is only a vague political opinion on how to proceed; ii) The gap must be closed between academia based provision of tools and maps, and the needs of decision makers and the public; iii) Lack of knowledge and awareness about risk and risk reduction in the public; iv) Lack of transdisciplinary work especially between natural and social sciences; v) Timing of actions for coastal protection and DRM/CCA. Although legislative frameworks and capacity building efforts are different to those in Australia, many of the Danish coastal challenges are comparable in relation to future as well as acute risks to coastal communities and individual property owners.

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Hybrid inventory, gravimetry and altimetry (HiGA) mass balance product for Greenland and the Canadian Arctic

We present a novel inversion algorithm that generates a mass balance field that is simultaneously consistent with independent observations of glacier inventory derived from optical imagery, cryosphere-attributed mass trends derived from satellite gravimetry, and ice surface elevation trends derived from airborne and satellite altimetry. We use this algorithm to assess mass balance across Greenland and the Canadian Arctic over the Sep-2003 to Oct-2009 period at 26 km resolution. We evaluate local algorithm-inferred mass balance against forty in situ point observations. This evaluation yields an RMSE of 0.15 mWE/a, and highlights a paucity of in situ observations from regions of high dynamic mass loss and peripheral glaciers. We assess mass losses of 212 ± 67 Gt/a to the Greenland ice sheet proper, 38 ± 11 Gt/a to peripheral glaciers in Greenland, and 42 ± 11 Gt/a to glaciers in the Canadian Arctic. These magnitudes of mass loss are dependent on the gravimetry-derived spherical harmonic mass trend we invert. We spatially partition the transient glacier continuity equation by differencing algorithm-inferred mass balance from modeled surface mass balance, in order to solve the horizontal divergence of ice flux as a residual. This residual ice dynamic field infers flux divergence (or submergent flow) in the ice sheet accumulation area and at tidewater margins, and flux convergence (or emergent flow) in land-terminating ablation areas, which is consistent with continuum mechanics theory.

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Ice Velocity Mapping Using TOPS SAR Data and Offset Tracking

Feature tracking and speckle tracking, are robust techniques to measure the velocity of glaciers and ice sheets. Displacement maps based on TOPS data may have small gaps if the bursts are not handled properly. Ice moving from one burst to a consecutive burst between two observations is not observed under the same squint angle, and hence speckle tracking is supposed to fail when cross-correlating consecutive bursts, whereas feature tracking provides the same result as when cross-correlating corresponding bursts. The size of the potential gaps depends on the ice displacement and the choice of Sentinel-1 product, as consecutive bursts overlap in the SLC product but not in the GRD product. An analysis of Sentinel-1 data from Greenland confirms the results expected from theory.

Improved sea level determination in the Arctic regions through development of tolerant altimetry retracking

This PhD project involves the development of a suitable retracking strategy for processing of Cryosat-2 SAR (Synthetic Aperture Radar) altimetry waveforms in the Arctic Ocean. The Cryosat-2SAR altimetry waveforms are processed for precise and accurate SSH determination. Precise and accurate knowledge of SSH has various applications like gravity field determination, climate prediction, weather forecasting and studies of ocean currents and circulations. Cryosat-2 SAR altimetry waveforms in the Arctic can have a variety of shapes because of the superposition of the echoes from the water and the sea ice. Consequently, the waveforms are not well fitted with the existing physical retrackers and provide erroneous results with existing empirical retrackers like threshold retracker and OCOG (Offset Centre of Gravity)
retracker. The research performed in this project is primarily divided in three segments. The first segment deals with the development of an improved and customized empirical retracker for the sea ice covered regions in the Arctic. The improved retrackers which are termed as primary peak empirical retrackers work on just the primary peak of the waveform rather than the complete waveform. It is demonstrated through performance evaluation of the retracted SSHA, that the primary peak empirical retrackers demonstrate a more precise SSHA as compared to empirical retrackers like threshold retracker and OCOG retracker. Retracker performance evaluation is done for the primary peak threshold retracker, primary peak COG retracker, threshold retracker, OCOG retracker and the ESA retracker. For retracker performance evaluation, the standard deviation (STD) of the 1 Hz SSHA is computed and a lower value of this STD indicates a more precisely retracted SSHA. The second segment deals with the customized application of physical retracking to Cryosat-2 SAR altimetry waveforms available in the Arctic Ocean. The SAMOSA3-C has been applied in the Arctic and is a combination of two modes – SAMOSA3-O mode and SAMOSA3-L Mode. The two modes deal with SSHA determination from the ocean type waveforms and the lead type waveforms. It is demonstrated that the SAMOSA3-C retracker exhibits a more precise SSHA as compared to the primary peak retrackers and the ESA retracker. The accuracy evaluation of the retrackers show that the SAMOSA3-O retracker has the best accuracy when compared to tide gauge data in the Arctic.

Combination of the physical and empirical retrackers is attempted in order to get the advantages of both the retrackers. The third segment deals with the combination of the physical (SAMOSA3-C) retracker and primary peak COG (empirical) retracker. It has the advantage of high precision from the SAMOSA3-C retracker. It also has the advantage of primary peak COG retracker with capability of estimating SSH in the sea ice areas where irregular type waveforms are present, which are neither lead type nor ocean type. Prior to combining the physical and empirical retracking, bias is removed and the primary peak COG retrackers SSHA values are corrected with the estimated bias. The removal of bias between the physical and empirical retrackers is a complex procedure. Various bias removal methods were tried and the best approach has been presented in this thesis. The combined physical empirical retracker results in a better precision than the primary peak retrackers and has a larger dataset of the estimated SSHA as compared to the SAMOSA3-C retracker with inclusion of the SSHA in sea ice areas.

Improved sea level record over the satellite altimetry era (1993-2010) from the Climate Change Initiative project

Sea level is one of the 50 Essential Climate Variables (ECVs) listed by the Global Climate Observing System (GCOS) in climate change monitoring. In the past two decades, sea level has been routinely measured from space using satellite altimetry techniques. In order to address a number of important scientific questions such as "Is sea level rise accelerating?", "Can we close the sea level budget?", "What are the causes of the regional and interannual variability?", "Can we already detect the anthropogenic forcing signature and separate it from the internal/natural climate variability?", and "What are the coastal impacts of sea level rise?", the accuracy of altimetry-based sea level records at global and regional scales needs to be significantly improved. For example, the global mean and regional sea level trend uncertainty should become better than 0.3 and 0.5 mm year(-1), respectively (currently 0.6 and 1.2 mm year(-1)). Similarly, interannual global mean sea level variations (currently uncertain to 2-3 mm) need to be monitored with better accuracy. In this paper, we present various data improvements achieved within the European Space Agency (ESA) Climate Change Initiative (ESA CCI) project on "Sea Level" during its first phase (2010-2013), using multi-mission satellite altimetry data over the 1993-2010 time span. In a first step, using a new processing system with dedicated algorithms and adapted data processing strategies, an improved set of sea level products has been produced. The main improvements include: reduction of orbit errors and wet/dry atmospheric correction errors, reduction of instrumental drifts and bias, intercalibration biases, intercalibration between missions and combination of the different sea level data sets, and an improvement of the reference mean sea surface. We also present preliminary independent validations of the SL_cci products, based on tide gauges comparison and a sea level budget closure approach, as well as comparisons with ocean reanalyses and climate model outputs.
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Scopus rating (2013): SJR 1.551 SNIP 1.052 CiteScore 2.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.752 SNIP 1.032 CiteScore 1.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.512 SNIP 0.965 CiteScore 2.21
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.538 SNIP 0.964
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.846 SNIP 0.698
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.149 SNIP 0.735
Scopus rating (2007): SJR 1.458 SNIP 0.723
Scopus rating (2006): SJR 2.827 SNIP 1.139

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INTEGRAL confirms the detection of renewed activity from the NS transient H 1658-298

INTEGRAL observed the Galactic Center Region between (UT) 2015-08-22 05:26 and 18:44. Enhanced X-ray emission was detected by the Joint European Monitor for X-rays (JEM-X) in the 3-10 keV band, (15 mCrab; 9-sigma significance) at the following position: (R.A., Dec) = (255.5284, -29.94175) = (17 02 06.82, -29 56 30.3) (J2000); 0.4 arc min 90% confidence limit. These coordinates are consistent with those of the optical counterpart of H 1658-298: (R.A., Dec) = (17 02 06.5, -29 56 44.1; J2000, Liu et al., 2007 A&A, 469, 807), and thus confirm the system as the origin of the MAXI trigger on Aug 21 (see ATel #7943). The source spectrum extracted from the JEM-X data (effective exposure time 10.7 ksec) can be fit by a power-law model with photon index 2.9+/-0.5. The flux estimated from the spectral fit is 2.8E-10 erg/cm^2/s (3-10 keV). H 1658-298 was marginally detected in hard X-rays (~6.8 mCrab, 4.5-sigma significance in the 20-40 keV energy band) by IBIS, the Imager Onboard the INTEGRAL Satellite. H 1658-298 is a known X-ray burster. Therefore we have searched for Type-I burst activity in the JEM-X data during these observations, but no indications of burst activity have been found. We note here that the last outburst from this system was detected in 1999 April and lasted for ~2.5 years. It is likely we are at the onset of a similar outburst. Further INTEGRAL observations of the Galactic Center field are foreseen in the coming time, from August 26. Multi-wavelength observations of H 1658-298 are encouraged.

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Organisations: National Space Institute, Astrophysics, University of Geneva, European Space Astronomy Centre and European Space Agency
Authors: Sanchez-Fernandez, C. (Ekstern), Eckert, D. (Ekstern), Bozzo, E. (Ekstern), Kajava, J. (Ekstern), Kuulkers, E. (Ekstern), Chenevez, J. (Intern)
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Publication: Research › Journal article – Annual report year: 2015

INTEGRAL detection of a hard X-ray transient in NGC 6440
Referred to by ATEL #: 7106, 7136, 7183
Tweet

During INTEGRAL Galactic bulge monitoring (e.g., ATel #438) observations performed on UT 2015 February 17 at 12.53-16.45, IBIS/ISGRI detected renewed activity at hard X-rays from a transient within the Globular Cluster NGC 6440. The best determined position is: RA, Dec (J2000) = 267.208, -20.314 degrees, with an error radius of 2.4 arcmin (90% c.l.). Formally, there is no known X-ray source within the error circle, so we label the source as IGR J17488-2018. The hard X-ray transient is detected at a significance of 11 (6.5) sigma on the IBIS/ISGRI mosaic in the 20-40 keV (40-80 keV) energy band. The IBIS/ISGRI spectrum (total exposure time of 12 ks) provides a photon index of 2.4 +/- 0.5 and a 20-100 keV flux of 4.8E-10 ergs/cm^2/s. NGC 6440 was outside the JEM-X field-of-view for the entire observation. The Globular Cluster NGC 6440 is known to host millisecond X-ray pulsars (see, e.g., ATel #2672), so it is possible that INTEGRAL detected an outburst from one of these sources. We can not rule out that one of the known X-ray sources just outside the error circle (such as MXB 1746-20 aka H1745-203) is experiencing an outburst. Note that Swift/BAT also detects enhanced activity from H1745-203 over the last days. Further INTEGRAL observations in the direction of NGC 6440 are planned for the coming weeks. Swift ToO follow-up observations have been requested. Observations at other wavelengths are encouraged.

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Organisations: National Space Institute, Astrophysics, NASA Goddard Space Flight Center, European Space Astronomy Centre and European Space Agency, University of Geneva, National Institute for Astrophysics, University of Southampton, CAB/INTA-CSIC, SRON, University of Amsterdam
INTEGRAL detection of the on-going outbursts from 1RXS J180408.9-342058 and GRO J1750-27

During the observations of the Galactic Center (from 2015 February 16 12:46 to February 17 at 4:25 UTC), INTEGRAL detected the two sources 1RXS J180408.9-342058 (Atel #6997, #7008, #7039) and GRO J1750-27 (Atel #1385, #1400, #6839) which were recently reported to undergo new outbursts.

1RXS J180408.9-342058 was observed in both the IBIS/ISGRI and the JEM-X FoV. A preliminary analysis of the ISGRI and JEM-X data revealed that the source broad-band spectrum (effective exposure time 34.2 ks for ISGRI and 9.3 ks for the two JEM-X) could be described by using a cut-off power-law model. We measured a power-law photon index of 1.4 +/- 0.2 and a cut-off energy of 58 +/- 9 keV. The estimated fluxes from the spectral analysis were 2.1E-9 erg/cm^2/s in the 3-20 keV energy band and 2.2E-9 erg/cm^2/s in the 20-100 keV energy band. No type-I X-ray bursts were found in the JEM-X data by scanning the 3-10 keV lightcurve of the source.

GRO J1750-27 was observed by IBIS/ISGRI for an effective exposure time 34.2 ks and by the two JEM-X for a total effective exposure time 9 ks. The ISGRI spectrum of the source could be roughly described with a soft power-law of photon index ~4. The estimated source flux from the spectral fit is 7.4E-10 erg/cm^2/s in the 20-60 keV energy band. The 3-10 keV flux estimated from the JEM-X mosaic is of roughly 7E-10 erg/cm^2/s.

We also report on the continued detection of the outburst from IGR J17451-3022 (ATel #6451, ATel #7028). JEM-X confirms the detection of the source at 3.7 sigma for 20 ks effective exposure with a flux of 5.2 +/- 1.6 mCrab between 3-10 keV (corresponding to roughly 7.3E-11 erg/cm^2/s). This is slightly below the flux (6.5 mCrab) the source had the last time INTEGRAL saw it at the end of October 2014. The source is still undetected above 10 keV at a 5-sigma upper limit of 2 mCrab between 10-20 keV (corresponding to roughly 1.8E-11 erg/cm^2/s).

Finally, we note that the INTEGRAL transient IGR J17454-2919 (ATels #6530, #6574, #6602) is not detected by the two JEM-X in the current observations of the Galactic Center (effective exposure time 19 ks). We estimated a 5-sigma upper limit on the source flux of 4 mCrab in the 3-10 keV energy band (corresponding to roughly 5.6E-11 erg/cm^2/s) and 2 mCrab in the 10-20 keV energy band (corresponding to roughly 1.8E-11 erg/cm^2/s).

Additional INTEGRAL observations of the Galactic Center are planned for the coming weeks.

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Organisations: National Space Institute, Astrophysics, Massachusetts Institute of Technology, National Institute for Astrophysics, Florida Gulf Coast University, University of Geneva, European Space Agency
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INTEGRAL detects a new outburst from the millisecond X-ray pulsar IGR J17511-3057

During the observations performed in the direction of the Galactic Bulge on 2015 March 23 from 02:49 to 07:26 (UTC), the instruments on-board INTEGRAL detected a new outburst from the millisecond X-ray pulsar IGR J17511-3057 (ATel #2196, #2197; Papitto et al., 2010, MNRAS, 407, 2575). The source was included in both the IBIS and JEM-X field of views. IGR J17511-3057 is detected by IBIS/ISGRI at a flux of 18+/-2 mCrab in the 20-40 keV energy band and 24+/-2 mCrab in the 40-80 keV energy band. The fluxes estimated from the JEM-X data were 18+/-3 mCrab in the 3-10 keV energy band and 24+/-5 mCrab in the 10-20 keV energy band. All uncertainties on the fluxes are quoted at 1 sigma c.l. The IBIS/ISGRI spectrum (effective exposure time 9.1 ks) could be reasonably well described by using a power-law model with photon index 2.3+/-0.4. The 20-100 keV X-ray flux estimated from the spectral fit is 4.5E-10 ergs/cm²/s. Further INTEGRAL observations in the direction of the source are already planned for the next days. The INTEGRAL monitoring of the Galactic bulge will also continue in the coming weeks, and the observational results from near real time data will be made available HERE.

INTEGRAL detects renewed activity from IGR J11435-6109

During a recent INTEGRAL public observation of Musca region, performed between 2015-12-11 17:54 and 2015-12-12 12:54 (UTC), renewed activity from the transient X-ray pulsar IGR J11435-6109 has been detected. The 22-60 keV IBIS/ISGRI flux corresponds to (10+/-1) mCrab with an effective exposure time of 18 ks. The source was within the field of view of JEM-X instruments for a net exposure time of 36 ks. In the combined JEM-X1 and JEM-X2 mosaic, it was detected at a flux level of 3.8+/-0.4 mCrab and 3.7+/-1.1 mCrab in the 3-10 keV and 10-25 keV energy bands, respectively. We note the time of this detection is consistent with the epoch of expected maximum flux, assuming the ephemeris information reported in (ATel #377).
INTEGRAL finds renewed X-ray activity of the Neutron star X-ray transient SAX J1750.8-2900

INTEGRAL Galactic bulge monitoring observations (ATel #438) on UT 13 September 2015 18:50-22:32 reveal renewed X-ray activity from the low-mass X-ray binary transient and Type I X-ray burster SAX J1750.8-2900 (IAU Circ. #6597). The last outburst from this source was reported in 2011 (ATels #3170, 3181). The JEM-X 3-10 keV and 10-25 keV fluxes during our observations are 32+/−3 mCrab and 16+/−6 mCrab respectively. A Type I X-ray burst from SAX J1750.8-2900 was detected during these observations, on UT 13 September 2015 20:51, with a peak flux of 2.3+/−0.2 Crab (3-25 keV) and a duration of 17 seconds. The source is not detected with IBIS/ISGRI on September 13 with 3-sigma upper limits of about 5 and 8 mCrab in the 18-40 keV and 40-100 keV bands, respectively (12.6 ksec exposure). Similar observations about 5 days earlier (on UT 8 September 2015 13:52-17:34; 12.6 ksec exposure) did not reveal the source with 3-sigma upper limits of 7 (3-10 keV) and 15 mCrab (10-25 keV). We encourage further observations of SAX J1750.8-2900 at X-rays and other wavelengths.

INTEGRAL/IBIS detection of hard X-ray activity from the HMXB 4U 1036-56

The Be high mass X-ray binary (HMXB) 4U 1036-56 has been recently detected by INTEGRAL/JEM-X during enhanced activity in the soft X-ray band 3-10 KeV (ATel #8425). On the contrary no emission was detected by INTEGRAL/IBIS in the band 22-60 keV, leading to a 3sigma upper limit of 6 mCrab. INTEGRAL recently performed further observations in the direction of 4U1036-56 starting from 15 Dec 16:56 (UTC) to 17 Dec 20:43 (UTC). The source was detected by IBIS/ISGRI in the energy band 22-60 keV at 6.8 level (6.3 ks of effective exposure time) with an average flux of 12.5+/−1.8 mCrab (22-60 keV). The source was never in the field of view of JEM-X monitor during this observation. The IBIS/ISGRI spectrum is reasonably fitted by a power law with photon index 2.3+/−0.8. The average flux is 1.8 x 10-10 erg cm-2 s-1 (18-60 keV) which, at the 5 kpc source distance, translates into a luminosity of 5.4 x 1035 erg s-1.
INTEGRAL/JEM-X detection of hard X-ray activity from the HMXB 4U 1036-56

On November 15th 2015 the MAXI/GSC detected a big flare from the RS CVn star GT Mus with a flux of ~100 mCrab in the 2-20 keV energy band. (ATel #8285). During recent INTEGRAL observations of the Musca region performed between 17 Nov 16:08 and 18 Nov 00:05 (UTC) the source GT Mus was within the field of view of JEM-X instruments for a net exposure time of 16.2 ks. It was detected at a flux level of 9.0 +/- 0.9 mCrab (3-10 keV) in the combined JEM-X1 and JEM-X2 mosaic. The 5-sigma upper limit in the 10-25 keV energy range is 1 mCrab. The source was not detected with IBIS/ISGRI and we estimate a 3 sigma upper limit of about 25 mCrab in the 18-40 keV energy range. In addition, INTEGRAL observed the Musca region on Nov 12 2015 between 11:14 and 17:11 (UTC) and the source was not significantly detected by JEM-X. We derive a 5-sigma upper limit of 4 mCrab (3-10 keV) for a net exposure time of 13.5 ks, in the combined JEM-X1 and JEM-X2 mosaic.

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Organisations: National Space Institute, Astrophysics, University of Southampton, National Institute for Astrophysics
Authors: Fiocchi, M. (Ekstern), Chenevez, J. (Intern), Sguera, V. (Ekstern), Bazzano, A. (Ekstern), Natalucci, L. (Ekstern), Ubertini, P. (Ekstern), Bird, A. J. (Ekstern)
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Publication date: 2015
Main Research Area: Technical/natural sciences

INTEGRAL/JEM-X reports enhanced activity from the HMXB 4U 1036-56

During the Galactic Plane Scanning performed by INTEGRAL on December 11th, 2015, the X-ray monitor JEM-X has detected enhanced activity from the high mass X-ray binary (HMXB) 4U 1036-56, aka RX J1037.5-5647. The position of the source was covered by the JEM-X field of view two times between UTC 6:55 and 12:38. The source was only detected at 4σ between 3-10 keV for a total effective exposure of 2.7 ks in the combined JEMX-1+2 mosaic. The averaged 3-10 keV flux was 5.2 +/- 1.5 mCrab, which, at the 5 kpc source distance (Motch et al. 1997, A&A 323, 853), leads to a luminosity of about 2.7×10^35 erg/s. We derive a 5σ upper limit of 2 mCrab between 10-25 keV. The source was not detected by IBIS/ISGRI with an exposure of 4 ks leading to a 3σ upper limit of 6 mCrab in the band 22-60 keV. The source was not detected at all the last time its position was observed by INTEGRAL on November 23rd, 2015. 4U 1036-56 is a Be X-ray pulsar (e.g. Torres et al. 2012, ApJ 761, 49), whose last outburst was reported by Swift in February 2012 (Krimm et al. ATel #3936).

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Organisations: National Space Institute, Astrophysics, National Institute for Astrophysics, European Space Agency
Authors: Chenevez, J. (Intern), Fiocchi, M. (Ekstern), Bazzano, A. (Ekstern), Natalucci, L. (Ekstern), Ubertini, P. (Ekstern), Sguera, V. (Ekstern), Kuulkers, E. (Ekstern)
INTEGRAL observations of SAX J1808.4-3658 currently in outburst
The latest INTEGRAL Galactic Bulge monitoring (ATel #438) was performed during revolution 1529 on 2015 April 12 starting at 18:15 UT (57124.761 MJD) for a total of 12462 seconds. We report on the IBIS/ISGRI detection of the new outburst from the millisecond X-ray pulsar SAX J1808.4-3658 (ATels #7364 #7371 #7376 #7379). The source is detected at about 23 sigma in both 18-40 keV and 40-80 keV IBIS/ISGRI maps with 8.7 ks effective exposure time, and the estimated fluxes are 60+/-3 mCrab and 78+/-3 mCrab in the two energy bands, respectively. SAX J1808.4-3658 was outside the JEM-X and OMC field of view. The IBIS/ISGRI spectrum extends up to 100 keV and it is well described by a simple power-law model with a photon index of 2.0+/-0.2. The 20-100 keV X-ray flux estimated from the spectral fit is 1.4E-09 erg/cm²/s. The INTEGRAL monitoring of the Galactic bulge will also continue in the coming weeks, and the observation results from the near real time data will be made available on the WEB (http://integral.esac.esa.int/BULGE/).

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Organisations: National Space Institute, Astrophysics, University of Southampton, University of Geneva, National Institute for Astrophysics, European Space Astronomy Centre and European Space Agency, CAB/INTA-CSIC, SRON, NASA Goddard Space Flight Center, University of Amsterdam
Authors: Del Santo, M. (Ekstern), Bozzo, E. (Ekstern), Kuulkers, E. (Ekstern), Bazzano, A. (Ekstern), Beckmann, V. (Ekstern), Bird, T. (Ekstern), Bodaghee, A. (Ekstern), Chenevez, J. (Intern), Domingo, A. (Ekstern), Jonker, P. (Ekstern), Markwardt, C. (Ekstern), Paizis, A. (Ekstern), Pottscheidt, K. (Ekstern), Sanchez-Fernandez, C. (Ekstern), Wijnands, R. (Ekstern)
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Inter-comparison and evaluation of sea ice algorithms: towards further identification of challenges and optimal approach using passive microwave observations
Sea ice concentration has been retrieved in polar regions with satellite microwave radiometers for over 30 years. However, the question remains as to what is an optimal sea ice concentration retrieval method for climate monitoring. This paper presents some of the key results of an extensive algorithm inter-comparison and evaluation experiment. The skills of 30 sea ice algorithms were evaluated systematically over low and high sea ice concentrations. Evaluation criteria included standard deviation relative to independent validation data, performance in the presence of thin ice and melt ponds, and sensitivity to error sources with seasonal to inter-annual variations and potential climatic trends, such as atmospheric water vapour and water-surface roughening by wind. A selection of 13 algorithms is shown in the article to demonstrate the results. Based on the findings, a hybrid approach is suggested to retrieve sea ice concentration globally for climate monitoring purposes. This approach consists of a combination of two algorithms plus dynamic tie points implementation and atmospheric correction of input brightness temperatures. The method minimizes inter-sensor
calibration discrepancies and sensitivity to the mentioned error sources.

**General information**

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Organisations: National Space Institute, Microwaves and Remote Sensing, Nansen Environmental and Remote Sensing Center, Danish Meteorological Institute, University of Hamburg, Norwegian Meteorological Institute, NASA Goddard Space Flight Center, Environment Canada

Authors: Ivanova, N. (Ekstern), Pedersen, L. T. (Ekstern), Tonboe, R. T. (Ekstern), Kern, S. (Ekstern), Heygster, G. (Ekstern), Lavergne, T. (Ekstern), Sørensen, A. (Ekstern), Saldo, R. (Intern), Dybkjær, G. (Ekstern), Brucker, L. (Ekstern), Shokr, M. (Ekstern)

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Scopus rating (2015): SJR 4.118 SNIP 1.663 CiteScore 5.35

Web of Science (2015): Indexed yes

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Scopus rating (2014): SJR 3.976 SNIP 1.727 CiteScore 5.39

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Scopus rating (2013): SJR 3.249 SNIP 1.449 CiteScore 4.36

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BFI (2011): BFI-level 1

Scopus rating (2011): SJR 2.319 SNIP 1.616 CiteScore 3.81

ISI indexed (2011): ISI indexed no

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BFI (2010): BFI-level 1

Scopus rating (2010): SJR 2.854 SNIP 1.625

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International Geomagnetic Reference Field: the 12th generation
The 12th generation of the International Geomagnetic Reference Field (IGRF) was adopted in December 2014 by the Working Group V-MOD appointed by the International Association of Geomagnetism and Aeronomy (IAGA). It updates the previous IGRF generation with a definitive main field model for epoch 2010.0, a main field model for epoch 2015.0, and a linear annual predictive secular variation model for 2015.0-2020.0. Here, we present the equations defining the IGRF model, provide the spherical harmonic coefficients, and provide maps of the magnetic declination, inclination, and total intensity for epoch 2015.0 and their predicted rates of change for 2015.0-2020.0. We also update the magnetic pole positions and discuss briefly the latest changes and possible future trends of the Earth’s magnetic field.

General information
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Organisations: National Space Institute, Geomagnetism, IT-Department, University of Nantes, British Geological Survey, University of Colorado, University Paris Diderot - Paris 7, Université Grenoble Alpes, Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation
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Scopus rating (2016): SJR 0.981 SNIP 0.89 CiteScore 1.79
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 0.969 SNIP 0.966 CiteScore 1.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.493 SNIP 1.081 CiteScore 2.23
BFI (2013): BFI-level 1
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ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.322 SNIP 0.987 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.677 SNIP 0.746 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.909 SNIP 0.73
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.878 SNIP 0.912
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.827 SNIP 0.775
Nustar and Suzaku X-Ray Spectroscopy Of Ngc 4151: Evidence For Reflection From The Inner Accretion Disk

We present X-ray timing and spectral analyses of simultaneous 150 ks Nuclear Spectroscopic Telescope Array (NuSTAR) and Suzaku X-ray observations of the Seyfert 1.5 galaxy NGC 4151. We disentangle the continuum emission, absorption, and reflection properties of the active galactic nucleus (AGN) by applying inner accretion disk reflection and absorption-dominated models. With a time-averaged spectral analysis, we find strong evidence for relativistic reflection from the inner accretion disk. We find that relativistic emission arises from a highly ionized inner accretion disk with a steep emissivity profile, which suggests an intense, compact illuminating source. We find a preliminary, near-maximal black hole spin accounting for statistical and systematic modeling errors. We find a relatively moderate reflection fraction with respect to predictions for the lamp post geometry, in which the illuminating corona is modeled as a point source. Through a time-resolved spectral analysis, we find that modest coronal and inner disk reflection (IDR) flux variation drives the spectral variability during the observations. We discuss various physical scenarios for the IDR model and we find that a compact corona is consistent with the observed features.
The black hole (BH) candidate XTE J1908+094 went into outburst for the first time since 2003 in 2013 October. We report on an observation with the Nuclear Spectroscopic Telescope Array (NuSTAR) and monitoring observations with Swift during the outburst. NuSTAR caught the source in the soft state: the spectra show a broad relativistic iron line, and the light curves reveal a similar to 40 ks flare, with the count rate peaking about 40% above the non-flare level and with significant spectral variation. A model combining a multi-temperature thermal component, a power law, and a reflection component with an iron line provides a good description of the NuSTAR spectrum. Although relativistic broadening of the iron line is observed, it is not possible to constrain the BH spin with these data. The variability of the power-law component, which can also be modeled as a Comptonization component, is responsible for the flux and spectral change during the flare, suggesting that changes in the corona (or possibly continued jet activity) are the likely cause of the flare.
Powerful blazars are flat-spectrum radio quasars whose emission is dominated by a Compton component peaking between a few hundred keV and a few hundred MeV. We observed two bright blazars, PKS 2149–306 at redshift $z = 2.345$ and S5 0836+710 at $z = 2.172$, in the hard X-ray band with the Nuclear Spectroscopic Telescope Array satellite. Simultaneous soft-X-rays and UV–optical observations were performed with the Swift satellite, while near-infrared (near-IR) data were obtained with the Rapid Eye Mount telescope. To study their variability, we repeated these observations for both sources on a timescale of a few months. While no fast variability was detected during a single observation, both sources were variable in the X-ray band, up to 50%, between the two observations, with larger variability at higher energies. No variability was detected in the optical/NIR band. These data, together with Fermi-Large Area Telescope, Wide-field Infrared Survey Explorer, and other literature data, are then used to study the overall spectral energy distributions (SEDs) of these blazars. Although the jet nonthermal emission dominates the SED, it leaves the UV band unhidden, allowing us to detect the thermal emission of the disk and to estimate the black hole mass. The nonthermal emission is well reproduced by a one-zone leptonic model by the synchrotron, self-Compton, and external Compton processes. Our data are better reproduced if we assume that the location of the dissipation region of the jet, $R_{\text{diss}}$, is in between the torus and the broad-line region. The observed variability is explained by changing a minimum number of model parameters by a very small amount.
NuSTAR detection of a cyclotron line in the supergiant fast X-ray transient IGR J17544-2619

We present NuSTAR spectral and timing studies of the supergiant fast X-ray transient (SFXT) IGR J17544-2619. The spectrum is well described by an $\sim 1$ keV blackbody and a hard continuum component, as expected from an accreting X-ray pulsar. We detect a cyclotron line at 17 keV, confirming that the compact object in IGR J17544-2619 is indeed a neutron star. This is the first measurement of the magnetic field in an SFXT. The inferred magnetic field strength, $B = (1.45 \pm 0.03) \times 10^{12} G (1 + z)$ is typical of neutron stars in X-ray binaries, and rules out a magnetar nature for the compact object. We do not find any significant pulsations in the source on time-scales of 1-2000 s.

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We present spectral and timing analysis of NuSTAR observations of the accreting X-ray pulsar 2RXP J130159.6-635806. The source was serendipitously observed during a campaign focused on the gamma-ray binary PSR B1259-63 and was later targeted for a dedicated observation. The spectrum has a typical shape for accreting X-ray pulsars, consisting of a simple power law with an exponential cutoff starting at ~7 keV with a folding energy of \(E_{\text{fold}}\approx 18\) keV. There is also an indication of the presence of a 6.4 keV iron line in the spectrum at the \(\sim 3\sigma\) significance level. NuSTAR measurements of the pulsation period reveal that the pulsar has undergone a strong and steady spin-up for the last 20 years. The pulsed fraction is estimated to be \(\sim 80\%\), and is constant with energy up to 40 keV. The power density spectrum shows a break towards higher frequencies relative to the current spin period. This, together with steady persistent luminosity, points to a long-term mass accretion rate high enough to bring the pulsar out of spin equilibrium.
NuSTAR Observation Of A Type I X-Ray Burst From GRS 1741.9-2853

We report on two NuSTAR observations of GRS 1741.9-2853, a faint neutron star (NS) low-mass X-ray binary burster located 10' away from the Galactic center. NuSTAR detected the source serendipitously as it was emerging from quiescence: its luminosity was $6 \times 10^{34}$ erg s$^{-1}$ on 2013 July 31 and $5 \times 10^{35}$ erg s$^{-1}$ in a second observation on 2013 August 3. A bright, 800 s long, H-triggered mixed H/He thermonuclear Type I burst with mild photospheric radius expansion (PRE) was present during the second observation. Assuming that the luminosity during the PRE was at the Eddington level, an H mass fraction $X = 0.7$ in the atmosphere, and an NS mass $M = 1.4$ M$\odot$, we determine a new lower limit on the distance for this source of $6.3 \pm 0.5$ kpc. Combining with previous upper limits, this places GRS 1741.9-2853 at a distance of 7 kpc. Energy independent (achromatic) variability is observed during the cooling of the NS, which could result from the disturbance of the inner accretion disk by the burst. The large dynamic range of this burst reveals a long power-law decay tail. We also detect, at a 95.6% confidence level (1.7σ), a narrow absorption line at $5.46 \pm 0.10$ keV during the PRE phase of the burst, reminiscent of the detection by Waki et al. We propose that the line, if real, is formed in the wind above the photosphere of the NS by a resonant K alpha transition from H-like Cr gravitationally redshifted by a factor $1 + z = 1.09$, corresponding to a radius range of 29.0-41.4 km for a mass range of 1.4-2.0 M$\odot$.

General information
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Organisations: National Space Institute, Astrophysics, University of California at Berkeley, IRAP, Massachusetts Institute of Technology, Columbia University, California Institute of Technology
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NuSTAR Observations of the Powerful Radio-Galaxy Cygnus A

We present NuSTAR observations of the powerful radio galaxy Cygnus A, focusing on the central absorbed active galactic nucleus (AGN). Cygnus A is embedded in a cool-core galaxy cluster, and hence we also examine archival XMM-Newton data to facilitate the decomposition of the spectrum into the AGN and intracluster medium (ICM) components. NuSTAR gives a source-dominated spectrum of the AGN out to >70keV. In gross terms, the NuSTAR spectrum of the AGN has the form of a power law ($\Gamma \approx 1.6-1.7$) absorbed by a neutral column density of $N_H \approx 1.6 \times 10^{23} \text{ cm}^{-2}$. However, we also detect curvature in the hard (>10keV) spectrum resulting from reflection by Compton-thick matter out of our line-of-sight to the X-ray source. Compton reflection, possibly from the outer accretion disk or obscuring torus, is required even permitting a high-energy cut off in the continuum source; the limit on the cut off energy is $E_{\text{cut}} > 111 \text{ keV}$ (90% confidence). Interestingly, the absorbed power-law plus reflection model leaves residuals suggesting the absorption/emission from a fast (15,000-26,000 km/s), highly ionized ($\xi \approx 2.500 \text{ erg cm/s}$) wind. A second, even faster ionized wind component is also suggested by these data. We show that the ionized wind likely carries a significant mass and momentum flux, and may carry sufficient kinetic energy to exercise feedback on the host galaxy. If confirmed, the simultaneous presence of a strong wind and powerful jets in Cygnus A demonstrates that feedback from radio-jets and sub-relativistic winds are not mutually exclusive phases of AGN activity but can occur simultaneously.
NuSTAR Reveals Relativistic Reflection but no Ultra-fast Outflow in the Quasar PG1211+143
We report on four epochs of observations of the quasar PG 1211+143 using NuSTAR. The net exposure time is 300 ks. Prior work on this source found suggestive evidence of an ultra-fast outflow (UFO) in the Fe K band with a velocity of approximately 0.1c. The putative flow would carry away a high-mass flux and kinetic power, with broad implications for feedback and black hole-galaxy co-evolution. NuSTAR detects PG 1211+143 out to 30 keV, meaning that the continuum is well-defined both through and above the Fe K band. A characteristic relativistic disk reflection spectrum is clearly revealed via a broad Fe K emission line and Compton back-scattering curvature. The data offer only weak constraints on the spin of the black hole. A careful search for UFOs shows no significant absorption feature above 90% confidence. The limits are particularly tight when relativistic reflection is included. We discuss the statistics and the implications of these results in terms of connections between accretion onto quasars, Seyferts, and stellar-mass black holes, and feedback into their host environments.
NuSTAR, XMM-Newton and Suzaku Observations of the Ultraluminous X-Ray Source Holmberg II X-1

We present the first broadband 0.3-25.0 keV X-ray observations of the bright ultraluminous X-ray source (ULX) Holmberg II X-1, performed by NuSTAR, XMM-Newton, and Suzaku in 2013 September. The NuSTAR data provide the first observations of Holmberg II X-1 above 10 keV and reveal a very steep high-energy spectrum, similar to other ULXs observed by NuSTAR to date. These observations further demonstrate that ULXs exhibit spectral states that are not typically seen in Galactic black hole binaries. Comparison with other sources implies that Holmberg II X-1 accretes at a high fraction of its Eddington accretion rate and possibly exceeds it. The soft X-ray spectrum (~1 keV) appears to be dominated by two blackbody-like emission components, the hotter of which may be associated with an accretion disk. However, all simple disk models under-predict the NuSTAR data above ~10 keV and require an additional emission component at the highest energies probed, implying the NuSTAR data does not fall away with a Wien spectrum. We investigate physical origins for such an additional high-energy emission component and favor a scenario in which the excess arises from Compton scattering in a hot corona of electrons with some properties similar to the very high state seen in Galactic binaries. The observed broadband 0.3-25.0 keV luminosity inferred from these epochs is \(L_X (8.1 \pm 0.1) \times 10^{39} \text{ erg s}^{-1}\), typical for Holmberg II X-1, with the majority of this flux (~90%) emitted below 10 keV.

General information
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Organisations: National Space Institute, Astrophysics, California Institute of Technology, University of Cambridge, University of California at Berkeley, University of Michigan
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Invariants of the Dirichlet/Voronoi Tilings of Hyperspheres in $\mathbb{R}^n$ and their Dual Delone/Delaunay Graphs

In this paper, we are addressing the geometric and topological invariants that arise in the exact computation of the Delone (Delaunay) graph and the Dirichlet/Voronoi tiling of $N$-dimensional hyperspheres using Ritt-Wu's algorithm. Our main contribution is a methodology for automated derivation of geometric and topological invariants of the Dirichlet tiling of $N + 1$-dimensional hyperspheres and its dual Delone graph from the invariants of the Dirichlet tiling of $N$-dimensional hyperspheres and its dual Delone graph (starting from $N = 3$).

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Inverted-conical light guide for crosstalk reduction in tightly-packed scintillator matrix and MAPMT assembly

In this paper we present the Inverted-Conical light guide designed for optical crosstalk reduction in the scintillator-MAPMT assemblies. The research was motivated by the 30% crosstalk observed in UFFO X-ray telescope, UBAT, during the preliminary calibration with MAPMTs of 64 2.88 × 2.88 mm² pixels and identical grid YSO crystal matrices. We began the study with the energy and crosstalk calibrations of the detector, then we constructed a GEANT4 simulation with the customized metallic film model as the MAPMT photocathode. The simulation reproduced more than 70% of the crosstalk and explained it as a consequence of the total reflection produced by the photocathode. The result indicated that the crosstalk mechanism could be a common case in most of the contact-assembled scintillation detectors. The concept of the Inverted-Conical light guide was to suppress the total reflection by contracting the incident angle of the scintillation. We optimized the design in the simulation and fabricated a test sample. The test sample reduced 52% crosstalk with a loss of 6% signal yield. The idea of the Inverted-Conical light guide can be adapted by scintillation detectors multi-pixel, imaging-purpose scintillation detectors such as the ultra-fast GRB observatory UFFO-UBAT, whose performances are sensitive to responding time, image resolution, and geometrical modifications.

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Authors: Chang, Y. (Ekstern), Chen, P. (Ekstern), Huang, J. (Ekstern), Nam, J. (Ekstern), Wang, M. (Ekstern), Huang, M. (Ekstern), Liu, T. (Ekstern), Chen, C. (Ekstern), Bogomolov, V. (Ekstern), Panasyuk, M. (Ekstern), Petrov, V. (Ekstern), Svertilov, S. (Ekstern), Yashin. I. (Ekstern), Brandt, S. (Intern), Budtz-Jørgensen, C. (Intern), Castro-Tirado, A. (Ekstern), Jeong, S. (Ekstern), Choi, H. (Ekstern), Connell, P. (Ekstern), Eyles, C. (Ekstern), Reglero, V. (Ekstern), Rodrigo, J. (Ekstern), Kim, J. (Ekstern), Kim, M. (Ekstern), Lee, J. (Ekstern), Lim, H. (Ekstern), Park, I. (Ekstern), Kim, S. (Ekstern), Min, K. (Ekstern), Ripa, J. (Ekstern)
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ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 1
Investigating the Nature of IGR J17454-2919 Using X-Ray and Near-Infrared Observations

IGR J17454-2919 is a hard X-ray transient discovered by INTEGRAL on 2014 September 27. We report on our 20 ks Chandra observation of the source, performed about five weeks after the discovery, as well as on INTEGRAL and Swift long-term monitoring observations. X-ray broad-band spectra of the source are compatible with an absorbed power law, $\Gamma \sim 1.6-1.8$, $N_{\text{H}} \sim (10-12) \times 10^{22}$ cm$^{-2}$, with no trace of a cut-off in the data up to about 100 keV, and with an average absorbed 0.5-100 keV flux of about $(7.1-9.7) \times 10^{-10}$ erg cm$^{-2}$ s$^{-1}$. With Chandra, we determine the most accurate X-ray position of IGR J17454-2919, $\alpha_{\text{J2000}} = 17^h 45^m 27.6^s$, $\delta_{\text{J2000}} = -29^\circ 19' 53.8''$ (90% uncertainty of 0''.6), consistent with the NIR source 2MASS J17452768-2919534. We also include NIR investigations from our observations of the source field on 2014 October 6 with GROND. With the multi-wavelength information at hand, we discuss the possible nature of IGR J17454-2919.
Investigation of Photolithography Process on SPOs for the ATHENA Mission

As part of the ongoing effort to optimize the throughput of the Athena optics we have produced mirrors with a state-of-the-art cleaning process. We report on the studies related to the importance of the photolithographic process. Pre-coating characterization of the mirrors has shown and still shows photoresist remnants on the SiO2-rib bonding zones, which influences the quality of the metallic coating and ultimately the mirror performance. The size of the photoresist remnants is on the order of 10 nm which is about half the thickness of final metallic coating. An improved photoresist process has been developed including cleaning with O2 plasma in order to remove the remaining photoresist remnants prior to coating. Surface roughness results indicate that the SiO2-rib bonding zones are as clean as before the photolithography process is performed.

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Planck Intermediate Results. XXI. Comparison of polarized thermal emission from Galactic dust at 353 GHz with interstellar polarization in the visible

The Planck survey provides unprecedented full-sky coverage of the submillimetre polarized emission from Galactic dust. In addition to the information on the direction of the Galactic magnetic field, this also brings new constraints on the properties of dust. The dust grains that emit the radiation seen by Planck in the submillimetre also extinguish and polarize starlight in the visible. Comparison of the polarization of the emission and of the interstellar polarization on selected lines of sight probed by stars provides unique new diagnostics of the emission and light scattering properties of dust, and therefore of the important dust model parameters, composition, size, and shape. Using ancillary catalogues of interstellar polarization and extinction of starlight, we obtain the degree of polarization, \( p_V \), and the optical depth in the V band to the star, \( \tau_V \). Toward these stars we measure the submillimetre polarized intensity, \( P_S \), and total intensity, \( I_S \), in the Planck 353 GHz channel. We compare the column density measure in the visible, \( E(B - V) \), with that inferred from the Planck product map of the submillimetre dust optical depth and compare the polarization direction (position angle) in the visible with that in the submillimetre. For those lines of sight through the diffuse interstellar medium with comparable values of the estimated column density and polarization directions close to orthogonal, we correlate properties in the submillimetre and visible to find two ratios, \( R_{P/N} = (P_S / I_S) / (p_V / \tau_V) \) and \( R_{P/V} = P_S / p_V \), the latter focusing directly on the polarization properties of the aligned grain population alone. We find \( R_{P/N} = 4.2 \), with statistical and systematic uncertainties 0.2 and 0.3, respectively, and \( R_{P/V} = 5.4 \) MJy sr\(^{-1} \), with uncertainties 0.2 and 0.3 MJy sr\(^{-1} \), respectively. Our estimate of \( R_{P/N} \) is compatible with predictions based on a range of polarizing dust models that have been developed for the diffuse interstellar medium. This estimate provides new empirical validation of many of the common underlying assumptions of the models, but is not yet very discriminating among them. However, our estimate of \( R_{P/V} \) is not compatible with predictions, which are too low by a factor of about 2.5. This more discriminating diagnostic, \( R_{P/V} \), indicates that changes to the optical properties in the models of the aligned grain population are required. These new diagnostics, together with the spectral dependence in the submillimetre from Planck, will be important for constraining and understanding the full complexity of the grain models, and for interpreting the Planck thermal dust polarization and refinement of the separation of this contamination of the cosmic microwave background.
Planck intermediate results XXIII. Galactic plane emission components derived from Planck with ancillary data

Planck data when combined with ancillary data provide a unique opportunity to separate the diffuse emission components of the inner Galaxy. The purpose of the paper is to elucidate the morphology of the various emission components in the strong star-formation region lying inside the solar radius and to clarify the relationship between the various components. The region of the Galactic plane covered is l = 300 \degree to 60\degree where star-formation is highest and the emission is strong enough to make meaningful component separation. The latitude widths in this longitude range lie between 1 and 2, which
The frequency Planck bands have similar widths, showing that they are all indicators of the total gaseous matter on the plane in latitude. The thermal dust is identified in the SED with average parameters of $T_{\text{dust}} = 20.40 \pm 4.9$, $\text{FIR} = 1.940 \pm 0.03 (> 353 \, \text{GHz})$, and $\beta_{\text{mm}} = 1.670 \pm 0.02 (< 353 \, \text{GHz})$. The latitude distributions of gamma-rays, CO, and the emission in high-frequency Planck bands have similar widths, showing that they are all indicators of the total gaseous matter on the plane in the inner Galaxy.

### General information

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**Organisations:** National Space Institute, Astrophysics, IT-Department, University of Copenhagen

Planck intermediate results XXVII. High-redshift infrared galaxy overdensity candidates and lensed sources discovered by Planck and confirmed by Herschel-SPIRE

We have used the Planck all-sky submillimetre and millimetre maps to search for rare sources distinguished by extreme brightness, a few hundred millijanskies, and their potential for being situated at high redshift. These "cold" Planck sources, selected using the High Frequency Instrument (HFI) directly from the maps and from the Planck Catalogue of Compact Sources (PCCS), all satisfy the criterion of having their rest-frame far-infrared peak redshifted to the frequency range 353-857 GHz. This colour-selection favours galaxies in the redshift range z = 2-4, which we consider as cold peaks in the cosmic infrared background. With a 4.5' beam at the four highest frequencies, our sample is expected to include overdensities of galaxies in groups or clusters, lensed galaxies, and chance line-of-sight projections. We perform a dedicated Herschel-SPIRE follow-up of 234 such Planck targets, finding a significant excess of red 350 and 500 μm m sources, in comparison to reference SPIRE fields. About 94% of the SPIRE sources in the Planck fields are consistent with being overdensities of galaxies peaking at 350 μm m, with 3% peaking at 500 μm m, and none peaking at 250 μm m.

About 3% are candidate lensed systems, all 12 of which have secure spectroscopic confirmations, placing them at redshifts z > 2. Only four targets are Galactic cirrus, yielding a success rate in our search strategy for identifying extragalactic sources within the Planck beam of better than 98%. The galaxy overdensities are detected with high significance, half of the sample showing statistical significance above 10 sigma. The SPIRE photometric redshifts of galaxies in overdensities suggest a peak at z similar or equal to 2, assuming a single common dust temperature for the sources of T_d = 35 K. Under this assumption, we derive an infrared (IR) luminosity for each SPIRE source of about 4x10(12) L-circle dot, yielding star formation rates of typically 700 M-circle dot yr(-1). If the observed overdensities are actual gravitationally-bound structures, the total IR luminosity of all their SPIRE-detected sources peaks at 4 x 10(13) L-circle dot, leading to total star formation rates of perhaps 7 x 10(3) M-circle dot yr(-1) per overdensity. Taken together, these sources show the signatures of high-z (z > 2) protoclusters of intensively star-forming galaxies. All these observations confirm the uniqueness of our sample compared to reference samples and demonstrate the ability of the all-sky Planck-HFI cold sources to select populations of cosmological and astrophysical interest for structure formation studies.

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Organisations: National Space Institute, University of Copenhagen
Iron K and Compton hump reverberation in SWIFT J2127.4+5654 and NGC 1365 revealed by NuSTAR and XMM–Newton

In the past five years, a flurry of X-ray reverberation lag measurements of accreting supermassive black holes have been made using the XMM–Newton telescope in the 0.3–10 keV energy range. In this work, we use the NuSTAR (Nuclear Spectroscopic Telescope Array) telescope to extend the lag analysis up to higher energies for two Seyfert galaxies, SWIFT J2127.4+5654 and NGC 1365. X-ray reverberation lags are due to the light travel time delays between the direct continuum emission and the reprocessed emission from the inner radii of an ionized accretion disc. XMM–Newton has been particularly adept at measuring the lag associated with the broad Fe K emission line, where the gravitationally redshifted wing of the line is observed to respond before the line centroid at 6.4 keV, produced at larger radii. Now, we use NuSTAR to probe the lag at higher energies, where the spectrum shows clear evidence for Compton reflection, known as the Compton hump. The XMM–Newton data show Fe K lags in both SWIFT J2127.4+5654 and NGC 1365. The NuSTAR data provide independent confirmation of these Fe K lags, and also show evidence for the corresponding Compton hump lags, especially in SWIFT J2127.4+5654. These broad-band lag measurements confirm that the Compton hump and Fe K lag are produced at small radii. At low frequencies in NGC 1365, where the spectrum shows evidence for eclipsing clouds in the line of sight, we find a clear negative (not positive) lag from 2 to 10 keV, which can be understood as the decrease in column density from a neutral eclipsing cloud moving out of our line of sight during the observation.

General information
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Organisations: National Space Institute, Astrophysics, University of Cambridge, University of Maryland, Università degli Studi Roma Tre, California Institute of Technology, Harvard-Smithsonian Center for Astrophysics, University of California at Berkeley, Columbia University, NASA Goddard Space Flight Center
Authors: Kara, E. (Ekstern), Zoghbi, A. (Ekstern), Marinucci, A. (Ekstern), Walton, D. J. (Ekstern), Fabian, A. C. (Ekstern), Risaliti, G. (Ekstern), Bogg, S. E. (Ekstern), Christensen, F. E. (Intern), Boggs, S. E. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Matt, G. (Ekstern), Parker, M. L. (Ekstern), Reynolds, C. (Ekstern), Stern, D. (Ekstern), Zhang, W. W. (Ekstern)
Pages: 737-749
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Original language: English

Black hole physics, Galaxies: active, X-rays: galaxies

Electronic versions:

MNRAS_2015_Kara_737_49.pdf

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Joint Analysis of BICEP2/Keck Array and Planck Data

We report the results of a joint analysis of data from BICEP2/Keck Array and Planck. BICEP2 and Keck Array have observed the same approximately 400 deg$^2$ patch of sky centered on RA 0 h, Dec. -57.5°. The combined maps reach a depth of 57 nK deg in Stokes Q and U in a band centered at 150 GHz. Planck has observed the full sky in polarization at seven frequencies from 30 to 353 GHz, but much less deeply in any given region (1.2 μK deg in Q and U at 143 GHz). We detect 150×353 cross-correlation in B modes at high significance. We fit the single- and cross-frequency power spectra at frequencies ≥150 GHz to a lensed-ΛCDM model that includes dust and a possible contribution from inflationary gravitational waves (as parametrized by the tensor-to-scalar ratio r), using a prior on the frequency spectral behavior of polarized dust emission from previous Planck analysis of other regions of the sky. We find strong evidence for dust and no statistically significant evidence for tensor modes. We probe various model variations and extensions, including adding a synchrotron component in combination with lower frequency data, and find that these make little difference to the r constraint. Finally, we present an alternative analysis which is similar to a map-based cleaning of the dust contribution, and show that this gives similar constraints. The final result is expressed as a likelihood curve for r, and yields an upper limit $r < 0.12$ at 95% confidence. Marginalizing over dust and r, lensing B modes are detected at 7.0σ significance.

General information

State: Published
Organisations: National Space Institute, Astrophysics, Stanford University, California Institute of Technology, Harvard-Smithsonian Center for Astrophysics, Joint ALMA Observatory, University of Copenhagen, Cardiff University, Universite Paris-Sud, University Paris Diderot - Paris 7, International School for Advanced Studies, Max Planck Institute, Universidad de Cantabria
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Web of Science (2017): Indexed yes
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Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 4.656 SNIP 2.538 CiteScore 5.76
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 5.232 SNIP 2.71 CiteScore 6.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.675 SNIP 2.781 CiteScore 7.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 6.292 SNIP 2.867 CiteScore 7.19
Limitations in paleomagnetic data and modelling techniques and their impact on Holocene geomagnetic field models

Characterization of geomagnetic field behaviour on timescales of centuries to millennia is necessary to understand the mechanisms that sustain the geodynamo and drive its evolution. As Holocene paleomagnetic and archeomagnetic data have become more abundant, strategies for regularized inversion of modern field data have been adapted to produce numerous time-varying global field models. We evaluate the effectiveness of several approaches to inversion and data handling, by assessing both global and regional properties of the resulting models. Global Holocene field models cannot resolve Southern hemisphere regional field variations without the use of sediments. A standard data set is used to construct multiple models using two different strategies for relative paleointensity calibration and declination orientation and a selection of starting models in the inversion procedure. When data uncertainties are considered, the results are similar overall regardless of whether we use iterative calibration and reorientation, or co-estimation of the calibration and orientation parameters as part of the inversion procedure. In each case the quality of the starting model used for initial relative paleointensity calibration and declination orientation is crucial and must be based on the best absolute information available. Without adequate initial calibration the morphology of dipole moment variations can be recovered but its absolute value will be correlated with the initial intensity calibrations, an effect that might be mitigated by ensuring an appropriate fit to enough high quality absolute intensity data with low uncertainties. The declination reorientation mainly impacts regional field structure and in the presence of non-zonal fields will result in a non-zero local average. The importance of declination orientation is highlighted by inconsistencies in the West Pacific and Australian sediment records in CALS10k.1b model. Great care must also be taken to assess uncertainties associated with both paleomagnetic and age data and to evaluate the effects of poor data distribution. New consistently allocated uncertainty estimates for sediment
Paleomagnetic records highlight the importance of adequate uncertainties in the inversion process, as they determine the relative weighting among the data and overall normalized misfit levels which in turn influence the complexity of the inferred field models. Residual distributions suggest that the most appropriate misfit measure is the L1 norm (minimum absolute deviation) rather than L2 (least squares), but this seems to have relatively minor impact on the overall results. For future Holocene field modelling we see a need for comprehensive methods to assess uncertainty in individual archeomagnetic data so that these data or models derived from them can be used for reliable initial relative paleointensity calibration and declination orientation in sediments. More work will be needed to assess whether co-estimation or an iterative approach to inversion is more efficient overall. This would be facilitated by realistic and globally consistent data and age uncertainties from the paleomagnetic community.
We present deep (>2.4 Ms) observations of the Cassiopeia A supernova remnant with NuSTAR, which operates in the 3-79 keV bandpass and is the first instrument capable of spatially resolving the remnant above 15 keV. We find that the emission is not entirely dominated by the forward shock nor by a smooth "bright ring" at the reverse shock. Instead we find that the >15 keV emission is dominated by knots near the center of the remnant and dimmer filaments near the remnant's outer rim. These regions are fit with unbroken power laws in the 15-50 keV bandpass, though the central knots have a steeper ($\Gamma \sim -3.35$) spectrum than the outer filaments ($\Gamma \sim -3.06$). We argue this difference implies that the central knots are located in the 3-D interior of the remnant rather than at the outer rim of the remnant and seen in the center due to projection effects. The morphology of >15 keV emission does not follow that of the radio emission nor that of the low energy (>15 keV emission an open mystery. Even at the forward shock front we find less steepening of the spectrum than expected from an exponentially cut off electron distribution with a single cutoff energy. Finally, we find that the GeV emission is not associated with the bright features in the NuSTAR band while the TeV emission may be, suggesting that both hadronic and leptonic emission mechanisms may be at work.

General information
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Organisations: National Space Institute, Astrophysics, California Institute of Technology, North Carolina State University, Columbia University, University of California at Berkeley, Los Alamos National Laboratory, West Virginia Wesleyan College, NASA Goddard Space Flight Center
Authors: Grefenstette, B. W. (Ekstern), Reynolds, S. P. (Ekstern), Harrison, F. A. (Ekstern), Humensky, T. B. (Ekstern), Boggs, S. E. (Ekstern), Fryer, C. L. (Ekstern), DeLaney, T. (Ekstern), Madsen, K. K. (Ekstern), Miyasaka, H. (Ekstern), Wik, D. R. (Ekstern), Christensen, F. E. (Intern)
Number of pages: 11
Publication date: 2015
Main Research Area: Technical/natural sciences

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Journal: Astrophysical Journal
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BFI (2018): BFI-level 2
The Earth has a large and complicated magnetic field, the major part of which is produced by a self-sustaining dynamo operating in the fluid outer core. Magnetic field observations provide one of the few tools for remote sensing the Earth’s deep interior, especially regarding the dynamics of the fluid flow at the top of the core. However, what is measured at or near the surface of the Earth is the superposition of the core field and fields caused by magnetized rocks in the Earth’s crust, by electric currents flowing in the ionosphere, magnetosphere, and oceans, and by currents induced in the Earth by time-varying external fields. These sources have their specific characteristics in terms of spatial and temporal variations, and their proper separation, based on magnetic measurements, is a major challenge. Such a separation is a prerequisite for remote sensing by means of magnetic field observations.
General information
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Organisations: National Space Institute, Geomagnetism
Authors: Olsen, N. (Intern)
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Maritime route optimization

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Organisations: National Space Institute, Sunclimate
Authors: Pedersen, J. O. P. (Intern)
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Media of output: PowerPoint
Original language: English
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Electronic versions:
Blue_SIROS_Arctic_Maritime_Platform.pdf

Relations
Activities:
Maritime Route Optimization
Mass changes in Arctic ice caps and glaciers: implications of regionalizing elevation changes
The mass balance of glaciers and ice caps is sensitive to changing climate conditions. The mass changes derived in this study are determined from elevation changes derived measured by the Ice, Cloud, and land Elevation Satellite (ICESat) for the time period 2003–2009. Four methods, based on interpolation and extrapolation, are used to regionalize these elevation changes to areas without satellite coverage. A constant density assumption is then applied to estimate the mass change by integrating over the entire glaciated region. The main purpose of this study is to investigate the sensitivity of the regional mass balance of Arctic ice caps and glaciers to different regionalization schemes. The sensitivity analysis is based on studying the spread of mass changes and their associated errors, and the suitability of the different regionalization techniques is assessed through cross validation. The cross-validation results show comparable accuracies for all regionalization methods, but the inferred mass change in individual regions, such as Svalbard and Iceland, can vary up to 4 Gt a⁻¹, which exceeds the estimated errors by roughly 50% for these regions. This study further finds that this spread in mass balance is connected to the magnitude of the elevation change variability. This indicates that care should be taken when choosing a regionalization method, especially for areas which exhibit large variability in elevation change.

General information
State: Published
Organisations: National Space Institute, Geodynamics
Authors: Nilsson, J. (Intern), Sørensen, L. S. (Intern), Barletta, V. R. (Intern), Forsberg, R. (Intern)
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BFI (2018): BFI-level 1
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Scopus rating (2017): SNIP 1.425 SJR 3.034
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.49 SJR 3.696 SNIP 1.825
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 4.118 SNIP 1.663 CiteScore 5.35
Web of Science (2015): Indexed yes
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Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 3.249 SNIP 1.449 CiteScore 4.36
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.27 SNIP 1.523 CiteScore 4.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.319 SNIP 1.616 CiteScore 3.81
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.854 SNIP 1.625
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.265 SNIP 1.426
Modelling the Antarctic Ice Sheet

The Antarctic ice sheet is a major player in the Earth’s climate system and is by far the largest depository of fresh water on the planet. Ice stored in the Antarctic ice sheet (AIS) contains enough water to raise sea level by about 58 m, and ice loss from Antarctica contributed significantly to sea level high stands during past interglacial periods.

A number of AIS models have been developed and applied to try to understand the workings of the AIS and to form a robust basis for future projections of the AIS contribution to sea level change. The recent DCESS (Danish Center for Earth System Science) Antarctic Ice Sheet (DAIS) model (Shaffer 2014) is forced by reconstructed time series of Antarctic temperature, global sea level and ocean subsurface temperature over the last two glacial cycles.

In this talk a modelling work of the Antarctic ice sheet over most of the Cenozoic era using the DAIS model will be presented.

G. Shaffer (2014) Formulation, calibration and validation of the DAIS model (version 1), a simple Antarctic ice sheet model sensitive to variations of sea level and ocean subsurface temperature, Geosci. Model Dev., 7, 1803-1818

Monte Carlo evaluation of a CZT 3D spectrometer suitable for a Hard X- and soft-γ rays polarimetry balloon borne experiment

Today, the measurement of the polarization status of cosmic sources high-energy emission, is recognized as a key observational parameter to understand the active production mechanism and its geometry. Therefore, a mandatory requirement for new instrumentations operating in this energy range will be to provide high sensitivity for polarimetric measurements. In this framework, we have presented the concept of a small high-performance imaging spectrometer optimized for polarimetry between 100 and 600 keV suitable for a stratospheric balloon-borne payload and as a pathfinder for a future satellite mission. The detector with 3D spatial resolution is based on a CZT spectrometer in a highly segmented configuration designed to operate simultaneously as a high performance scattering polarimeter. Herein, we report results of a Monte Carlo study devoted to optimize the configuration of the detector for polarimetry with particular focus on event selection filter able to increase the polarimetric performance. This preliminary analysis shows that a procedure to optimize the polarization response of a 3D spectrometers should first of all determine the best tradeoff between the statistical significance and the quality of the modulation factor.
Monte Carlo reservoir analysis combining seismic reflection data and informed priors

Determination of a petroleum reservoir structure and rock bulk properties relies extensively on inference from reflection seismology. However, classic deterministic methods to invert seismic data for reservoir properties suffer from some limitations, among which are the difficulty of handling complex, possibly nonlinear forward models, and the lack of robust uncertainty estimations. To overcome these limitations, we studied a methodology to invert seismic reflection data in the framework of the probabilistic approach to inverse problems, using a Markov chain Monte Carlo (McMC) algorithm with the goal to directly infer the rock facies and porosity of a target reservoir zone. We thus combined a rock-physics model with seismic data in a single inversion algorithm. For large data sets, the McMC method may become computationally impractical, so we relied on multiple-point-based a priori information to quantify geologically plausible models. We tested this methodology on a synthetic reservoir model. The solution of the inverse problem was then represented by a collection of facies and porosity reservoir models, which were samples of the posterior distribution. The final product included probability maps of the reservoir properties in obtained by performing statistical analysis on the collection of solutions.

General information

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Organisations: CERE – Center for Energy Resources Engineering, National Space Institute, Mathematical and Computational Geoscience, University of Copenhagen
Authors: Zunino, A. (Ekstern), Mosegaard, K. (Ekstern), Lange, K. (Intern), Melnikova, Y. (Intern), Hansen, T. M. (Intern)
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Scopus rating (2017): SNIP 1.28 SJR 1.018
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.939 SNIP 1.756 CiteScore 1.53
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.974 SNIP 2.6 CiteScore 2.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Multispacecraft current estimates at Swarm

During the first several months of the three-spacecraft Swarm mission all three spacecraft came repeatedly into close alignment, providing an ideal opportunity for validating the proposed dual-spacecraft method for estimating current density from the Swarm magnetic field data. Two of the Swarm spacecraft regularly fly side-by-side in closely similar orbits, while the third at times approaches the other two. This provides a data set which under certain assumptions of stationarity of the magnetic field can produce 2, 3, 4, 5 (or more) point measurements, which can be cross compared. We find that at low...
Earth orbit the use of time-shifted positions allow stable estimates of current density to be made and can verify temporal effects as well as validating the interpretation of the current components as arising predominantly from field-aligned currents. In the case of four-spacecraft configurations we can resolve the full vector current and therefore can check the perpendicular as well as parallel current density components directly, together with the quality factor for the estimates directly (for the first time in situ at low Earth orbit).

**General information**

State: Published
Organisations: National Space Institute, Geomagnetism, Beihang University, Institute of Crustal Dynamics, German Research Centre for Geosciences, Chinese Academy of Sciences, Shandong University, ESTEC

**Authors:** Dunlop, M. W. (Ekstern), Yang, Y. (Ekstern), Yang, J. (Ekstern), Lühr, H. (Ekstern), Shen, C. (Ekstern), Olsen, N. (Intern), Ritter, P. (Ekstern), Zhang, Q. (Ekstern), Cao, J. (Ekstern), Fu, H. (Ekstern), Haagmans, R. (Ekstern)

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**Publication information**

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- BFI (2017): BFI-level 2
- Scopus rating (2017): SJR 2.272 SNIP 1.475
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 3.056 SNIP 1.753
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.85 SNIP 1.738
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 2.826 SNIP 1.529
- Web of Science (2008): Indexed yes
Ocean flooding related to extreme storm surges poses a large damage potential for society. With future climate changes such as sea level rise and increased storminess, ocean flooding becomes one of the largest challenges for Denmark, due to its many islands and long low-lying coastline. At The Danish Coastal Authority under the Ministry of the Environment we are carrying out a rapid screening of the areas vulnerable to ocean flooding throughout the whole of Denmark; today, in 2065 and in 2100, respectively, to determine hazard areas and vulnerabilities towards floods. With this information we can estimate the future requirement for sea defences along the Danish coastline now and into the future. While carrying out this screening we have to assess the factors influencing the flood level. This includes changes in the topography from glacial isostasy and subsidence along with future mean sea level and storminess. Once the flood levels are estimated the coastline can be separated into areas of high and low hazard. The coastline can also be separated into areas with different vulnerabilities, depending on the expected direct and indirect damages. In these areas the tangible and intangible losses will be compared, e.g. a nature area compared with a power station, or, a summerhouse area compared with a hospital. Together with the hazard map, the risk of flooding along the entire coast of Denmark is then calculated. This rapid screening and risk mapping provides an effective tool to develop adaptation and mitigation plans for the coastal areas for local and national governments on both short term and on a longer timescale. It can be used to decide where to protect and where to allow nature and natural processes to dominate.
Naturvidenskabelig analfabetisme
Når helt almindelige ord som atomer, radioaktivitet, kemi og gener kan give anledning til bekymring, bør vi måske være bekymrede for, om en naturvidenskabelig analfabetisme er ved at brede sig.

NetSat-4G A four nano-satellite formation for global geomagnetic gradiometry
This paper proposes a concept for a Global GeomaGnetic Gradiometry (4G) nano-satellite mission. The proposed concept makes use of a formation of four nano-satellites carrying vector magnetometers and flying in a Cartwheel-Helix formation at low altitude. The use of four satellites makes possible the simultaneous measurement of the geomagnetic gradients in all three directions (east-west, north-south and radial), and thus the realisation of a full gradiometry mission. The concept foresees the use of a miniaturised propulsion system for formation acquisition and maintenance, allowing not only to setup optimal formation geometries for optimal gradient retrieval but also to extend the mission lifetime at the targeted low altitude. The preliminary results of an end-to-end simulation are presented, and the gradient concept for NetSat-4G demonstrated. Given the constraints inherent to a nano-satellite platform, measurement performance is still, as expected, inferior to what can nowadays be achieved with larger and more expensive missions. Despite the disadvantages, the proposed concept is still considered pertinent as it would allow, for the first time, to implement a full geomagnetic gradiometry mission.
New geoid of Greenland: A case study of terrain and ice effects, GOCE and use of local sea level data

Making an accurate geoid model of Greenland has always been a challenge due to the ice sheet and glaciers, and the rough topography and deep fjords in the ice free parts. Terrestrial gravity coverage has for the same reasons been relatively sparse, with an older airborne survey of the interior being the only gravity field data over the interior, and terrain and ice thickness models being insufficient both in terms of resolution and accuracy. This data situation has in the later years changed substantially, first of all due to GOCE, but also new airborne gravity and ice thickness data from the NASA IceBridge mission, and new terrain models from ASTER, SPOT-5 and digital photogrammetry. In the paper we use all available data to make a new geoid of Greenland and surrounding ocean regions, using remove-restore techniques for ice and topography, spherical FFT techniques and downward continuation by least squares collocation. The impact of GOCE and the new terrestrial data yielded a much improved geoid, as evidenced by comparison to GPS measurements along fjords, which serves as a proxy for GPS leveling data, and comparisons to new GPS leveling data in Iceland. The comparisons show significant improvements over EGM08 and older geoid models, and also highlight the problems of global sea level models, especially in sea ice covered regions, and the definition of a new consistent vertical datum of Greenland.

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No time for dead time: timing analysis of bright black hole binaries with NuSTAR
Timing of high-count-rate sources with the NuSTAR Small Explorer Mission requires specialized analysis techniques. NuSTAR was primarily designed for spectroscopic observations of sources with relatively low count rates rather than for timing analysis of bright objects. The instrumental dead time per event is relatively long (~2.5 msec) and varies event-to-event by a few percent. The most obvious effect is a distortion of the white noise level in the power density spectrum (PDS) that cannot be easily modeled with standard techniques due to the variable nature of the dead time. In this paper, we show that it is possible to exploit the presence of two completely independent focal planes and use the cospectrum, the real part of the cross PDS, to obtain a good proxy of the white-noise-subtracted PDS. Thereafter, one can use a Monte Carlo approach to estimate the remaining effects of dead time, namely, a frequency-dependent modulation of the variance and a frequency-independent drop of the sensitivity to variability. In this way, most of the standard timing analysis can be performed, albeit with a sacrifice in signal-to-noise ratio relative to what would be achieved using more standard techniques. We apply this technique to NuSTAR observations of the black hole binaries GX 339-4, Cyg X-1, and GRS 1915+105.

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NuSTAR and SUZAKU observations of the hard state in Cygnus X-1: locating the inner accretion disk

We present simultaneous Nuclear Spectroscopic Telescope Array (NuSTAR) and Suzaku observations of the X-ray binary Cygnus X-1 in the hard state. This is the first time this state has been observed in Cyg X-1 with NuSTAR, which enables us to study the reflection and broadband spectra in unprecedented detail. We confirm that the iron line cannot be fit with a combination of narrow lines and absorption features, instead requiring a relativistically blurred profile in combination with a narrow line and absorption from the companion wind. We use the reflection models of García et al. to simultaneously measure the black hole spin, disk inner radius, and coronal height in a self-consistent manner. Detailed fits to the iron line profile indicate a high level of relativistic blurring, indicative of reflection from the inner accretion disk. We find a high spin, a small inner disk radius, and a low source height and rule out truncation to greater than three gravitational radii at the 3σ confidence level. In addition, we find that the line profile has not changed greatly in the switch from soft to hard states, and that the differences are consistent with changes in the underlying reflection spectrum rather than the relativistic blurring. We find that the blurring parameters are consistent when fitting either just the iron line or the entire broadband spectrum, which is well modeled with a Comptonized continuum plus reflection model.

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NUSTAR and Xmm-Newton Observations of the Extreme Ultraluminous X-Ray Source NGC 5907 ULX1: A Vanishing Act

We present results obtained from two broadband X-ray observations of the extreme ultraluminous X-ray source (ULX) NGC 5907 ULX1, known to have a peak X-ray luminosity of \(\sim 5 \times 10^{40} \text{ erg s}^{-1}\). These XMM-Newton and NuSTAR observations, separated by only \(\sim 4\) days, revealed an extreme level of short-term flux variability. In the first epoch, NGC 5907 ULX1 was undetected by NuSTAR, and only weakly detected (if at all) with XMM-Newton, while in the second NGC 5907 ULX1 was clearly detected at high luminosity by both missions. This implies an increase in flux of \(\sim 2\) orders of magnitude or more during this \(\sim 4\) day window. We argue that this is likely due to a rapid rise in the mass accretion rate, rather than to a transition from an extremely obscured to an unobscured state. During the second epoch we observed the broadband 0.3-20.0 keV X-ray luminosity to be \((1.55 \pm 0.06) \times 10^{40} \text{ erg s}^{-1}\), similar to the majority of the archival X-ray observations. The broadband X-ray spectrum obtained from the second epoch is inconsistent with the low/hard accretion state observed in Galactic black hole binaries, but is well modeled with a simple accretion disk model incorporating the effects of photon advection. This strongly suggests that when bright, NGC 5907 ULX1 is a high-Eddington accretor.

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We present the first sub-arcminute images of the Galactic Center above 10 keV, obtained with NuSTAR. NuSTAR resolves the hard X-ray source IGR J17456-2901 into non-thermal X-ray filaments, molecular clouds, point sources, and a previously unknown central component of hard X-ray emission (CHXE). NuSTAR detects four non-thermal X-ray filaments, extending the detection of their power-law spectra with Gamma similar to 1.3-2.3 up to similar to 50 keV. A morphological and spectral study of the filaments suggests that their origin may be heterogeneous, where previous studies suggested a common origin in young pulsar wind nebulae (PWNe). NuSTAR detects non-thermal X-ray continuum emission spatially correlated with the 6.4 keV Fe K alpha fluorescence line emission associated with two Sgr A molecular clouds: MC1 and the Bridge. Broadband X-ray spectral analysis with a Monte-Carlo based X-ray reflection model self-consistently determined their intrinsic column density (similar to 10^{23} cm^{-2}), primary X-ray spectra (power-laws with Gamma similar...
to 2) and set a lower limit of the X-ray luminosity of Sgr A* flare illuminating the Sgr A clouds to $L_X \geq 10^{38}$ erg s$^{-1}$.

Above similar to 20 keV, hard X-ray emission in the central 10 pc region around Sgr A* consists of the candidate PWN G359.95-0.04 and the CHXE, possibly resulting from an unresolved population of massive CVs with white dwarf masses $M_{WD} \sim 0.9 M_{\odot}$. Spectral energy distribution analysis suggests that G359.95-0.04 is likely the hard X-ray counterpart of the ultra-high gamma-ray source HESS J1745-290, strongly favoring a leptonic origin of the GC TeV emission.

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We present two Nuclear Spectroscopic Telescope Array (NuSTAR) observations of the local Seyfert 2 active galactic nucleus (AGN) and an ultraluminous X-ray source (ULX) candidate in NGC 5643. Together with archival data from Chandra, XMM-Newton, and Swift-BAT, we perform a high-quality broadband spectral analysis of the AGN over two decades in energy (∼ 0.5-100 keV). Previous X-ray observations suggested that the AGN is obscured by a Compton-thick (CT) column of obscuring gas along our line of sight. However, the lack of high-quality greater than or similar to 10 keV observations, together with the presence of a nearby X-ray luminous source, NGC 5643 X-1, have left significant uncertainties in the characterization of the nuclear spectrum. NuSTAR now enables the AGN and NGC 5643 X-1 to be separately resolved above 10 keV for the first time and allows a direct measurement of the absorbing column density toward the nucleus. The new data show that the nucleus is indeed obscured by a CT column of N_H greater than or similar to 5 x 10^{24} cm^{-2}. The range of 2-10 keV absorption-corrected luminosity inferred from the bestfitting models is L_{2-10,\text{int}} = (0.8-1.7) x 10^{42} erg s^{-1}, consistent with that predicted from multiwavelength intrinsic luminosity indicators. In addition, we also study the NuSTAR data for NGC 5643 X-1 and show that it exhibits evidence of a spectral cutoff at energy E∼10 keV, similar to that seen in other ULXs observed by NuSTAR. Along with the evidence for significant X-ray luminosity variations in the 3-8 keV band from 2003 to 2014, our results further strengthen the ULX classification of NGC 5643 X-1.
The intrinsic column density (N-H) distribution of quasars is poorly known. At the high obscuration end of the quasar population and for redshifts z <1, the X-ray spectra can only be reliably characterized using broad-band measurements that extend to energies above 10 keV. Using the hard X-ray observatory NuSTAR, along with archival Chandra and XMM-Newton data, we study the broad-band X-ray spectra of nine optically selected (from the SDSS), candidate Compton-thick (N-H > 1.5 x 10^{24} cm^{-2}) type 2 quasars (CTQSOSs); five new NuSTAR observations are reported herein, and four have been previously published. The candidate CTQSOSs lie at z <0.5, have observed [O III] luminosities in the range 8.4<log(L-[O III]/L_\odot)<9.6, and show evidence for extreme, Compton-thick absorption when indirect absorption diagnostics are considered. Among the nine candidate CTQSOSs, five are detected by NuSTAR in the high-energy (8-24
keV) band: two are weakly detected at the approximate to 3 sigma confidence level and three are strongly detected with sufficient counts for spectral modeling (greater than or similar to 90 net source counts at 8-24 keV). For these NuSTAR-detected sources direct (i.e., X-ray spectral) constraints on the intrinsic active galactic nucleus properties are feasible, and we measure column densities approximate to 2.5-1600 times higher and intrinsic (unabsorbed) X-ray luminosities approximate to 10-70 times higher than pre-NuSTAR constraints from Chandra and XMM-Newton. Assuming the NuSTAR-detected type 2 quasars are representative of other Compton-thick candidates, we make a correction to the N-H distribution for optically selected type 2 quasars as measured by Chandra and XMM-Newton for 39 objects. With this approach, we predict a Compton-thick fraction of $f(CT) = 36(-12)(+14)\%$, although higher fractions (up to 76\%) are possible if indirect absorption diagnostics are assumed to be reliable.

**General information**

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**Authors:** Lansbury, G. B. (Ekstern), Gandhi, P. (Ekstern), Alexander, D. M. (Ekstern), Assef, R. J. (Ekstern), Aird, J. (Ekstern), Annuar, A. (Ekstern), Ballantyne, D. R. (Ekstern), Balokovic, M. (Ekstern), Bauer, F. E. (Ekstern), Boggs, S. E. (Ekstern), Brandt, W. N. (Ekstern), Brightman, M. (Ekstern), Christensen, F. E. (Intern), Civano, F. (Ekstern), Comastri, A. (Ekstern), Craig, W. W. (Ekstern), Del Moro, A. (Ekstern), Grefenstette, B. W. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Hickox, R. C. (Ekstern), Koss, M. (Ekstern), LAMASSA, S. M. (Ekstern), Luo, B. (Ekstern), Puccetti, S. (Ekstern), Stern, D. (Ekstern), Treister, E. (Ekstern), Vignali, C. (Ekstern), Zappacosta, L. (Ekstern), Zhang, W. W. (Ekstern)

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We report on high-energy X-ray observations of the Compton-thick Seyfert 2 galaxy NGC 1068 with NuSTAR, which provide the best constraints to date on its >10 keV spectral shape. The NuSTAR data are consistent with those from past and current instruments to within cross-calibration uncertainties, and we find no strong continuum or line variability over the past two decades, which is in line with its X-ray classification as a reflection-dominated Compton-thick active galactic nucleus. The combined NuSTAR, Chandra, XMM-Newton, and Swift BAT spectral data set offers new insights into the complex secondary emission seen instead of the completely obscured transmitted nuclear continuum. The critical combination of the high signal-to-noise NuSTAR data and the decomposition of the nuclear and extranuclear emission with Chandra allow us to break several model degeneracies and greatly aid physical interpretation. When modeled as a monolithic (i.e., a single N-H) reflector, none of the common Compton reflection models are able to match the neutral fluorescence lines and broad spectral shape of the Compton reflection hump without requiring unrealistic physical parameters (e.g., large Fe overabundances, inconsistent viewing angles, or poor fits to the spatially resolved spectra). A multi-component reflector with three distinct column densities (e.g., with best-fit values of N-H of 1.4 x 10(23), 5.0 x 10(24), and 10(25) cm(-2)) provides a more reasonable fit to the spectral lines and Compton hump, with near-solar Fe abundances. In this model, the higher N-H component provides the bulk of the flux to the Compton hump, while the lower N-H component produces much of the line emission, effectively decoupling two key features of Compton reflection. We find that approximate to 30% of the neutral Fe K alpha line flux arises from >2'' (approximate to 140 pc) and is clearly extended, implying that a significant fraction (and perhaps most) of the

**NuSTAR Spectroscopy of Multi-Component X-Ray Reflection from NGC 1068**

We report on high-energy X-ray observations of the Compton-thick Seyfert 2 galaxy NGC 1068 with NuSTAR, which provide the best constraints to date on its >10 keV spectral shape. The NuSTAR data are consistent with those from past and current instruments to within cross-calibration uncertainties, and we find no strong continuum or line variability over the past two decades, which is in line with its X-ray classification as a reflection-dominated Compton-thick active galactic nucleus. The combined NuSTAR, Chandra, XMM-Newton, and Swift BAT spectral data set offers new insights into the complex secondary emission seen instead of the completely obscured transmitted nuclear continuum. The critical combination of the high signal-to-noise NuSTAR data and the decomposition of the nuclear and extranuclear emission with Chandra allow us to break several model degeneracies and greatly aid physical interpretation. When modeled as a monolithic (i.e., a single N-H) reflector, none of the common Compton reflection models are able to match the neutral fluorescence lines and broad spectral shape of the Compton reflection hump without requiring unrealistic physical parameters (e.g., large Fe overabundances, inconsistent viewing angles, or poor fits to the spatially resolved spectra). A multi-component reflector with three distinct column densities (e.g., with best-fit values of N-H of 1.4 x 10(23), 5.0 x 10(24), and 10(25) cm(-2)) provides a more reasonable fit to the spectral lines and Compton hump, with near-solar Fe abundances. In this model, the higher N-H component provides the bulk of the flux to the Compton hump, while the lower N-H component produces much of the line emission, effectively decoupling two key features of Compton reflection. We find that approximate to 30% of the neutral Fe K alpha line flux arises from >2'' (approximate to 140 pc) and is clearly extended, implying that a significant fraction (and perhaps most) of the

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On the performance of topobathymetric LiDAR in shallow water environments: the Ribe Vesterå river and the Knudedyb tidal inlet in the Danish Wadden Sea

Shallow water environments in the land-sea transition zone are challenging to map in high spatial resolution at large spatial scales. Historically this has led to gaps (white ribbons) between terrestrial and marine surveys. Topobathymetric LiDAR (Light Detection And Ranging), also referred to as green LiDAR which is able to penetrate through water, holds the
potential to close this gap. However, water column turbidity poses limitations to the penetration of the green laser beam, and water column refraction of the laser beam poses limitations to the scale of features which can be resolved at the seabed. The aim of this study is to investigate the performance of topobathymetric LiDAR in shallow water environments in relation to resolving small-scale morphological features at landscape scale. More specifically, the objectives are: 1) to determine the spatial resolution as well as the horizontal and vertical precision of green LiDAR based on object detection; and 2) to assess the potential of topobathymetric LiDAR as a tool to combine and integrate terrestrial and marine mapping and related investigations in the land-sea transition zone. Topobathymetric LiDAR surveys were carried out in spring 2014 on an app. 7 km reach of the Ribe Vesterå river and in a 5 km x 10 km section of the Knudedyb tidal inlet in the Danish Wadden Sea using the airborne hydrographic laser scanner RIEGL® VQR-820-G. Prior to the surveys three geometrically defined objects (steel frames with dimensions of 0.8 m x 0.8 m x 0.25 m) were placed within the survey area in the river section, and on a back-barrier tidal channel and on a back-barrier salt marsh in the tidal inlet system, respectively. The exact locations of the three objects were determined by a Trimble® R8 GNSS Receiver. The preliminary results show that the topobathymetric LiDAR system can detect the three objects. However, the sharp corners and edges of the objects are not perfectly resolved due to a combination of point density, which primarily is a function of effective measurement rate and flight height and speed, and seabed footprint size, which primarily is a function of water depth and water column refraction. The horizontal and vertical precision of the LiDAR system is at sub-decimetre scale at a 95% confidence level. This suggests that topobathymetric LiDAR is capable of resolving relatively small-scale morphological features in challenging shallow water environments in the land-sea transition zone at landscape scale, as large spatial areas can be covered within short time, thereby enabling a closing of the historical gap between terrestrial and marine surveys.
Outburst from the SFXT IGR J17544-2619 detected by INTEGRAL

During public INTEGRAL Galactic bulge monitoring observations (ATel #438) performed on 2015 February 20-21 at UT 23:04-02:45, we detected the SFXT IGR J17544-2619 (see ATel #7137 for the recent Swift detection of the source outburst). The source was detected using IBIS/ISGRI in the 18-40 keV range at an average level of 24 +/- 2 mCrab (detection significance of 10 sigma) and using JEM-X at 26 +/- 4 mCrab (3-10 keV, 10 sigma) and 21 +/- 6 mCrab (10-25 keV, 6 sigma). The source was detected neither in the previous INTEGRAL Galactic bulge observation (starting February 20, UT 07:41) nor in the following one (February 24, UT 23:52), compatible with the Swift/XRT non detection from February 24, UT 17:11 (ATel #7137). JEM-X upper limits for the non detections in the previous and following observations are about 5 mCrab (3-10 keV) and 2 mCrab (10-25 keV). The results of the INTEGRAL Galactic bulge monitoring program are publicly available at http://integral.esac.esa.int/BULGE/.

Oxidation of SO2 and formation of water droplets under irradiation of 20MeV protons in N2/H2O/2SO2

We have performed an experiment on charged droplet formation in a humidified N2 gas with trace SO2 concentration and induced by 20MeV proton irradiation. It is thought that SO2 reacts with the chemical species, such as OH radicals, generated through the reactions triggered by N2+ production. Both droplet number and droplet size increased with SO2 consumption for the proton irradiation. The total charged droplet numbers entering the differential mobility analyzer per unit time were proportional to the 0.68 power of the SO2 consumption. These two findings suggest that coagulation among the small droplets contributes to the formation of the droplets. The charged droplet volume detected per unit time is proportional to the SO2 consumption, which indicates that a constant amount of sulfur atoms is contained in a unit volume of droplet, regardless of different droplet-size distributions depending on the SO2 consumption.
Performance assessment of an LNA used as active cold load

The EMIRAD-2 radiometer is an airborne radiometer, which has been developed for calibration and validation of the ESA/SMOS mission data, as well as for data collection for development and evaluation of models for parameter retrieval, based on radiometric L-band data. The instrument has been applied in various campaigns in very different environments. Primary calibration sources are a traditional hot load along with a noise diode, and the calibration quality is verified prior to almost each flight using a liquid Nitrogen cooled target. EMIRAD-2 also features a commercial-off-the-shelf (Miteq) low noise amplifier (LNA), operated as an active cold load (ACL). This paper shows results for the ACL performance throughout several years of operation under very different conditions, and important parameters, such as stability, repeatability, and sensitivity to operating temperature variations are assessed.

Phase-resolved NuSTAR and SWIFT-XRT observations of magnetar 4U 0142+61

We present temporal and spectral analysis of simultaneous 0.5-79 keV Swift-XRT and Nuclear Spectroscopic Telescope Array observations of the magnetar 4U 0142+61. The pulse profile changes significantly with photon energy between 3 and 35 keV. The pulse fraction increases with energy, reaching a value of ≈20%, similar to that observed in 1E 1841-045 and much lower than the ≈80% pulse fraction observed in 1E 2259+586. We do not detect the 55 ks phase modulation reported in previous Suzaku-HXD observations. The phase-averaged spectrum of 4U 0142+61 above 20 keV is dominated by a hard power law (PL) with a photon index $\Gamma_H \approx 0.65$, and the spectrum below 20 keV can be described by two blackbodies, a blackbody plus a soft PL, or by a Comptonized blackbody model. We study the full phase-resolved spectra using the $e^\pm$ outflow model of Beloborodov. Our results are consistent with the parameters of the active j-bundle derived from INTEGRAL data by Hascoe¨t et al. We find that a significant degeneracy appears in the inferred parameters if the footprint of the j-bundle is allowed to be a thin ring instead of a polar cap. The degeneracy is reduced when the footprint is required to be the hot spot inferred from the soft X-ray data.
Planck 2013 results. XXII. The updated Planck catalogue of Sunyaev-Zeldovich sources

We update the all-sky Planck catalogue of 1227 clusters and cluster candidates (PSZ1) published in March 2013, derived from detections of the Sunyaev-Zeldovich (SZ) effect using the first 15.5 months of Planck satellite observations. As an addendum, we deliver an updated version of the PSZ1 catalogue, reporting the further confirmation of 86 Planck-discovered clusters. In total, the PSZ1 now contains 947 confirmed clusters, of which 214 were confirmed as newly discovered clusters through follow-up observations undertaken by the Planck Collaboration. The updated PSZ1 contains redshifts for 913 systems, of which 736 (similar to 80.6%) are spectroscopic, and associated mass estimates derived from the Y-z mass proxy. We also provide a new NZ quality flag for the remaining 280 candidates. This flag was derived from a novel artificial neural-network classification of the SZ signal. Based on this assessment, the purity of the updated PSZ1 catalogue is estimated to be 94%. In this release, we provide the full updated catalogue and an additional readme file with further information on the Planck SZ detections.

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This paper presents an overview of the polarized sky as seen by Planck HFI at 353 GHz, which is the most sensitive Planck channel for dust polarization. We construct and analyse maps of dust polarization fraction and polarization angle at 1° resolution, taking into account noise bias and possible systematic effects. The sensitivity of the Planck HFI polarization measurements allows for the first time a mapping of Galactic dust polarized emission on large scales, including low column density regions. We find that the maximum observed dust polarization fraction is high ($p_{\text{max}} = 19.8\%$), in particular in some regions of moderate hydrogen column density ($NH < 2 \times 10^{21} \text{ cm}^{-2}$). The polarization fraction displays a large scatter at NH below a few $10^{21} \text{ cm}^{-2}$. There is a general decrease in the dust polarization fraction with increasing column density above $NH \sim 1 \times 10^{21} \text{ cm}^{-2}$ and in particular a sharp drop above $NH \sim 1.5 \times 10^{22} \text{ cm}^{-2}$. We characterize the spatial structure of the polarization angle using the angle dispersion function. We find that the polarization angle is ordered over extended areas of several square degrees, separated by filamentary structures of high angle dispersion function. These appear as interfaces where the sky projection of the magnetic field changes abruptly without variations in the column density. The polarization fraction is found to be anti-correlated with the dispersion of polarization angles. These results suggest that, at the resolution of 1°, depolarization is due mainly to fluctuations in the magnetic field orientation along the line of sight, rather than to the loss of grain alignment in shielded regions. We also compare the polarization of thermal dust emission with that of synchrotron measured with Planck, low-frequency radio data, and Faraday rotation measurements toward extragalactic sources. These components bear resemblance along the Galactic plane and in some regions such as the Fan and North Polar Spur regions. The poor match observed in other regions shows, however, that dust, cosmic-ray electrons, and thermal electrons generally sample different parts of the line of sight.

**General information**

State: Published

Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen

Planck intermediate results XVIII. The millimetre and sub-millimetre emission from planetary nebulae

Late stages of stellar evolution are characterized by copious mass-loss events whose signature is the formation of circumstellar envelopes (CSE). Planck multi-frequency measurements have provided relevant information on a sample of Galactic planetary nebulae (PNe) in the important and relatively unexplored observational band between 30 and 857 GHz. Planck enables the assembly of comprehensive PNe spectral energy distributions (SEDs) from radio to far-IR frequencies. Modelling the derived SEDs provides us with information on physical properties of CSEs and the mass content of both main components: ionized gas, traced by the free-free emission at cm-mm waves; and thermal dust, traced by the millimetre and far-IR emission. In particular, the amount of ionized gas and dust has been derived here. Such quantities have also been estimated for the very young PN CRL? 618, where the strong variability observed in its radio and millimetre emission has previously prevented constructing its SED. A morphological study of the Helix Nebula was also performed. Planck maps reveal, for the first time, the spatial distribution of the dust inside the envelope, allowing us to identify different components, the most interesting of which is a very extended component (up to 1? pc) that may be related to a region where the slow expanding envelope is interacting with the surrounding interstellar medium.

General information

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Organisations: National Space Institute, Astrophysics, IT-Department

Planck intermediate results. XX. Comparison of polarized thermal emission from Galactic dust with simulations of MHD turbulence

Polarized emission observed by Planck HFI at 353 GHz towards a sample of nearby fields is presented, focusing on the statistics of polarization fractions $p$ and angles $\psi$. The polarization fractions and column densities in these nearby fields are representative of the range of values obtained over the whole sky. We find that: (i) the largest polarization fractions are reached in the most diffuse fields; (ii) the maximum polarization fraction $p_{\text{max}}$ decreases with column density $N_H$ in the more opaque fields with $N_H > 10^{24} \text{ cm}^{-2}$; and (iii) the polarization fraction along a given line of sight is correlated with the local spatial coherence of the polarization angle. These observations are compared to polarized emission maps computed in simulations of anisotropic magnetohydrodynamical turbulence in which we assume a uniform intrinsic polarization fraction of the dust grains. We find that an estimate of this parameter may be recovered from the maximum polarization fraction $p_{\text{max}}$ in diffuse regions where the magnetic field is ordered on large scales and perpendicular to the line of sight. This emphasizes the impact of anisotropies of the magnetic field on the emerging polarization signal. The decrease of the maximum polarization fraction with column density in nearby molecular clouds is well reproduced in the simulations, indicating that it is essentially due to the turbulent structure of the magnetic field: an accumulation of variously polarized structures along the line of sight leads to such an anti-correlation. In the simulations, polarization fractions are also found to anti-correlate with the angle dispersion function $S$. However, the dispersion of the polarization angle for a given polarization fraction is found to be larger in the simulations than in the observations, suggesting a shortcoming in the physical content of these numerical models. In summary, we find that the turbulent structure of the magnetic field is able to reproduce the main statistical properties of the dust polarization as observed in a variety of nearby clouds, dense cores excluded, and that the large-scale field orientation with respect to the line of sight plays a major role in the quantitative analysis of these statistical properties.
Planck intermediate results. XXII. Frequency dependence of thermal emission from Galactic dust in intensity and polarization

Planck has mapped the intensity and polarization of the sky at microwave frequencies with unprecedented sensitivity. We use these data to characterize the frequency dependence of dust emission. We make use of the Planck 353 GHz I, Q, and U Stokes maps as dust templates, and cross-correlate them with the Planck and WMAP data at 12 frequencies from 23 to 353 GHz, over circular patches with 10° radius. The cross-correlation analysis is performed for both intensity and polarization data in a consistent manner. The results are corrected for the chance correlation between the templates and the anisotropies of the cosmic microwave background. We use a mask that focuses our analysis on the diffuse interstellar...
medium at intermediate Galactic latitudes. We determine the spectral indices of dust emission in intensity and polarization between 100 and 353 GHz, for each sky patch. Both indices are found to be remarkably constant over the sky. The mean values, $1.59 \pm 0.02$ for polarization and $1.51 \pm 0.01$ for intensity, for a mean dust temperature of 19.6 K, are close, but significantly different (3.6σ). We determine the mean spectral energy distribution (SED) of the microwave emission, correlated with the 353 GHz dust templates, by averaging the results of the correlation over all sky patches. We find that the mean SED increases for decreasing frequencies at $\nu \leq 60$ GHz for both intensity and polarization. The rise of the polarization SED towards low frequencies may be accounted for by a synchrotron component correlated with dust, with no need for any polarization of the anomalous microwave emission. We use a spectral model to separate the synchrotron and dust polarization and to characterize the spectral dependence of the dust polarization fraction. The polarization fraction (p) of the dust emission decreases by $(21 \pm 6)\%$ from 353 to 70 GHz. We discuss this result within the context of existing dust models. The decrease in p could indicate differences in polarization efficiency among components of interstellar dust (e.g., carbon versus silicate grains). Our observational results provide inputs to quantify and optimize the separation between Galactic and cosmological polarization.

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Planck intermediate results XXIV. Constraints on variations in fundamental constants

Any variation in the fundamental physical constants, more particularly in the fine structure constant, $a$, or in the mass of the electron, $m_e$, affects the recombination history of the Universe and cause an imprint on the cosmic microwave background angular power spectra. We show that the Planck data allow one to improve the constraint on the time variation of the fine structure constant at redshift $z \approx 10(3)$ by about a factor of 5 compared to WMAP data, as well as to break the degeneracy with the Hubble constant, $H_0$. In addition to $a$, we can set a constraint on the variation in the mass of the electron, $m_e$, and in the simultaneous variation of the two constants. We examine in detail the degeneracies between fundamental constants and the cosmological parameters, in order to compare the limits obtained from Planck and WMAP and to determine the constraining power gained by including other cosmological probes. We conclude that independent time variations of the fine structure constant and of the mass of the electron are constrained by Planck to $\Delta A/A = (3.6 \pm 3.7) \times 10^{-2}$ and $\Delta m_e/m_e = (4 \pm 11) \times 10^{-3}$ at the 68% confidence level. We also investigate the possibility of a spatial variation of the fine structure constant. The relative amplitude of a dipolar spatial variation in a (corresponding to a gradient across our Hubble volume) is constrained to be $\Delta A/A = (-2.4 \pm 3.7) \times 10^{-2}$. 

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Planck intermediate results XXVIII. Interstellar gas and dust in the Chamaeleon clouds as seen by Fermi LAT and Planck

The nearby Chamaeleon clouds have been observed in γ rays by the Fermi Large Area Telescope (LAT) and in thermal dust emission by Planck and IRAS. Cosmic rays and large dust grains, if smoothly mixed with gas, can jointly serve with the HI and 12CO radio data to (i) map the hydrogen column densities, $N_{\text{HI}}$, in the different gas phases, in particular at the dark neutral medium (DNM) transition between the HI-bright and CO-bright media; (ii) constrain the CO-to-H$_2$ conversion factor, $X_{\text{CO}}$, and (iii) probe the dust properties per gas nucleon in each phase and map their spatial variations across the clouds. We have separated clouds at local, intermediate, and Galactic velocities in HI and 12CO line emission to model in parallel the γ-ray intensity recorded between 0.4 and 100 GeV; the dust optical depth at 353 GHz, $\tau_{353}$; the thermal radiance of the large grains; and an estimate of the dust extinction, $A_{\text{V,Q}}$, empirically corrected for the starlight intensity. The dust and gamma-models have been coupled to account for the DNM gas. The consistent γ-emissivity spectra recorded in the different phases confirm that the GeV-TeV cosmic rays probed by the LAT uniformly permeate all gas phases up to the 12CO cores. The dust and cosmic-ray particles both reveal large amounts of DNM gas, with comparable spatial distributions and twice as much mass as in the CO-bright clouds. We give constraints on the HI-DNM-CO transitions for five separate clouds. CO-dark H$_2$ dominates the molecular columns up to A(V) similar or equal to 0.9 and its mass often exceeds the one-third of the molecular mass expected by theory. The corrected A(V,Q) extinction largely provides the best fit to the total gas traced by the γ rays. Nevertheless, we find evidence for a marked rise in $A_{\text{V,Q}}/N_{\text{H}}$ with increasing $N_{\text{HI}}$ and molecular fraction, and with decreasing dust temperature. The rise in $X_{\text{CO}}/N_{\text{H}}$ is even steeper. We observe variations of lesser amplitude and orderliness for the specific power of the grains, except for a coherent decline by half in the CO cores. This combined information suggests grain evolution. We provide average values for the dust properties per gas nucleon in the different phases. The gamma rays and dust radiance yield consistent $X_{\text{CO}}$ estimates near $0.7 \times 10^{20}$ cm$^{-2}$ K$^{-1}$ km s$^{-1}$. The $A_{\text{V,Q}}$ and $\tau_{353}$ tracers yield biased values because of the large rise in grain opacity in the CO clouds. These results clarify a recurrent disparity in the gamma-versus dust calibration of $X_{\text{CO}}$, but they confirm the factor of 2 difference found between the $X_{\text{CO}}$ estimates in nearby clouds and in the neighbouring spiral arms.

General information
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Planck intermediate results. XXVI. Optical identification and redshifts of Planck clusters with the RTT150 telescope

We present the results of approximately three years of observations of Planck Sunyaev-Zeldovich (SZ) sources with the Russian-Turkish 1.5m telescope (RTT150), as a part of the optical follow-up programme undertaken by the Planck collaboration. During this time period approximately 20% of all dark and grey clear time available at the telescope was devoted to observations of Planck objects. Some observations of distant clusters were also done at the 6 m Bolshoi Telescope Alt-azimutalnyi (BTA) of the Special Astrophysical Observatory of the Russian Academy of Sciences. In total, deep, direct images of more than one hundred fields were obtained in multiple filters. We identified 47 previously unknown galaxy clusters, 41 of which are included in the Planck catalogue of SZ sources. The redshifts of 65 Planck clusters were measured spectroscopically and 14 more were measured photometrically. We discuss the details of cluster optical identifications and redshift measurements. We also present new spectroscopic redshifts for 39 Planck clusters that were not included in the Planck SZ source catalogue and are published here for the first time.

General information
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Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Planck intermediate results XXV. The Andromeda galaxy as seen by Planck

The Andromeda galaxy (M 31) is one of a few galaxies that has sufficient angular size on the sky to be resolved by the Planck satellite. Planck has detected M 31 in all of its frequency bands, and has mapped out the dust emission with the High Frequency Instrument, clearly resolving multiple spiral arms and sub-features. We examine the morphology of this long-wavelength dust emission as seen by Planck, including a study of its outermost spiral arms, and investigate the dust heating mechanism across M 31. We find that dust dominating the longer wavelength emission (greater than or similar to 0.3 mm) is heated by the diffuse stellar population (as traced by 3.6 μm emission), with the dust dominating the shorter wavelength emission heated by a mix of the old stellar population and star-forming regions (as traced by 24 μm emission). We also fit spectral energy distributions for individual 5' pixels and quantify the dust properties across the galaxy, taking into account these different heating mechanisms, finding that there is a linear decrease in temperature with galactocentric distance for dust heated by the old stellar population, as would be expected, with temperatures ranging from around 22 K in the nucleus to 14 K outside of the 10 kpc ring. Finally, we measure the integrated spectrum of the whole galaxy, which we find to be well-fitted with a global dust temperature of (18.2 +/- 1.0) K with a spectral index of 1.62 +/- 0.11 (assuming a single modified blackbody), and a significant amount of free-free emission at intermediate frequencies of 20-60 GHz, which corresponds to a star formation rate of around 0.12 M-circle dot yr(-1). We find a 2.3 sigma detection of the presence of spinning dust emission, with a 30 GHz amplitude of 0.7 +/- 0.3 Jy, which is in line with expectations from our Galaxy.

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Planetary gyre, time-dependent eddies, torsional waves, and equatorial jets at the Earth's core surface

We report a calculation of time-dependent quasi-geostrophic core flows for 1940–2010. Inverting recursively for an ensemble of solutions, we evaluate the main source of uncertainties, namely, the model errors arising from interactions between unresolved core surface motions and magnetic fields. Temporal correlations of these uncertainties are accounted for. The covariance matrix for the flow coefficients is also obtained recursively from the dispersion of an ensemble of solutions. Maps of the flow at the core surface show, upon a planetary-scale gyre, time-dependent large-scale eddies at midlatitudes, and vigorous azimuthal jets in the equatorial belt. The stationary part of the flow predominates on all the spatial scales that we can resolve. We retrieve torsional waves that explain the length-of-day changes at 4 to 9.5 years periods. These waves may be triggered by the nonlinear interaction between the magnetic field and subdecadal nonzonal motions within the fluid outer core. Both the zonal and the more energetic nonzonal interannual motions were particularly intense close to the equator (below 10° latitude) between 1995 and 2010. We revise down the amplitude of the decade fluctuations of the planetary-scale circulation and find that electromagnetic core-mantle coupling is not the main...
mechanism for angular momentum exchanges on decadal time scales if mantle conductance is $3 \times 10^8$ S or lower.
Plasmaphysik og fusionsenergi - fremtidens energikilde
Fusionsreaktoren ITER bygges i disse år i Frankrig af EU, Kina, Japan, Rusland, Indien, Sydkorea og USA og aflæser JET i England. ITER er nok sidste trin i forskningsfusionsreaktorer. ITER forventes at kunne producere mere energi, end der bruges til at køre den, og vil dermed være den første fusionsreaktor med energioverskud. Forskerne tror og håber, at erfaringer fra ITER fører til kommercielle fusionsreaktorer, der vil kunne løse vores energiproblemer for altid.

POGO satellite orbit corrections: an opportunity to improve the quality of the geomagnetic field measurements?
We present an attempt to improve the quality of the geomagnetic field measurements from the Polar Orbiting Geophysical Observatory (POGO) satellite missions in the late 1960s. Inaccurate satellite positions are believed to be a major source of errors for using the magnetic observations for field modelling. To improve the data, we use an iterative approach consisting of two main parts: one is a main field modelling process to obtain the radial field gradient to perturb the orbits and the other is the state-of-the-art GPS orbit modelling software BERNESE to calculate new physical orbits. We report results based on a single-day approach showing a clear increase of the data quality. That single-day approach leads, however, to undesirable orbital jumps at midnight. Furthermore, we report results obtained for a much larger data set comprising almost all of the data from the three missions. With this approach, we eliminate the orbit discontinuities at midnight but only tiny quality improvements could be achieved for geomagnetically quiet data. We believe that improvements to the data are probably still possible, but it would require the original tracking observations to be found.
Probing the emission physics and weak/soft population of Gamma-Ray Bursts with LOFT. White Paper in Support of the Mission Concept of the Large Observatory for X-ray Timing

The Large Observatory for X-ray Timing, LOFT, is designed to perform fast X-ray timing and spectroscopy with uniquely large throughput (Feroci et al., 2014a). LOFT focuses on two fundamental questions of ESA's Cosmic Vision Theme "Matter under extreme conditions": what is the equation of state of ultra-dense matter in neutron stars? Does matter orbiting close to the event horizon follow the predictions of general relativity? These goals are elaborated in the mission Yellow Book (http://sci.esa.int/loft/53447-loft-yellow-book/) describing the LOFT mission as proposed in M3, which closely resembles the LOFT mission now being proposed for M4. The extensive assessment study of LOFT as ESA’s M3 mission candidate demonstrates the high level of maturity and the technical feasibility of the mission, as well as the scientific importance of its unique core science goals. For this reason, the LOFT development has been continued, aiming at the new M4 launch opportunity, for which the M3 science goals have been confirmed. The unprecedentedly large effective area, large grasp, and spectroscopic capabilities of LOFT’s instruments make the mission capable of state-of-the-art science not only for its core science case, but also for many other open questions in astrophysics. LOFT’s primary instrument is the Large Area Detector (LAD), a 8.5 m² instrument operating in the 2–30 keV energy range, which will revolutionise studies of Galactic and extragalactic X-ray sources down to their fundamental time scales. The mission also features a Wide Field Monitor (WFM), which in the 2–50 keV range simultaneously observes more than a third of the sky at any time, detecting objects down to mCrab fluxes and providing data with excellent timing and spectral resolution. Additionally, the mission is equipped with an on-board alert system for the detection and rapid broadcasting to the ground of celestial bright and fast outbursts of X-rays (particularly, Gamma-ray Bursts). This paper is one of twelve White Papers that illustrate the unique potential of LOFT as an X-ray observatory in a variety of astrophysical fields in addition to the core science.
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Organisations: National Space Institute, Microwaves and Remote Sensing, IT-Department, Technical University of Denmark
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Rapid and Accurate Assembly Method for a New Laue Lens Prototype
The Laue lens is a technology for gamma-ray astrophysics whereby gamma-rays of particular energies can be focused by a suitable arrangement of crystals. The Laue lens assembly station at UC Berkeley was used to build a technological demonstrator addressing the key issues of crystal mounting speed, crystal positioning and orientation accuracy, and crystal reflectivity. The new prototype is a lens segment containing a total of 48 5 x 5 mm² crystals - 36 Iron and 12 Aluminium. The segment is composed of 8 partial rings, each of which is aligned to diffract an energy between 95 and 130 keV from a source at 12.5m with a focal length of 1.5 m.

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Rapid variability of blazar 3C 279 during flaring states in 2013-2014 with joint FERMI-LAT, NuSTAR, swift, and ground-based multi-wavelength observations

We report the results of a multiband observing campaign on the famous blazar 3C 279 conducted during a phase of increased activity from 2013 December to 2014 April, including first observations of it with NuSTAR. The γ-ray emission of the source measured by Fermi-LAT showed multiple distinct flares reaching the highest flux level measured in this object since the beginning of the Fermi mission, with $F (E > 100 \text{ MeV})$ of $10^{-5} \text{ photons cm}^{-2} \text{ s}^{-1}$, and with a flux-doubling time scale as short as 2 hr. The γ-ray spectrum during one of the flares was very hard, with an index of $\Gamma_{\gamma} = 1.7 \pm 0.1$, which is rarely seen in flat-spectrum radio quasars. The lack of concurrent optical variability implies a very high Compton dominance parameter $L_{\gamma} / L_{\text{syn}} > 300$. Two 1 day NuSTAR observations with accompanying Swift pointings were separated by 2 weeks, probing different levels of source activity. While the 0.5-70 keV X-ray spectrum obtained during the first pointing, and fitted jointly with Swift-XRT is well-described by a simple power law, the second joint observation showed an unusual spectral structure: the spectrum softens by $\Delta \Gamma_X \approx 0.4$ at ~4 keV. Modeling the broadband spectral energy distribution during this flare with the standard synchrotron plus inverse-Compton model requires: (1) the location of the γ-ray emitting region is comparable with the broad-line region radius, (2) a very hard electron energy distribution index $p \approx 1$, (3) total jet power significantly exceeding the accretion-disk luminosity $L_{\text{j}} / L_{\text{d}} \gtrsim 10$, and (4) extremely low jet magnetization with $L_{\text{B}} / L_{\text{j}} \lesssim 10^{-4}$. We also find that single-zone models that match the observed γ-ray and optical spectra cannot satisfactorily explain the production of X-ray emission.

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Readout for intersatellite laser interferometry: Measuring low frequency phase fluctuations of high-frequency signals with microradian precision

Precision phase readout of optical beat note signals is one of the core techniques required for inter-satellite laser interferometry. Future space based gravitational wave detectors like eLISA require such a readout over a wide range of MHz frequencies, due to orbit induced Doppler shifts, with a precision in the order of µ rad/root Hz at frequencies between 0.1 mHz and 1 Hz. In this paper, we present phase readout systems, so-called phasemeters, that are able to achieve such precisions and we discuss various means that have been employed to reduce noise in the analogue circuit domain and during digitisation. We also discuss the influence of some non-linear noise sources in the analogue domain of such phasemeters. And finally, we present the performance that was achieved during testing of the elegant breadboard model of the LISA phasemeter, which was developed in the scope of a European Space Agency technology development activity. (C) 2015 AIP Publishing LLC.
Reconciled freshwater flux into the Godthåbsfjord system from satellite and airborne remote sensing

As the rapid reduction in ice volume of the Greenland ice sheet (GrIS) continues, increased melt water flux from the GrIS enters the deep Greenlandic fjords. This increased freshwater flux may change the salinity and eventually the ecology of the fjords. Here, we present a case study in which we, from various remote-sensing data sets, estimate the freshwater flux from the GrIS into a specific fjord system, the Godthåbsfjord, in southwest Greenland. The area of the GrIS draining into Godthåbsfjord covers approximately 36,700 km². The large areal extent and the multiple outlets from the GrIS hamper in situ observations. Here, we evaluate available data from remote sensing and find a drainage basin in rapid change. An analysis of data from the Gravity Recovery and Climate Experiment (GRACE) satellites shows a mean seasonal freshwater flux into Godthåbsfjord of 18.2 ± 1.2 Gt, in addition to an imbalance in the mass balance of the drainage basin from 2003 to 2013 of 14.4 ± 0.2 Gt year⁻¹. Altimetry data from air and spaceborne missions also suggest rapid changes in the outlet glacier dynamics. We find that only applying data from the Ice, Cloud, and land Elevation Satellite (ICESat) mission the mass change of the Godthåbsfjord drainage basin is significantly underestimated. When including additional laser-altimetry surveys, to account for changes in the outlet glaciers elevation, not captured by ICESat, the altimetry data were able to reconcile the basin mass balance with the gravimetric estimate and provide a higher spatial resolution of the mass changes.
Regional Arctic observations of TEC gradients and scintillations

There has been a growing scientific interest in the Arctic ionospheric properties and variations during the recent years. However, our understanding of the fundamental ionospheric processes present in this area is still incomplete. Today, GNSS networks present in Greenland make it possible to acquire near-real time observations of the state and variations of the high-latitude ionosphere. This data can be employed to obtain relevant geophysical variables and statistics. In our study, GPS-derived total electron content (TEC) measurements have been complemented with amplitude scintillation indices ($S_4$) and phase scintillation indices ($\sigma_{\phi}$). The investigation of relations of these geophysical variables can lead to possible new ways to study the underlying processes and to build tools for monitoring and predicting Arctic TEC and scintillation large-scale patterns. A number of specific ionosphere events will be presented and the underlying geophysical process will be identified and described. Especially results where large-scale gradients in the regional TEC are compared with the growth of scintillations. The statistics of the scintillations will be investigated, with emphasis on how well the scintillations follow the Nakagami-m distribution. The spectra of both the intensities and phase will be calculated, and the corner frequency of these spectra will also be determined. These corner frequencies will be used to compute a number of important geophysical and ionospheric parameters. Furthermore, we will discuss how the spectral characteristics of the scintillations during large TEC gradients vary, and how values of the power spectra slopes change during increasing scintillations. These values will be validated against values found in prior studies. TEC and scintillation time-series and maps will also be presented over the Greenlandic region. We will show how the expansion of the auroral oval during geomagnetic storms can be detected from GNSS-derived data. We will then investigate the correlation between TEC and ionospheric indices.

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Response of reverse convection to fast IMF transitions

The nature of the transition that high-latitude reverse convection makes in response to fast interplanetary magnetic field (IMF) changes is investigated using observations from multiple spacecraft and a ground magnetometer array. We focused on two fast IMF-transition events on 22 April 2006. Immediately after the first event, three ST5 spacecraft identified a clear change in the distribution of the polar cap field-aligned current. Coordinate observations with the Greenland magnetometer chain showed that the near-noon Hall current distribution, which is closely related to the polar cap field-aligned current or reverse convection, was in a transition state for about 10 min. For the second event, the Greenland magnetic perturbations also showed that a transition state occurred in the near-noon sector for 10-15 min. Three DMSP spacecraft that traversed the polar cap provided evidence showing that variations of the ground magnetic perturbations were produced by the transition from clockwise plasma circulation to the anticlockwise circulation over the polar cap. A simple calculation based on the Biot-Savart law shows that the near-noon transition state is consistent with the approach of a new convection region to the near-noon sector at the speed of 0.5-1 km s\(^{-1}\), which is coupled with the moving away of the old convection region at a similar speed. For the higher-latitude sunward flow region, it is found that the convection takes a transition state almost simultaneously (within 1 min) with that in the near-noon sector, i.e., quasi-instantaneous response.
Rift magmatism on the Eurasia basin margin: U–Pb baddeleyite ages of alkaline dyke swarms in North Greenland

The opening of the Arctic Ocean involved multiple stages of continental rifting and intrusion of extensive dyke swarms. To trace tectonomagmatic processes of the High Arctic, we present the first U–Pb ages for alkaline dyke swarms of North Greenland. Concordia ages of 80.8 ± 0.6 and 82.1 ± 1.5 Ma indicate that north–south and east–west dykes are coeval. The north–south dykes reflect initial east–west rifting that led to break-up along the Gakkel Ridge and formation of the Eurasia Basin. The east–west dykes reflect local variations in the stress field associated with reactivated Palaeozoic faults. Supplementary materials: U–Pb data are available at http://www.geolsoc.org.uk/SUP18857.
Search for chameleons with CAST

In this work we present a search for (solar) chameleons with the CERN Axion Solar Telescope (CAST). This novel experimental technique, in the field of dark energy research, exploits both the chameleon coupling to matter (\(\beta_m\)) and to photons (\(\beta_\gamma\)) via the Primako effect. By reducing the X-ray detection energy threshold used for axions from 1 keV to 400 eV, CAST became sensitive to the converted solar chameleon spectrum which peaks around 600 eV. Even though we have not observed any excess above background, we can provide a 95% C.L. limit for the coupling strength of chameleons to photons of \(\beta_\gamma \leq 10^{11}\) for \(1 < \beta_m < 10^6\).
We investigate three annual mass-balance cycles on Helheim Glacier in south-east Greenland using TanDEM-X interferometric digital elevation models (DEMs), bedrock GPS measurements, and ice velocity from feature-tracking. The DEMs exhibit seasonal surface elevation cycles at elevations up to 800 m. a.s.l. with amplitudes of up to 19 m, from a maximum in July to a minimum in October or November, concentrated on the fast-flowing areas of the glacier indicating that the elevation changes have a mostly dynamic origin. By modelling the detrended bedrock loading/unloading signal we estimate a mean density for the loss of $671\pm70\text{kgm}^{-3}$ and calculate that total water equivalent volume loss from the active part of the glacier (surface flow speeds >1 m day$^{-1}$) ranges from 0.5 km$^3$ in 2011 to 1.6 km$^3$ in 2013. A rough ice-flux divergence analysis shows that at lower elevations (<200 m) mass loss by dynamic thinning fully explains seasonal elevation changes. In addition, surface elevations decrease by a greater amount than field observations of surface ablation or surface-energy-balance modelling predict, emphasising the dynamic nature of the mass loss. We conclude, on the basis of ice-front position observations through the time series, that melt-induced acceleration is most likely the main driver of the seasonal dynamic thinning, as opposed to changes triggered by retreat.
SAR waveforms from Cryosat-2 are processed using primary peak empirical retractors to determine the sea surface height in the Arctic. The empirical retractors investigated are based on the combination of the traditional OCOG (Offset Center of Gravity) and threshold methods with primary peak extraction. The primary peak retractors involve the application of retracking algorithms on just the primary peak of the waveform instead of the complete reflected waveform. These primary peak empirical retractors are developed for Cryosat-2 SAR data. This is the first time SAR data in the Arctic are processed using such primary peak retractors. The sea surface heights determined are compared with the sea surface heights generated by the ESA Retracker as available in the Cryosat-2 Level-2 dataset from 2012. Performance of the primary peak retractors is also compared with the traditional OCOG, threshold and five parameter beta retractors. In the case of SAR-lead data, it is concluded that the proposed primary peak retractors work better as compared with the traditional retractors (OCOG, threshold, five parameter beta) as well as the ESA Retracker.
SAR altimetry, Croysat-2, Empirical retracking, Sea ice

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SENTINEL-1 RESULTS: SEA ICE OPERATIONAL MONITORING

In the present paper we demonstrate the capabilities of the Sentinel-1 SAR data for operational sea-ice and iceberg monitoring. Most of the examples are drawn from the Copernicus Marine Environmental Monitoring Service (CMEMS) production.

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Silicon Pore Optics development for ATHENA

The ATHENA mission, a European large (L) class X-ray observatory to be launched in 2028, will essentially consist of an X-ray lens and two focal plane instruments. The lens, based on a Wolter-I type double reflection grazing incidence angle design, will be very large (similar to 3 m in diameter) to meet the science requirements of large effective area (1-2 m² at a few keV) at a focal length of 12 m. To meet the high angular resolution (5 arc seconds) requirement the X-ray lens will also need to be very accurate. Silicon Pore Optics (SPO) technology has been invented to enable building such a lens and thus enabling the ATHENA mission. We will report in this paper on the latest status of the development, including details of X-ray test campaigns.

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Authors: Collon, M. J. (Ekstern), Vacanti, G. (Ekstern), Guenther, R. (Ekstern), Yanson, A. (Ekstern), Barriere, N. (Ekstern), Landgraf, B. (Ekstern), Vervest, M. (Ekstern), Chatbi, A. (Ekstern), Beijersbergen, M. W. (Ekstern), Bavdaz, M. (Ekstern), Wille, E. (Ekstern), Haneveld, J. (Ekstern), Koelewijn, A. (Ekstern), van Baren, C. (Ekstern), Mueller, P. (Ekstern), Krumrey, M. (Ekstern), Burwitz, V. (Ekstern), Pareschi, G. (Ekstern), Conconi, P. (Ekstern), Christensen, F. E. (Intern)
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Simulation of GNSS reflected signals and estimation of position accuracy in GNSS-challenged environment
The paper describes the development and testing of a simulation tool, called QualiSIM. The tool estimates GNSS-based position accuracy based on a simulation of the environment surrounding the GNSS antenna, with a special focus on city-scape environments with large amounts of signal reflections from non-line-of-sight satellites. The signal reflections are implemented using the extended geometric path length of the signal path caused by reflections from the surrounding buildings. Based on real GPS satellite positions, simulated Galileo satellite positions, models of atmospheric effect on the satellite signals, designs of representative environments e.g. urban and rural scenarios, and a method to simulate reflection of satellite signals within the environment we are able to estimate the position accuracy given several prerequisites as described in the paper. The result is a modelling of the signal path from satellite to receiver, the satellite availability, the extended pseudoranges caused by signal reflection, and an estimate of the position accuracy based on a least squares adjustment of the extended pseudoranges. The paper describes the models and algorithms used and a verification test where the results of QualiSIM are compared with results from collection of real GPS data in an environment with much signal reflection.
Simulation Tool for GNSS Ocean Surface Reflections

GNSS coherent and incoherent reflected signals have the potential of deriving large scale parameters of ocean surfaces, as barotropic variability, eddy currents and fronts, Rossby waves, coastal upwelling, mean ocean surface heights, and patterns of the general ocean circulation. In the reflection zone the measurements may derive parameters as sea surface roughness, winds, waves, heights and tilts from the spectral measurements. Previous measurements from the top of mountains and airplanes have shown such results leading. The coming satellite missions, CYGNSS, COSMIC-2, and GEROS on the International Space Station, are focusing on GNSS ocean reflection measurements. Thus, simulation studies highlighting the assumptions for the data retrievals and the precision and the accuracy of such measurements are of interest for assessing the observational method. The theory of propagation of microwaves in the atmosphere is well established, and methods for propagation modeling range from ray tracing to numerical solutions to the wave equation. Besides ray tracing there are propagation methods that use mode theory and a finite difference solution to the parabolic equation. The presented propagator is based on the solution of the parabolic equation. The parabolic equation in our simulator is solved using the split-step sine transformation. The Earth’s surface is modeled with the use of an impedance model. The value of the Earth impedance is given as a function of the range along the surface of the Earth. This impedance concept gives an accurate lower boundary condition in the determination of the electromagnetic field, and makes it possible to simulate reflections and the effects of transitions between different mediums. A semi-isotropic Philipsspectrum is used to represent the air-sea interaction. Simulated GPS ocean surface reflections will be presented and discussed based on different ocean characteristics. The spectra of the simulated surface reflections will be analyzed and compared with existing observations. The analysis of both the simulated surface reflection signals and the measured reflection signals will reveal spectral structures of the reflected signals leading to the extraction of sea surface roughness, ocean wave heights, surface wind speed and direction.

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Simultaneous field-aligned currents at Swarm and Cluster satellites

We show for the first time, with direct, multispacecraft calculations of electric current density, and other methods, matched signatures of field-aligned currents (FACs) sampled simultaneously near the ionosphere at low (~500km altitude) orbit and in the magnetosphere at medium (similar to 2.5 Re altitude) orbits using a particular Swarm and Cluster conjunction. The Cluster signatures are interpreted and ordered through joint mapping of the ground/magnetospheric footprints and estimation of the auroral zone boundaries (taken as indication of the boundaries of Region 1 and Region 2 currents). We find clear evidence of both small-scale and large-scale FACs and clear matching of the behavior and structure of the large-scale currents at both Cluster and Swarm. The methodology is made possible through the joint operations of Cluster and Swarm, which contain, in the first several months of Swarm operations, a number of close three-spacecraft configurations.

General information
We report on a 10 ks simultaneous Chandra/High Energy Transmission Grating (HETG)-Nuclear Spectroscopic Telescope Array (NuSTAR) observation of the Bursting Pulsar, GRO J1744-28, during its third detected outburst since discovery and after nearly 18 yr of quiescence. The source is detected up to 60 keV with an Eddington persistent flux level. Seven bursts, followed by dips, are seen with Chandra, three of which are also detected with NuSTAR. Timing analysis reveals a slight increase in the persistent emission pulsed fraction with energy (from 10% to 15%) up to 10 keV, above which it remains constant. The 0.5-70 keV spectra of the persistent and dip emission are the same within errors and well described by a blackbody (BB), a power-law (PL) with an exponential rolloff, a 10 keV feature, and a 6.7 keV emission feature, all modified by neutral absorption. Assuming that the BB emission originates in an accretion disk, we estimate its inner (magnetospheric) radius to be about 4 × 10^7 cm, which translates to a surface dipole field $B \approx 9 \times 10^{10}$ G. The Chandra/HETG spectrum resolves the 6.7 keV feature into (quasi-)neutral and highly ionized Fe xxv and Fe xxvi emission lines. XSTAR modeling shows these lines to also emanate from a truncated accretion disk. The burst spectra, with a peak flux more than an order of magnitude higher than Eddington, are well fit with a PL with an exponential rolloff and a 10 keV feature, with similar fit values compared to the persistent and dip spectra. The burst spectra lack a thermal component and any Fe features. Anisotropic (beamed) burst emission would explain both the lack of the BB and any Fe components.
Slaget om havet. Den nye tilgang til anvendelsen af søterritoriet.

Software-Defined GPS Receiver Implemented on the Parallella-16 Board

This paper describes a GPS software receiver design made of inexpensive and physically small hardware components. The small embedded platform, known as the Parallella-16 computer has been utilized in conjunction with a commercial RF front-end to construct a 4-channel real time software GPS receiver. The Parallella-16 board is a kickstarter-funded platform consisting of a dual-core ARM A9 CPU, an integrated FPGA and a 16-core coprocessor known as the Epiphany. The main contribution in this paper has been the development of a GPS tracking algorithm, which utilizes the parallelism in the Epiphany processor. The total cost of the hardware is below 150$ and the size is comparable to a credit-card. The receiver has been developed for research in GNSS/INS integration on small Unmanned Aerial Vehicles (UAVs).

Space-compatible strain gauges as an integration aid for the James Webb Space Telescope Mid-Infrared Instrument

Space instruments are designed to be highly optimised, mass efficient hardware required to operate in extreme environments. Building and testing is extremely costly, and damage that appears to have no impact on performance at normal ambient conditions can have disastrous implications when in operation. The Mid-Infrared Instrument is one of four instruments to be used on the James Webb Space Telescope which is due for launch in 2018. This telescope will be successor to the Hubble Space Telescope and is the largest space-based astronomy project ever to be conceived. Critical to operation of the Mid-Infrared Instrument is its primary structure, which provides both a stable platform and thermal isolation for the scientific instruments. The primary structure contains strain-absorbing flexures and this article summarises how these have been instrumented with a novel strain gauge system designed to protect the structure from damage. Compatible with space flight requirements, the gauges have been used in both ambient and cryogenic environments and were successfully used to support various tasks including integration to the spacecraft. The article also discusses limitations to using the strain gauge instrumentation and other implications that should be considered if such a system is to be used for similar applications in future.
Authors: Samara-Ratna, P. (Ekstern), Sykes, J. (Ekstern), Bicknell, C. (Ekstern), Pye, J. (Ekstern), Jessen, N. C. (Intern), Nørgaard-Nielsen, H. U. (Intern)
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Spatial and temporal distribution of mass loss from the Greenland Ice Sheet since AD 1900

The response of the Greenland Ice Sheet (GIS) to changes in temperature during the twentieth century remains contentious, largely owing to difficulties in estimating the spatial and temporal distribution of ice mass changes before 1992, when Greenland-wide observations first became available. The only previous estimates of change during the twentieth century are based on empirical modelling and energy balance modelling. Consequently, no observation-based estimates of the contribution from the GIS to the global-mean sea level budget before 1990 are included in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Here we calculate spatial ice mass loss around the entire GIS from 1900 to the present using aerial imagery from the 1980s. This allows accurate high-resolution mapping of geomorphic features related to the maximum extent of the GIS during the Little Ice Age at the end of the nineteenth century. We estimate the total ice mass loss and its spatial distribution for three periods: 1900-1983 (75.1 ± 29.4 gigatonnes per year), 1983-2003 (73.8 ± 40.5 gigatonnes per year), and 2003-2010 (186.4 ± 18.9 gigatonnes per year). Furthermore, using two surface mass balance models we partition the mass balance into a term for surface mass balance (that is, total precipitation minus total sublimation minus runoff) and a dynamic term. We find that many areas currently undergoing change are identical to those that experienced considerable thinning throughout the twentieth century. We also reveal that the surface mass balance term shows a considerable decrease since 2003, whereas the dynamic term is constant over the past 110 years. Overall, our observation-based findings show that during the twentieth century the GIS contributed at least 25.0 ± 9.4 millimetres of global-mean sea level rise. Our result will help to close the twentieth-century sea level budget, which remains crucial for evaluating the reliability of models used to predict global sea level rise.
Spatial variation in extreme water levels in the Baltic Sea – North Sea transition from tide gauge records

Extreme water levels in the Danish waters, Figure 1, are governed by a variety of factors that provide a complex picture between locations, Figure 2 & Table 1, and where extremes may manifest themselves very differently between neighbouring locations and between water compartments during individual events. Knowledge about extremes is essential for climate adaptation, design, and planning purposes. In an ongoing research project we seek to develop more robust and objective statistics for Denmark. This includes a revisit to all tide gauge stations’ (TG) data and exploring methods for extreme value analysis (EVA). Below we provide four cases from Danish TGs to address some issues and questions regarding our work. Any feedback is much appreciated!

Spatial variation in extreme water levels in the Baltic Sea – North Sea transition from tide gauge records

This special issue “International Geomagnetic Reference Field—the twelfth generation” synthesizes the efforts made during the construction of the twelfth generation of the International Geomagnetic Reference Field (IGRF-12) that was released online in December 2014 (http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html). The IGRF-12 is a series of standard mathematical models describing the large scale internal part of the Earth’s magnetic field between epochs 1900.0 and 2015.0 with a forecast to epoch 2020.0. This activity has been maintained since 1968 by a working group of volunteer scientists from several international institutions but grew out from discussions started in the early 1960s (Barton, 1997). The IGRF task force operates under the auspices of the International Association of Geomagnetism and Aeronomy/Association Internationale de Géomagnétisme et d’Aéronomie (IAGA/AIGA), which is one of the International Union of Geodesy and Geophysics/Union
Statistical selection of tide gauges for Arctic sea-level reconstruction

In this paper, we seek an appropriate selection of tide gauges for Arctic Ocean sea-level reconstruction based on a combination of empirical criteria and statistical properties (leverages). Tide gauges provide the only in situ observations of sea level prior to the altimetry era. However, tide gauges are sparse, of questionable quality, and occasionally contradictory in their sea-level estimates. Therefore, it is essential to select the gauges very carefully. In this study, we have established a reconstruction based on empirical orthogonal functions (EOFs) of sea-level variations for the period 1950-2010 for the Arctic Ocean, constrained by tide gauge records, using the basic approach of Church et al. (2004). A major challenge is the sparsity of both satellite and tide gauge data beyond what can be covered with interpolation, necessitating a time-variable selection of tide gauges and the use of an ocean circulation model to provide gridded time series of sea level. As a surrogate for satellite altimetry, we have used the Drakkar ocean model to yield the EOFs. We initially evaluate the tide gauges through empirical criteria to reject obvious outlier gauges. Subsequently, we evaluate the "influence" of each Arctic tide gauge on the EOF-based reconstruction through the use of statistical leverage and use this as an indication in selecting appropriate tide gauges, in order to procedurally identify poor-quality data while still including as much data as possible. To accommodate sparse or contradictory tide gauge data, careful preprocessing and regularization of the reconstruction model are found to make a substantial difference to the quality of the reconstruction and the ability to select appropriate tide gauges for a reliable reconstruction. This is an especially important consideration for the Arctic, given the limited amount of data available. Thus, such a tide gauge selection study can be considered a precondition for further studies of Arctic sea-level reconstruction.
Stochastic forecasting of the geomagnetic field from the COV-OBS.x1 geomagnetic field model, and candidate models for IGRF-12

We present the geomagnetic field model COV-OBS.x1, covering 1840 to 2020, from which have been derived candidate models for the IGRF-12. Towards the most recent epochs, it is primarily constrained by first differences of observatory annual means and measurements from the Oersted, Champ, and Swarm satellite missions. Stochastic information derived from the temporal spectra of geomagnetic series is used to construct the a priori model covariance matrix that complements the constraint brought by the data. This approach makes it possible the use of a posteriori model errors, for instance, to measure the ‘observations’ uncertainties in data assimilation schemes for the study of the outer core dynamics. We also present and illustrate a stochastic algorithm designed to forecast the geomagnetic field. The radial field at the outer core surface is advected by core motions governed by an auto-regressive process of order 1. This particular choice is motivated by the slope observed for the power spectral density of geomagnetic series. Accounting for time-correlated model errors (subgrid processes associated with the unresolved magnetic field) is made possible thanks to the use of an augmented state ensemble Kalman filter algorithm. We show that the envelope of forecasts includes the observed secular variation of the geomagnetic field over 5-year intervals, even in the case of rapid changes. In a purpose
of testing hypotheses about the core dynamics, this prototype method could be implemented to build the 'state zero' of the ability to forecast the geomagnetic field, by measuring what can be predicted when no deterministic physics is incorporated into the dynamical model.

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**Stratospheric Air-Ships a Platform for Earth Observation**

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**44Ti gamma-ray emission lines from SN1987A reveal an asymmetric explosion**

In core-collapse supernovae, titanium-44 (\(^{44}\text{Ti}\)) is produced in the innermost ejecta, in the layer of material directly on top of the newly formed compact object. As such, it provides a direct probe of the supernova engine. Observations of supernova 1987A (SN1987A) have resolved the 67.87- and 78.32–kilo–electron volt emission lines from decay of \(^{44}\text{Ti}\) produced in the supernova explosion. These lines are narrow and redshifted with a Doppler velocity of ~700 kilometers per second, direct evidence of large-scale asymmetry in the explosion.

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Surface return direction-of-arrival analysis for radar ice sounding surface clutter suppression.

Airborne radar ice sounding is challenged by surface clutter masking the depth signal of interest. Surface clutter may even be prohibitive for potential space-based ice sounding radars. To some extent the radar antenna suppresses the surface clutter, and a multi-phase-center antenna in combination with coherent signal processing techniques can improve the suppression, in particular if the direction of arrival (DOA) of the clutter signal is estimated accurately. This paper deals with data-driven DOA estimation. By using P-band data from the ice shelf in Antarctica it is demonstrated that a varying penetration depth influences the DOA.

Swarm's absolute magnetometer experimental vector mode, an innovative capability for space magnetometry

ESA's Swarm satellites carry a new generation of 4He absolute magnetometers (ASM), designed by CEA-Leti and developed in partnership with CNES. These instruments are the rst-ever space-born magnetometers to use a common sensor to simultaneously deliver 1Hz independent absolute scalar and vector readings of the magnetic eld. Since launch, these ASMs provided very high accuracy scalar eld data, as nominally required for the mission, together with experimental vector eld data. Here, we compare geomagnetic eld models built from such ASM-only data with models built from the mission's nominal 1Hz data, combining ASM scalar data with independent uxgate magnetometer vector data. The high level of agreement between these models demonstrates the potential of the ASM's vector mode for data quality control and as a stand alone magnetometer, and illustrates the way the evolution of key eld features can easily be monitored from space with such absolute vector magnetometers.
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Scopus rating (2010): SJR 2.934 SNIP 1.416
Web of Science (2010): Indexed yes
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Synergipotentialet i satellitbaserede systemer og droner i Arktis

Denne rapport er en del af et projekt, som DTU udfører for Uddannelses- og Forskningsministeriet, hvor DTU i samarbejde med interessenter i Rigsfællesskabet undersøger mulighederne for at benytte satellitter og droner i løsningen af Forsvarets og civilsamfundets opgaver i Arktis. Satellitter og droner har mange anvendelser som en platform, der kan imødekomme både Forsvarets og civilsamfundets behov og således udgøre grundstammen i en fælles infrastruktur.

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The 0.3-30 Kev Spectra Of Powerful Starburst Galaxies: Nustar And Chandra Observations Of Ngc 3256 And Ngc 3310
We present nearly simultaneous Chandra and NuSTAR observations of two actively star-forming galaxies within 50 Mpc: NGC 3256 and NGC 3310. Both galaxies are significantly detected by both Chandra and NuSTAR, which together provide the first-ever spectra of these two galaxies spanning 0.3-30 keV. The X-ray emission from both galaxies is spatially resolved by Chandra; we find that hot gas dominates the E <1-3 keV emission while ultraluminous X-ray sources (ULXs) provide majority contributions to the emission at E > 1-3 keV. The NuSTAR galaxy-wide spectra of both galaxies follow steep power-law distributions with Γ ≈ 2.6 at E > 5-7 keV. Using new and archival Chandra data, we search for signatures of heavily obscured or low luminosity active galactic nuclei (AGNs). We find that both NGC 3256 and NGC 3310 have X-ray detected sources coincident with nuclear regions; however, the steep NuSTAR spectra of both galaxies restricts these sources to be either low luminosity AGNs (L_{2-10 kev}/L_{Edd} \leq 10^{-5}) or non-AGNs in nature (e.g., ULXs or crowded X-ray sources that reach L_{2-10 kev} \sim 1040 erg s^{-1} cannot be ruled out). Combining our constraints on the 0.3-30 keV spectra of NGC 3256 and NGC 3310 with equivalent measurements for nearby star-forming galaxies M83 and NGC 253, we analyze the star formation rate (SFR) normalized spectra of these starburst galaxies. The spectra of all four galaxies show sharply declining power-law slopes at energies above 3-6 keV primarily due to ULX populations. Our observations therefore constrain the average spectral shape of galaxy-wide populations of luminous accreting binaries (i.e., ULXs). Interestingly, despite a completely different galaxy sample selection, emphasizing here a range of SFRs and stellar masses, these properties are similar to those of super-Eddington accreting ULXs that have been studied individually in a targeted NuSTAR ULX program. We also find that NGC 3310 exhibits a factor of ≈3-10 elevation of X-ray emission over the other star-forming galaxies due to a corresponding overabundance of ULXs. We argue that the excess of ULXs in NGC 3310 is most likely explained by the relatively low metallicity of the young stellar population in this galaxy, a property that is expected to produce an excess of luminous X-ray binaries for a given SFR.

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Organisations: National Space Institute, Astrophysics, Johns Hopkins University, NASA Goddard Space Flight Center, Harvard-Smithsonian Center for Astrophysics, University of California at Berkeley, Columbia University
Authors: Lehmer, B. D. (Ekstern), Tyler, J. B. (Ekstern), Hornschemeier, A. E. (Ekstern), Wik, D. R. (Ekstern), Yukita, M. (Ekstern), Antoniou, V. (Ekstern), Boggs, S. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Hailey, C. J.
The Athena Optics

The Advanced Telescope for High ENergy Astrophysics (Athena) was selected in 2014 as the second large class mission (L2) of the ESA Cosmic Vision Science Programme within the Directorate of Science and Robotic Exploration. The mission development is proceeding via the implementation of the system studies and in parallel a comprehensive series of technology preparation activities. [1-3]. The core enabling technology for the high performance mirror is the Silicon Pore Optics (SPO), a modular X-ray optics technology, which utilises processes and equipment developed for the semiconductor industry [4-31]. This paper provides an overview of the programmatic background, the status of SPO technology and give an outline of the development roadmap and activities undertaken and planned by ESA.

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Authors: Bavdaz, M. (Ekstern), Wille, E. (Ekstern), Shortt, B. (Ekstern), Fransen, S. (Ekstern), Collon, M. (Ekstern), Vacanti, G. (Ekstern), Guenther, R. (Ekstern), Yanson, A. (Ekstern), Vervest, M. (Ekstern), Haneveld, J. (Ekstern), van Baren, C. (Ekstern), Zukanik, K. (Ekstern), Christensen, F. (Intern), Krumrey, M. (Ekstern), Burwitz, V. (Ekstern), Pareschi, G. (Ekstern), Valsecchi, G. (Ekstern)
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The Broadband XMM-Newton and NuSTAR X-ray Spectra of Two Ultraluminous X-ray Sources in the Galaxy IC 342

We present results for two Ultraluminous X-ray Sources (ULXs), IC 342 X-1 and IC 342 X-2, using two epochs of XMM-Newton and NuSTAR observations separated by ~7 days. We observe little spectral or flux variability above 1 keV between epoch_1 with unabsorbed 0.3-30 keV luminosities being $1.04\pm0.08/-0.06 \times 10^{40}$ erg s$^{-1}$ for IC 342 X-1 and $7.40\pm0.20 \times 10^{39}$ erg s$^{-1}$ for IC 342 X-2, so that both were observed in a similar, luminous state. Both sources have a high absorbing column in excess of the Galactic value. Neither source has a spectrum consistent with a black hole binary in low/hard state, and both ULXs exhibit strong curvature in their broadband X-ray spectra. This curvature rules out models that invoke a simple reflection-dominated spectrum with a broadened iron line and no cutoff in the illuminating power-law continuum. X-ray spectrum of IC 342 X-1 can be characterized by a soft disk-like black body component at low energies and a cool, optically thick Comptonization continuum at high energies, but unique physical interpretation of the spectral components remains challenging. The broadband spectrum of IC 342 X-2 can be fit by either a hot (3.8 keV) accretion disk, or a Comptonized continuum with no indication of a seed photon population. Although the seed photon component may be masked by soft excess emission unlikely to be associated with the binary system, combined with the high absorption column, it is more plausible that the broadband X-ray emission arises from a simple thin blackbody disk component. Secure identification of the origin of the spectral components in these sources will likely require broadband spectral variability studies.
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Organisations: National Space Institute, Astrophysics, California Institute of Technology, Universite de Toulouse, University of Cambridge, University of California at Berkeley, University of Michigan
Authors: Rana, V. (Ekstern), Harrison, F. A. (Ekstern), Bachetti, M. (Ekstern), Walton, D. J. (Ekstern), Furst, F. (Ekstern), Barret, D. (Ekstern), Miller, J. M. (Ekstern), Fabian, A. C. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern)
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Web of Science (2008): Indexed yes
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Web of Science (2005): Indexed yes
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Accretion, Accretion disks, Black hole physics, X-rays: binaries, X-rays: individual (IC 342 X-1, IC 342 X-2)
We present spectral analyses of five Nuclear Spectroscopic Telescope Array and Swift observations of GX 339-4 taken during a failed outburst during the summer of 2013. These observations cover Eddington luminosity fractions in the range approximate to 0.9%-6%. Throughout this outburst GX 339-4 stayed in the hard state and all five observations show similar X-ray spectra, with a hard power law with a photon index near 1.6, and significant contribution from reflection. Using simple reflection models we find unrealistically high iron abundances. Allowing for different photon indices for the continuum incident on the reflector relative to the underlying observed continuum results in a statistically better fit and reduced iron abundances. With a photon index around 1.3, the input power law on the reflector is significantly harder than that which is directly observed. We study the influence of different emissivity profiles and geometries and consistently find an improvement when using separate photon indices. The inferred inner accretion disk radius is strongly model dependent, but we do not find evidence for a truncation radius larger than 100 r_g in any model. The data do not allow independent spin constraints, but the results are consistent with the literature (i.e., a > 0). Our best-fit models indicate an inclination angle in the range 40 degrees-60 degrees, consistent with limits on the orbital inclination but higher than reported in the literature using standard reflection models. The iron line around 6.4 keV is clearly broadened, and we detect a superimposed narrow core as well. This core originates from a fluorescent region outside the influence of the strong gravity of the black hole. Additionally, we discuss possible geometries.
The Compton hump and variable blue wing in the extreme low-flux NuSTAR observations of 1H0707-495
The narrow-line Seyfert I galaxy, 1H0707-495, has been well observed in the 0.3-10 keV band, revealing a dramatic drop in flux in the iron K alpha band, a strong soft excess, and short time-scale reverberation lags associated with these spectral features. In this paper, we present the first results of a deep 250-ks NuSTAR (Nuclear Spectroscopic Telescope Array) observation of 1H0707-495, which includes the first sensitive observations above 10 keV. Even though the NuSTAR observations caught the source in an extreme low-flux state, the Compton hump is still significantly detected. NuSTAR, with its high effective area above 7 keV, clearly detects the drop in flux in the iron Ka band, and by comparing these observations with archival XMM-Newton observations, we find that the energy of this drop increases with increasing flux. We discuss possible explanations for this, the most likely of which is that the drop in flux is the blue wing of the relativistically broadened iron K alpha emission line. When the flux is low, the coronal source height is low, thus enhancing the most gravitationally redshifted emission.

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Organisations: National Space Institute, Astrophysics, California Institute of Technology, University of California at Berkeley, Columbia University, Università degli Studi Roma Tre, University of Cambridge
Authors: Kara, E. (Ekstern), Fabian, A. C. (Ekstern), Lohtfink, A. M. (Ekstern), Parker, M. L. (Ekstern), Walton, D. J. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Matt, G. (Ekstern)
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The corona of the broad-line radio galaxy 3C 390.3
We present the results from a joint Suzaku/NuSTAR broadband spectral analysis of 3C 390.3. The high quality data enables us to clearly separate the primary continuum from the reprocessed components allowing us to detect a high energy spectral cut-off ($E_{\text{cut}} = 117\pm14\pm18$ keV), and to place constraints on the Comptonization parameters of the primary continuum for the first time. The hard over soft compactness is $69\pm24\pm12$ and the optical depth is $4.1\pm3.6\pm0.5$, this leads to an electron temperature of $30\pm8\pm32$ keV. Expanding our study of the Comptonization spectrum to the optical/UV by studying the simultaneous Swift-UVOT data, we find indications that the compactness of the corona allows only a small fraction of the total UV/optical flux to be Comptonized. Our analysis of the reprocessed emission show that 3C 390.3 only has a small amount of reflection ($R \approx 0.3$), and of that the vast majority is from distant neutral matter. However, we also discover a soft-X-ray excess in the source, which can be described by a weak ionized reflection component from the inner parts of the accretion disk. In addition to the backscattered emission, we also detect the highly ionized iron emission lines Fe xxv and Fe xxvi.
The DTU13 MSS (Mean Sea Surface) and MDT (Mean Dynamic Topography) from 20 Years of Satellite Altimetry

The DTU13MSS is the latest release of the global high resolution mean sea surface (MSS) from DTU Space. The new MSS is based on multi-mission satellite altimetry from 10 different satellites. Three major advances have been made in order to release the new MSS. The time series have been extended to 20 years from 17 years used for DTU10MSS creating the first multi-decadal MSS. Secondly, the DTU13MSS ingest Cryosat-2 LRM and SAR data as well as 1 year of Jason-1 geodetic mission as part as it end-of-life mission between May 2012 and June 2013. Finally, the availability of Cryosat-2 SAR altimetry enables the determination of sea level in leads in the ice, which has enabled us to derive an accurate MSS all the way to 88°N.

With the availability to determine the geoid with higher accuracy than ever before due to the launch of the GRACE and GOCE satellites, is hence become possible to derive a satellite only mean dynamic topography (MDT) from the difference between the MSS and the geoid. Here the DTU13MSS and DTU13MDT are presented and we demonstrate how these can be used to derive realistic geostrophic currents in the world’s ocean comparable to oceanographic derived MDT.
The EChO science case

The discovery of almost two thousand exoplanets has revealed an unexpectedly diverse planet population. We see gas giants in few-day orbits, whole multi-planet systems within the orbit of Mercury, and new populations of planets with masses between that of the Earth and Neptune—all unknown in the Solar System. Observations to date have shown that our Solar System is certainly not representative of the general population of planets in our Milky Way. The key science questions that urgently need addressing are therefore: What are exoplanets made of? Why are planets as they are? How do planetary systems work and what causes the exceptional diversity observed as compared to the Solar System? The EChO (Exoplanet Characterisation Observatory) space mission was conceived to take up the challenge to explain this diversity in terms of formation, evolution, internal structure and planet and atmospheric composition. This requires in-depth spectroscopic knowledge of the atmospheres of a large and well-defined planet sample for which precise physical, chemical and dynamical information can be obtained. In order to fulfil this ambitious scientific program, EChO was designed as a dedicated survey mission for transit and eclipse spectroscopy capable of observing a large, diverse and well-defined planet sample within its 4-year mission lifetime. The transit and eclipse spectroscopy method, whereby the signal from the star and planet are differentiated using knowledge of the planetary ephemerides, allows us to measure atmospheric signals from the planet at levels of at least 10−4 relative to the star. This can only be achieved in conjunction with a carefully designed stable payload and satellite platform. It is also necessary to provide broad instantaneous wavelength coverage to detect as many molecular species as possible, to probe the thermal structure of the planetary atmospheres and to correct for the contaminating effects of the stellar photosphere. This requires wavelength coverage of at least 0.55 to 11 μm with a goal of covering from 0.4 to 16 μm. Only modest spectral resolving power is needed, with R ~ 300 for wavelengths less than 5 μm and R ~ 30 for wavelengths greater than this. The transit spectroscopy technique means that no spatial resolution is required. A telescope collecting area of about 1 m2 is sufficiently large to achieve the necessary spectro-photometric precision: for the Phase A study a 1.13 m2 telescope, diffraction limited at 3 μm has been adopted. Placing the satellite at L2 provides a cold and stable thermal environment as well as a large field of regard to allow efficient time-critical observation of targets randomly distributed over the sky. EChO has been conceived to achieve a single goal: exoplanet spectroscopy. The spectral coverage and signal-to-noise to be achieved by EChO, thanks to its high stability and dedicated design, would be a game changer by allowing atmospheric composition to be measured with unparalleled exactness: at least a factor 10 more precise and a factor 10 to 1000 more accurate than current observations. This would enable the detection of molecular abundances three orders of magnitude lower than currently possible and a fourfold increase from the handful of molecules detected to date. Combining these data with estimates of planetary bulk compositions from accurate measurements of their radii and masses, would allow degeneracies associated with planetary interior modelling to be broken, giving unique insight into the interior structure and elemental abundances of these alien worlds. EChO would allow scientists to study exoplanets both as a population and as individuals. The mission can target super-Earths, Neptune-like, and Jupiter-like planets, in the very hot to temperate zones (planet temperatures of 300–3000 K) of F to M-type host stars. The ECHO core science would be delivered by a three-tier survey. The ECHO Chemical Census: This is a broad survey of a few-hundred exoplanets, which allows us to explore the spectroscopic and chemical diversity of the exoplanet population as a whole. The ECHO Origin: This is a deep survey of a subsample of tens of exoplanets for which significantly higher signal to noise and spectral resolution spectra can be obtained to explain the origin of the exoplanet diversity (such as formation mechanisms, chemical processes, atmospheric escape). The ECHO Rosetta Stones: This is an ultra-high accuracy survey targeting a subsample of select exoplanets. These will be the bright “benchmark” cases for which a large number of measurements would be taken to explore temporal variations, and to obtain two and three dimensional spatial information on the atmospheric conditions through eclipse-mapping techniques. If EChO were launched today, the exoplanets currently observed are sufficient to provide a large and diverse sample. The Chemical Census survey would consist of >160 exoplanets with a range of planetary sizes, temperatures, orbital parameters and stellar host properties. Additionally, over the next 10 years, several new ground- and space-based transit photometric surveys and missions will come on-line (e.g. NGTS, CHEOPS, TESS, PLATO), which will specifically focus on finding bright, nearby systems. The current rapid rate of discovery would allow the target list to be further optimised in the years prior to EChO’s launch and enable the atmospheric characterisation of hundreds of planets.

General information

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Organisations: National Space Institute, Astrophysics, Mechanical Engineering, University College London, Observatoire de Paris, ESTEC, National Institute for Astrophysics, Institut d’Astrophysique Spatiale, Institut d’Estudis Espacials de Catalunya, Leiden University, University of Copenhagen, Rutherford Appleton Laboratory, University of Geneva
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Publication information
The hard X-ray spectrum of NGC 5506 as seen by *NuSTAR*

*NuSTAR* observed the bright Compton-thin, narrow-line Seyfert 1 galaxy, NGC 5506, for about 56 ks. In agreement with past observations, the spectrum is well fitted by a power law with $\Gamma \sim 1.9$, a distant reflection component and narrow ionized iron lines. A relativistically blurred reflection component is not required by the data. When an exponential high-energy cutoff is added to the power law, a value of $720^{+130/-190}$ keV (90 per cent confidence level) is found. Even allowing for systematic uncertainties, we find a 3 sigma lower limit to the high-energy cutoff of 350 keV, the highest lower limit to the cutoff energy found so far in an AGN by *NuSTAR*. 
The hard X-ray view of the young supernova remnant G1.9+0.3

NuSTAR observed G1.9+0.3, the youngest known supernova remnant in the Milky Way, for 350 ks and detected emission up to ~30 keV. The remnant's X-ray morphology does not change significantly across the energy range from 3 to 20 keV. A combined fit between NuSTAR and Chandra shows that the spectrum steepens with energy. The spectral shape can be well fitted with synchrotron emission from a power-law electron energy distribution with an exponential cutoff with no additional features. It can also be described by a purely phenomenological model such as a broken power law or a power law with an exponential cutoff, though these descriptions lack physical motivation. Using a fixed radio flux at 1 GHz of 1.17 Jy for the synchrotron model, we get a column density of \( N_H = (7.23 \pm 0.07) \times 10^{22} \text{ cm}^{-2} \), a spectral index of \( \alpha = 0.633 \pm 0.003 \), and a roll-off frequency of \( \nu_{rolloff} = (3.07 \pm 0.18) \times 10^{17} \text{ Hz} \). This can be explained by particle acceleration, to a maximum energy set by the finite remnant age, in a magnetic field of about 10 \( \mu \text{G} \), for which our roll-off implies a maximum energy of about 100 TeV for both electrons and ions. Much higher magnetic-field strengths would produce an electron spectrum that was cut off by radiative losses, giving a much higher roll-off frequency that is independent of magnetic-field strength. In this case, ions could be accelerated to much higher energies. A search for \(^{44}\text{Ti} \) emission in the 67.9 keV line results in an upper limit of \( 1.5 \times 10^{-5} \text{ photons cm}^{-2} \text{ s}^{-1} \) assuming a line width of 4.0 keV (1 sigma).

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The IAXO Helioscope

The IAXO (International Axion Experiment) is a fourth generation helioscope with a sensitivity, in terms of detectable signal counts, at least 104 better than CAST phase-I, resulting in sensitivity on gamma ray one order of magnitude better. To achieve this performance IAXO will count on a 8-coil toroidal magnet with 60 cm diameter bores and equipped with X-ray focusing optics into 0.20 cm² spots coupled to ultra-low background Micromegas X-ray detectors. The magnet will be on a platform that will allow solar tracking for 12 hours per day. The next short term objectives are to prepare a Technical Design Report and to construct the first prototypes of the hardware main ingredients: demonstration coil, X-ray optics and low background detector while refining the physics case and studying the feasibility studies for Dark Matter axions.

General information

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The impact of snow depth, snow density and ice density on sea ice thickness retrieval from satellite radar altimetry: results from the ESA-CCI Sea Ice ECV Project Round Robin Exercise

We assess different methods and input parameters, namely snow depth, snow density and ice density, used in freeboard-to-thickness conversion of Arctic sea ice. This conversion is an important part of sea ice thickness retrieval from spaceborne altimetry. A data base is created comprising sea ice freeboard derived from satellite radar altimetry between 1993 and 2012 and co-locate observations of total (sea ice + snow) and sea ice freeboard from the Operation Ice Bridge (OIB) and CryoSat Validation Experiment (CryoVEx) airborne campaigns, of sea ice draft from moored and submarine upward looking sonar (ULS), and of snow depth from OIB campaigns, Advanced Microwave Scanning Radiometer (AMSR-E) and the Warren climatology (Warren et al., 1999). We compare the different data sets in spatiotemporal scales where satellite radar altimetry yields meaningful results. An inter-comparison of the snow depth data sets emphasizes the limited usefulness of Warren climatology snow depth for freeboard-to-thickness conversion under current Arctic Ocean conditions reported in other studies. We test different freeboard-to-thickness and freeboard-to-draft conversion approaches. The mean observed ULS sea ice draft agrees with the mean sea ice draft derived from radar altimetry within the uncertainty bounds of the data sets involved. However, none of the approaches are able to reproduce the seasonal cycle in sea ice draft observed by moored ULS. A sensitivity analysis of the freeboard-to-thickness conversion suggests that sea ice density is as important as snow depth.

General information
State: Published
Organisations: National Space Institute, Geodynamics, University of Hamburg, Nansen Environmental and Remote Sensing Center, Finnish Meteorological Institute, University of Cambridge
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.27 SNIP 1.523 CiteScore 4.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.319 SNIP 1.616 CiteScore 3.81
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Based on magnetic field data sampled by the Swarm satellite constellation it is possible for the first time to determine uniquely F region currents at low latitudes. Initial results are presented from the first 200 days of formation flight (17 April to 5 November 2014). Detailed results have been obtained for interhemispheric field-aligned currents connecting the solar quiet day magnetic variation (Sq) current systems in the two hemispheres. We obtain prominent currents from the Southern (winter) Hemisphere to the Northern around noon. Weaker currents in opposite direction are observed during morning and evening hours. Furthermore, we could confirm the existence of vertical currents above the dip equator, downward around noon and upward around sunset. For both current systems we present and discuss longitudinal variations.
The NuSTAR Extragalactic Surveys: Initial Results and Catalog from the Extended Chandra Deep Field South

We present the initial results and the source catalog from the Nuclear Spectroscopic Telescope Array (NuSTAR) survey of the Extended Chandra Deep Field South (hereafter, ECDFS)—currently the deepest contiguous component of the NuSTAR extragalactic survey program. The survey covers the full =30’ × 30’ area of this field to a maximum depth of ≈360 ks (=220 ks when corrected for vignetting at 3–24 keV), reaching sensitivity limits of ≈1.3 × 10⁻¹⁴ erg s⁻¹ cm⁻² (3–8 keV), ≈3.4 × 10⁻¹⁴ erg s⁻¹ cm⁻² (8–24 keV), and ≈3.0 × 10⁻¹⁴ erg s⁻¹ cm⁻² (3–24 keV). A total of 54 sources are detected over the full field, although five of these are found to lie below our significance threshold once contaminating flux from neighboring (i.e., blended) sources is taken into account. Of the remaining 49 that are significant, 19 are detected in the 8–24 keV band. The 8–24 to 3–8 keV band ratios of the 12 sources that are detected in both bands span the range 0.39–1.7, corresponding to a photon index range of G ≈ 0.5–2.3, with a median photon index of G = 1.70 ± 0.52. Theredshifts of the 49 sources in our main sample span the range z = 0.21–2.7, and their rest-frame 10–40 keV luminosities (derived from the observed 8–24 keV fluxes) span the range L₁₀⁻⁴₀ keV (0.7–300) 10⁻⁴³ 1 − sampling below the “knee” of the X-ray luminosity function out to z ~ 0.8-1. Finally, we identify oneNuSTAR source that has neither a Chandra nor an XMM-Newton counterpart, but that shows evidence of nuclearactivity at infrared wavelengths and thus may represent a genuine, new X-ray source detected by NuSTAR in the ECDFS.
The NuSTAR Extragalactic Surveys: Overview And Catalog From The Cosmos Field

To provide the census of the sources contributing to the X-ray background peak above 10 keV, Nuclear Spectroscopic Telescope Array (NuSTAR) is performing extragalactic surveys using a three-tier "wedding cake" approach. We present the NuSTAR survey of the COSMOS field, the medium sensitivity, and medium area tier, covering 1.7 deg² and overlapping with both Chandra and XMM-Newton data. This survey consists of 121 observations for a total exposure of ∼3 Ms. To fully exploit these data, we developed a new detection strategy, carefully tested through extensive simulations. The survey sensitivity at 20% completeness is $5.9 \times 10^{-14}$, $2.9 \times 10^{-14}$, and $6.4 \times 10^{-14}$ erg cm⁻² s⁻¹ in the 3-24, 3-8, and 8-24 keV bands, respectively. By combining detections in 3 bands, we have a sample of 91 NuSTAR sources with $10^{42}$-10^{45.5} erg s⁻¹ luminosities and redshift $z = 0.04$-2.5. Thirty-two sources are detected in the 8-24 keV band with fluxes similar to 100 times fainter than sources detected by Swift-BAT. Of the 91 detections, all but 4 are associated with a Chandra and/or XMM-Newton point-like counterpart. One source is associated with an extended lower energy X-ray source. We present the X-ray (hardness ratio and luminosity) and optical-to-X-ray properties. The observed fraction of candidate Compton-thick active galactic nuclei measured from the hardness ratio is between 13%-20%. We discuss the spectral properties of NuSTAR J100259+0220.6 (ID 330) at $z = 0.044$, with the highest hardness ratio in the entire sample. The measured column density exceeds $10^{24}$ cm⁻², implying the source is Compton-thick. This source was not previously recognized as such without the >10 keV data.

General information
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Organisations: National Space Institute, Astrophysics, Dartmouth College, Columbia University, Yale University, California Institute of Technology, Pontificia Universidad Catolica de Chile, Durham University, Harvard-Smithsonian Center for Astrophysics, University of California at Berkeley, Pennsylvania State University, National Institute for Astrophysics, ASI Science Data Center, Georgia Institute of Technology, NASA Goddard Space Flight Center, Universidad de Concepcion, University of Sheffield
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The LOFT perspective on neutron star thermonuclear bursts
This is a White Paper in support of the mission concept of the Large Observatory for X-ray Timing (LOFT), proposed as a medium-sized ESA mission. We discuss the potential of LOFT for the study of thermonuclear X-ray bursts on accreting neutron stars. For a summary, we refer to the paper.

General information
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Organisations: National Space Institute, Astrophysics, Tata Institute of Fundamental Research, Michigan State University, University of Amsterdam, University of Cambridge, Monash University, Universitat Politècnica de Catalunya, Universidad de La Laguna, University of Maryland, Los Alamos National Laboratory, University of Groningen, Columbia University, University of Turku, Nicolaus Copernicus Astronomical Center, The Institute of Chemical and Physical Research, University of Tubingen, University of Basel, Massachusetts Institute of Technology, University of California, Santa Cruz,
The Mid-Infrared Instrument for the James Webb Space Telescope, II: Design and Build

The Mid-InfraRed Instrument (MIRI) on the James Webb Space Telescope (JWST) provides measurements over the wavelength range 5 to 28.5 μm. MIRI has, within a single "package," four key scientific functions: photometric imaging, coronagraphy, single-source low-spectral resolving power (R similar to 100) spectroscopy, and medium-resolving power (R ∼ 1500 to 3500) integral field spectroscopy. An associated cooler system maintains MIRI at its operating temperature of <6.7 K. This paper describes the driving principles behind the design of MIRI, the primary design parameters, and their realization in terms of the "as-built" instrument. It also describes the test program that led to delivery of the tested and calibrated Flight Model to NASA in 2012, and the confirmation after delivery of the key interface requirements.

General information

State: Published
Organisations: National Space Institute, Mechanical Engineering, Astrophysics, ESTEC, Centre Spatial de Liège, Johns Hopkins University, University of Arizona, ASTRON, University Paris Diderot - Paris 7, INTA, Dublin Institute for Advanced Studies, NASA Goddard Space Flight Center
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The Mid-Infrared Instrument for the James Webb Space Telescope, I: Introduction

MIRI (the Mid-Infrared Instrument for the James Webb Space Telescope [JWST]) operates from 5 to 28.5 μm and combines over this range: (1) unprecedented sensitivity levels; (2) subarcsecond angular resolution; (3) freedom from atmospheric interference; (4) the inherent stability of observing in space; and (5) a suite of versatile capabilities including imaging, low- and medium-resolution spectroscopy (with an integral field unit), and coronography. We illustrate the potential uses of this unique combination of capabilities with various science examples: (1) imaging exoplanets; (2) transit and eclipse spectroscopy of exoplanets; (3) probing the first stages of star and planet formation, including identifying bioactive molecules; (4) determining star formation rates and mass growth as galaxies are assembled; and (5) characterizing the youngest massive galaxies.

General information
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Organisations: National Space Institute, Astrophysics, University of Arizona, The Royal Observatory Edinburgh, European Space Agency, Max-Planck-Institut fur Astrophysik, CAB/INTA-CSIC, Universiteit Gent, NASA Ames Research Center, University of Vienna, Chalmers University of Technology, University Paris Diderot - Paris 7, Johns Hopkins University, Dublin Institute for Advanced Studies, California Institute of Technology, Leiden University, KU Leuven
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The multi-layer variable absorbers in NGC 1365 revealed by XMM-Newton and NuSTAR

Between 2012 July and 2013 February, NuSTAR and XMM-Newton performed four long-look joint observations of the type 1.8 Seyfert, NGC 1365. We have analyzed the variable absorption seen in these observations in order to characterize the geometry of the absorbing material. Two of the observations caught NGC 1365 in an unusually low absorption state, revealing complexity in the multi-layer absorber that had previously been hidden. We find the need for three distinct zones of neutral absorption in addition to the two zones of ionized absorption and the Compton-thick torus previously seen in this source. The most prominent absorber is likely associated with broad-line region clouds with column densities of around \( \sim 10^{23} \text{ cm}^{-2} \) and a highly clumpy nature as evidenced by an occultation event in 2013 February. We also find evidence of a patchy absorber with a variable column around \( \sim 10^{22} \text{ cm}^{-2} \) and a line-of-sight covering fraction of 0.3-0.9, which
responds directly to the intrinsic source flux, possibly due to a wind geometry. A full-covering, constant absorber with a low column density of $\sim 1 \times 10^{22} \text{ cm}^{-2}$ is also present, though the location of this low density haze is unknown.

**General information**

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**Organisations:** National Space Institute, Astrophysics, California Institute of Technology, National Institute for Astrophysics, Harvard-Smithsonian Center for Astrophysics, Universidad de Valparaiso, Pontifícia Universidade Católica, University of California at Berkeley  
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Scopus rating (2016): CiteScore 5.26  
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BFI (2015): BFI-level 2  
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BFI (2014): BFI-level 2  
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Web of Science (2012): Indexed yes  
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Scopus rating (2011): CiteScore 5.46  
ISI indexed (2011): ISI indexed yes  
BFI (2010): BFI-level 2  
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BFI (2009): BFI-level 2  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 2  
Web of Science (2008): Indexed yes  
Web of Science (2007): Indexed yes  
Web of Science (2006): Indexed yes  
Web of Science (2005): Indexed yes  
Web of Science (2004): Indexed yes  
Web of Science (2003): Indexed yes
The Next Generation of Axion Helioscopes: The International Axion Observatory (IAXO)

The International Axion Observatory (IAXO) is a proposed 4th-generation axion helioscope with the primary physics research goal to search for solar axions via their Primakoff conversion into photons of 1 – 10 keV energies in a strong magnetic field. IAXO will achieve a sensitivity to the axion-photon coupling gain down to a few \(10^{-12}\) GeV\(^{-1}\) for a wide range of axion masses up to \(0.25\) eV. This is an improvement over the currently best (3rd generation) axion helioscope, the CERN Axion Solar Telescope (CAST), of about 5 orders of magnitude in signal strength, corresponding to a factor \(\sim 20\) in the axion photon coupling. IAXO's sensitivity relies on the construction of a large superconducting 8-coil toroidal magnet of 20 m length optimized for axion research. Each of the eight 60cm diameter magnet bores is equipped with x-ray optics focusing the signal photons into \(0.2\) cm\(^2\) spots that are imaged by very low background x-ray detectors. The magnet will be built into a structure with elevation and azimuth drives that will allow solar tracking for 12 hours each day. This contribution is a summary of our papers [1–3] and we refer to these for further details.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Department of Physics, Neutrons and X-rays for Materials Physics, Lawrence Livermore National Laboratory, Centre d’Etudes Nucléaires de Saclay, University of South Carolina, CERN, University of Trieste, Lawrence Berkeley National Laboratory, Dogus University, Universidad de Zaragoza, University of Haifa
Authors: Vogel, J. (Ekstern), Armengaud, E. (Ekstern), Avignone, F. (Ekstern), Betz, M. (Ekstern), Brax, P. (Ekstern), Brun, P. G. (Ekstern), Cantatore, G. (Ekstern), Carmona, J. (Ekstern), Carosi, G. (Ekstern), Caspers, F. (Ekstern), Caspi, S. (Ekstern), Cetin, S. (Ekstern), Chelouche, D. (Ekstern), Christensen, F. E. (Intern), Jakobsen, A. C. (Intern)
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Scopus rating (2012): SJR 0.28 SNIP 0.623 CiteScore 0.5
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The NuSTAR Extragalactic Survey: First Direct Measurements of the Greater Than Or Similar To 10 Kev X-Ray Luminosity Function For Active Galactic Nuclei At z > 0.1

We present the first direct measurements of the rest-frame 10-40 keV X-ray luminosity function (XLF) of active galactic nuclei (AGNs) based on a sample of 94 sources at 0.1 < z < 3, selected at 8-24 keV energies from sources in the Nuclear Spectroscopic Telescope Array (NuSTAR) extragalactic survey program. Our results are consistent with the strong evolution of the AGN population seen in prior, lower-energy studies of the XLF. However, different models of the intrinsic distribution of absorption, which are used to correct for selection biases, give significantly different predictions for the total number of sources in our sample, leading to small, systematic differences in our binned estimates of the XLF. Adopting a model with a lower intrinsic fraction of Compton-thick sources and a larger population of sources with column densities $N_H \sim 10^{23-24}$ cm$^{-2}$ or a model with stronger Compton reflection component (with a relative normalization of $R \sim 2$ at all luminosities) can bring extrapolations of the XLF from 2-10 keV into agreement with our NuSTAR sample. Ultimately, X-ray spectral analysis of the NuSTAR sources is required to break this degeneracy between the distribution of absorbing column densities and the strength of the Compton reflection component and thus refine our measurements of the XLF. Furthermore, the models that successfully describe the high-redshift population seen by NuSTAR tend to over-predict previous, high-energy measurements of the local XLF, indicating that there is evolution of the AGN population that is not fully captured by the current models.

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The NuSTAR View of Reflection and Absorption In NGC 7582

NGC 7582 is a well-studied X-ray bright Seyfert 2 with moderately heavy (N-H similar to 10(23)-10(24) cm(-2)), highly variable absorption and strong reflection spectral features. The spectral shape changed around the year 2000, dropping in observed flux and becoming much more highly absorbed. Two scenarios have been put forth to explain this spectral change: (1) the central X-ray source partially "shut off" around this time, decreasing in intrinsic luminosity, with a delayed decrease in reflection features due to the light-crossing time of the Compton-thick material or (2) the source became more heavily obscured, with only a portion of the power law continuum leaking through. NuSTAR observed NGC 7582 twice in 2012, two weeks apart, in order to quantify the reflection using high-quality data above 10 keV. We find that the most plausible scenario is that NGC 7582 has recently become more heavily absorbed by a patchy torus with a covering fraction of similar to 80%-90% and an equatorial column density of similar to 3 x 10(24) cm(-2). We find the need for an additional highly variable full-covering absorber with N-H = (4-6) x 10(23) cm(-2) in the line of sight, possibly associated with a hidden broad line region.

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Organisations: National Space Institute, Astrophysics, Pennsylvania State University, Universidad de Valparaiso, Pontificia Universidad Catolica de Chile, University of California at Berkeley, Columbia University, California Institute of Technology, ETH Zurich, NASA Goddard Space Flight Center, University of Southampton
Authors: Rivers, E. (Ekstern), Balokovic, M. (Ekstern), Arevalo, P. (Ekstern), Bauer, F. E. (Ekstern), Boggs, S. E. (Ekstern), Brandt, W. N. (Ekstern), Brightman, M. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Gandhi, P. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. (Ekstern), Koss, M. (Ekstern), Ricci, C. (Ekstern), Stern, D. (Ekstern), Walton, D. J. (Ekstern), Zhang, W. W. (Ekstern)
Number of pages: 9
The Photographic History of Greenland’s Glaciers – and how the historical data plays an important role in today’s glacier research

As the Greenland Ice Sheet and Greenland’s glaciers are continuing to loss mass at high rates, knowledge of their past response to climatic changes is ever important. By harvesting the archives for images, both terrestrial and airborne, we are able to expand the record of glacier observation by several decades, thus supplying crucial knowledge on glacier behavior to important climatic transitions such as the end of the Little Ice Age and the early 20th Century warming. Here we show how a large collection of historical aerial images portray the glacial response to the Little Ice Age deglaciation in Greenland and document frontal change throughout the 20th Century. A detailed story of the LIA-deglaciation is told by supplementing with terrestrial photos that capture the onset of retreat and high resolution aerial images that portray geomorphological evidence of the Little Ice Age maximum extent. This work is the result of several generations of Greenland researches and their efforts to portray and document the state of the glaciers, and highlights that while interpretations and conclusions may be challenged and changed through time, the raw observations remain extremely valuable. Finally, we also show how archival data besides photos may play an important role in future glacier research in Greenland.

General information
State: Published
Organisations: National Space Institute, Geodesy, Geological Survey of Denmark and Greenland, University of Bristol, University of Copenhagen, Natural History Museum of Denmark, University of Oregon, York University, Aarhus University, University of Oslo, Norwegian University of Science and Technology
Authors: Bjørk, A. A. (Ekstern), Kjeldsen, K. K. (Ekstern), Korsgaard, N. J. (Ekstern), Aagaard, S. (Ekstern), Andresen, C. S. (Ekstern), Bamber, J. (Ekstern), van den Broeke, M. (Ekstern), Colgan, W. (Ekstern), Funder, S. V. (Ekstern), Khan, S. A. (Intern), Larsen, N. K. (Ekstern), Machguth, H. (Ekstern), Nuth, C. (Ekstern), Schomacker, A. (Ekstern), Kjær, K. H. (Ekstern)
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The Seyfert 2 galaxy NGC 2110: hard X-ray emission observed by NuSTAR and variability of the iron Kα line

We present NuSTAR observations of the bright Seyfert 2 galaxy NGC 2110 obtained in 2012, when the source was at the highest flux level ever observed, and in 2013, when the source was at a more typical flux level. We include archival observations from other X-ray satellites, namely XMM-Newton, Suzaku, BeppoSAX, Chandra and Swift. Simultaneous NuSTAR and Swift broad-band spectra (in the 3-80 keV range) indicate a cutoff energy $E_c > 210$ keV, with no detectable contribution from Compton reflection. NGC 2110 is one of the very few sources where no evidence for distant Compton-thick scattering is found and, by using temporal information collected over more than a decade, we investigate variations of the iron Kα line on time-scales of years. The Fe K alpha line is likely the sum of two components: one constant (originating from distant Compton-thick material) and the other one variable and linearly correlated with the source flux (possibly arising from Compton-thin material much closer to the black hole).

General information
State: Published
Organisations: National Space Institute, Astrophysics, Università degli Studi Roma Tre, California Institute of Technology, Pontificia Universidade Católica, Georgia Institute of Technology, University of California at Berkeley
Authors: Marinucci, A. (Ekstern), Matt, G. (Ekstern), Bianchi, S. (Ekstern), Lu, T. N. (Ekstern), Arevalo, P. (Ekstern), Balokovic, M. (Ekstern), Ballantyne, D. (Ekstern), Bauer, F. E. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern)
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The Solar and Southern Oscillation Components in the Satellite Altimetry Data

With satellite altimetry data accumulating over the past two decades, the mean sea level (MSL) can now be measured to unprecedented accuracy. We search for physical processes which can explain the sea level variations and find that at least 70% of the variance in the annually smoothed detrended altimetry data can be explained as the combined effect of both the solar forcing and the El Niño-Southern Oscillation (ENSO). The phase of the solar component can be used to derive the different steric and eustatic contributions. We find that the peak to peak radiative forcing associated with the solar cycle is $1.33 \pm 0.34$ W/m², contributing a $4.4 \pm 0.8$ mm variation. The slow eustatic component (describing, for example, the cryosphere and large bodies of surface water) has a somewhat smaller peak to peak amplitude of $2.4 \pm 0.6$ mm. Its phase implies that warming the oceans increases the ocean water loss rate. Additional much smaller terms include a steric feedback term and a fast eustatic term. The ENSO contributes a peak to peak variation of $5.5 \pm 0.8$ mm, predominantly through a direct effect on the MSL and significantly less so indirectly through variations in the radiative forcing.

General information
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Organisations: Solar System Physics, National Space Institute, Sunclimate, City of London School, Princeton University
Authors: Howard, D. (Ekstern), Shaviv, N. J. (Ekstern), Svensmark, H. (Intern)
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  Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 2
  Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 2
  Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
  ISI indexed (2011): ISI indexed yes
  Web of Science (2011): Indexed yes
  BFI (2010): BFI-level 2
  Scopus rating (2010): SJR 3.056 SNIP 1.753
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 2
  Scopus rating (2009): SJR 2.85 SNIP 1.738
  Web of Science (2009): Indexed yes
The Swarm Initial Field Model for the 2014 geomagnetic field

Data from the first year of ESA’s Swarm constellation mission are used to derive the Swarm Initial Field Model (SIFM), a new model of the Earth’s magnetic field and its time variation. In addition to the conventional magnetic field observations provided by each of the three Swarm satellites, explicit advantage is taken of the constellation aspect by including East-West magnetic intensity gradient information from the lower satellite pair. Along-track differences in magnetic intensity provide further information concerning the North-South gradient. The SIFM static field shows excellent agreement (up to at least degree 60) with recent field models derived from CHAMP data, providing an initial validation of the quality of the Swarm magnetic measurements. Use of gradient data improves the determination of both the static field and its secular variation, with the mean misfit for East-West intensity differences between the lower satellite pair being only 0.12 nT.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, IT-Department, University Paris Diderot - Paris 7, German Research Centre for Geosciences, British Geological Survey, National Geophysical Data Center, Planetary Geodynamics Laboratory, Directorate of Earth Observation Programmes
Authors: Olsen, N. (Intern), Hulot, G. (Ekstern), Lesur, V. (Ekstern), Finlay, C. (Intern), Beggan, C. (Ekstern), Chulliat, A. (Ekstern), Sabaka, T. J. (Ekstern), Floberghagen, R. (Ekstern), Friis-Christensen, E. (Intern), Kotsiaros, S. (Intern), Tøffner-Clausen, L. (Intern)
Pages: 1092-1098
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Geophysical Research Letters
Volume: 42
ISSN (Print): 0094-8276
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<td>1999</td>
<td>BFI-level 1</td>
<td>SJR 1.163 CiteScore 2.353</td>
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The vitamin D content and consumer acceptability of vitamin D biofortified eggs

Biofortification of foods with vitamin D may offer an additional strategy to traditional fortification approaches as a means of bridging the gap between current vitamin D intakes and recent new recommendations. In the biofortification process, animal produce (such as, e.g., eggs, cultured fish, beef, pork, lamb, chicken) could have increased vitamin D and/or 25-hydroxyvitamin D (25(OH)D) contents by virtue of addition of vitamin D and/or 25-hydroxyvitamin D (HyD®; where permissible) to the livestock feeds. The aim of the present work was to examine the effect of additional vitamin D3 (D3) and/or HyD® in hen diets on total vitamin D activity of resulting eggs and to assess their consumer acceptability. Sixty laying hens (Hyline; n 15/group) were allocated to one of the following experimental diets: basal diet plus either 1500 IU D3 (T1); 3000 IU D3 (T2); 1500 IU D3 + 1500 IU HyD® (T3); or 3000 IU HyD® (T4) per kg diet for 6 weeks. The vitamin D3 and 25(OH)D content of pooled samples of egg yolks (at week 6) from each group were analysed in Denmark using a sensitive liquid chromatography with tandem MS method. Following analysis, the total vitamin D activity was calculated as vitamin D3 plus (25(OH)D X 5). The total vitamin D activity (mean ± SD; two separate pooled samples on separate days during week 6 per treatment) of eggs from diets T1, T2, T3 and T4 was 2.9±0.6, 3.8±0.3, 4.8±0.4, 5.1±0.8 µg/egg, respectively.

Sensory evaluation of boiled and fried eggs was carried out in two separate sensory analysis sessions using 20 naive assessors where four egg samples (one from each of T1 to T4), identified with random three digit codes, were presented to each panellist in duplicate. Sensory analysis was undertaken in the panel booths at the sensory laboratory in accordance with ISO (1988) international standard regulations. Hedonic (appearance, liking of flavour, liking of texture and overall acceptability) and intensity sensory analysis descriptors (yolk colour (yellow/orange), egg white (white/grey), sulphur flavour (none/extreme), sour (not/very), sweet (not/very), salty (not/very), odour (weak/strong) and off-flavour (none/extreme)) were determined. ANOVA-partial least squares regression (APLSR) of the sensory data using Unscrambler software (version 10·3) has shown no significant positive or negative correlations between dietary treatments and the sensory descriptors examined.

In conclusion, biofortification of eggs with vitamin D may be a useful additional approach for tackling low vitamin D intakes in the population. While addition (at the EU upper allowable levels) of D3 alone to the hen diets increased total vitamin D activity of eggs, addition of HyD® alone to the hen diet (at the EU upper allowable level) produced the highest total vitamin D activity in eggs. All the vitamin D-enhanced eggs were of equal acceptability to consumers.

The project was funded by the Irish Department of Agriculture and Food’s Food Institutional Research Measure (FIRM), funded under the National Development Plan 2007–2013.

General information
State: Published
Organisations: National Space Institute, Geodesy, University College Cork, University College Dublin
Authors: Hayes, A. (Ekstern), O'Grady, M. (Ekstern), Duffy, S. (Ekstern), Seamans, K. M. (Ekstern), Kerry, J. (Ekstern), Jakobsen, J. (Intern), O'Doherty, J. (Ekstern), Cashman, K. D. (Ekstern)
Number of pages: 1
Publication date: 2015

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Main Research Area: Technical/natural sciences
DOIs: 10.1017/S0029665115002852
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015

Tomographic Techniques for Radar Ice Sounding

Abstract Low frequency radars, also known as sounders, can be used for subsurface measurements of Earth’s massive ice sheets. Radar data are essential in improving ice sheet models for better prediction of the response of these ice sheets to global climate change. While airborne sounders are needed for detailed measurements of fast-flowing outlet glaciers, a space-based sounder is potentially capable of broad coverage with high spatial and uniform sampling over the interior of the ice sheets. For both types of systems, however, surface clutter that obscures the depth signal of interest is a major technical challenge.

This dissertation deals with tomographic techniques based on multiphase-center radars that represent state-of-the-art technology within the field of ice sounding. The use of advanced tomographic processing for clutter suppression is
investigated, which up to this point has been largely unexplored in the literature. The investigation also includes a theoretical study of beamforming and direction-of-arrival (DOA) estimation techniques. In addition to the primary treatment of clutter suppression, additional novel applications of tomography are also explored. Based on an experimental multi-phase-center dataset acquired with the POLarimetric Airborne Radar Ice Sounder (POLARIS), single-passtomographic surface clutter suppression capabilities are demonstrated for the system. Using repeat-pass POLARIS data, a method based on data-driven DOA estimation is used to show an along-track variation of the effective scattering center of the surface return, which is caused by varying penetration depth.

As an alternative to the traditional echogram, a new DOA representation that offers a better visualization of the desired signals and clutter is suggested. Based on this alternative presentation, a novel technique for discrimination of the desired bed return from strong surface clutter is presented. The technique is applied to data from the channel of the challenging Jakobshavn Glacier acquired with the Multi-channel Coherent Radar Depth Sounder/Imager (MCoRDS/I), where it is shown how the technique can be used to close some of the critical gaps in bed detection along the channel.

Finally, a geometric model is used to show how the across-track slope of the bed is related to the DOA pattern of the bed return. Based on this, a technique for estimation of the backscattering characteristics is presented. Furthermore, waveform analysis is investigated for estimation of the bed roughness.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing
Authors: Nielsen, U. (Intern), Dall, J. (Intern)
Number of pages: 188
Publication date: 2015

Uplift rates from a new high-density GPS network in Palmer Land indicate significant late Holocene ice loss in the southwestern Weddell Sea
The measurement of ongoing ice-mass loss and associated melt water contribution to sea-level change from regions such as West Antarctica is dependent on a combination of remote sensing methods. A key method, the measurement of changes in Earth's gravity via the GRACE satellite mission, requires a potentially large correction to account for the isostatic response of the solid Earth to ice-load changes since the Last Glacial Maximum. In this study, we combine glacial isostatic adjustment modelling with a new GPS dataset of solid Earth deformation for the southern Antarctic Peninsula to test the current understanding of ice history in this region. A sufficiently complete history of past ice-load change is required for glacial isostatic adjustment models to accurately predict the spatial variation of ongoing solid Earth deformation, once the independently-constrained effects of present-day ice mass loss have been accounted for. Comparisons between the GPS data and glacial isostatic adjustment model predictions reveal a substantial misfit. The misfit is localized on the southwestern Weddell Sea, where current ice models under-predict uplift rates by approximately 2 mm yr⁻¹. This under-prediction suggests that either the retreat of the ice sheet grounding line in this region occurred significantly later in the Holocene than currently assumed, or that the region previously hosted more ice than currently assumed. This finding demonstrates the need for further fieldwork to obtain direct constraints on the timing of Holocene grounding line retreat in the southwestern Weddell Sea and that GRACE estimates of ice sheet mass balance will be unreliable in this region until this is resolved.

General information
State: Published
Organisations: National Space Institute, Department of Applied Mathematics and Computer Science, Durham University, University of Tasmania, Newcastle University, British Antarctic Survey, University of Leeds, Delft University of Technology, Georgia Institute of Technology
Authors: Wolstencroft, M. (Ekstern), King, M. A. (Ekstern), Whitehouse, P. L. (Ekstern), Bentley, M. J. (Ekstern), Nield, G. A. (Ekstern), King, E. C. (Ekstern), McMillan, M. (Ekstern), Shepherd, A. (Ekstern), Barletta, V. R. (Intern), Bordoni, A. (Intern), Riva, R. E. (Ekstern), Didova, O. (Ekstern), Gunter, B. C. (Ekstern)
Pages: 737-754
Publication date: 2015
Main Research Area: Technical/natural sciences
We demonstrate that first differences of polar orbiting satellite magnetic data in the along-track direction can be used to obtain high resolution models of the lithospheric field. Along-track differences approximate the north–south magnetic field gradients for non-polar latitudes. In a test case, using 2 yr of low altitude data from the CHAMP satellite, we show that use of along-track differences of vector field data results in an enhanced recovery of the small scale lithospheric field, compared to the use of the vector field data themselves. We show that the along-track technique performs especially well in the estimation of near zonal spherical harmonic coefficients. Moreover, lithospheric field models determined using along-track differences are found to be less sensitive to the presence of unmodelled external field contributions and problems associated with the polar gap are ameliorated. Experiments in modelling the Earth's lithospheric magnetic field with along-track differences are presented here as a proof of concept. We anticipate that use of such along-track differences in combination with east–west field differences, as are now provided by the Swarm satellite constellation, will be important in building the next generation of lithospheric field models.
Validation of CryoSat-2 SAR mode based lake levels

Lake level serve as an important indicator of the climate and continuous measurements are therefore essential. Satellite radar altimetry has now been used successfully for more than two decades to measure lake level as an addition to gauge measurements. The technique has, due to the large footprint of conventional altimetry, primarily been used for large lakes. CryoSat-2, which was launched in 2010, carries the first altimeter that is able to operate in SAR mode. The along-track resolution is approximately 300 m in SAR mode thus enabling us to accurately monitor substantially smaller lakes. Here we evaluate the precision of the along-track mean lake levels derived from CryoSat-2 data for five lakes; Skanderborg sø, Mosse, and Arresø (Denmark), Okeechobee (US), and Vänern (Sweden) with a surface area ranging from 9 to 5600 km². Three of the lakes are compared with gauge data. As a reference we compare our results with water levels obtained from Envisat. We find that the along-track precision of the mean based on CryoSat-2 is a few centimeters, even for the small lakes, which is a significant improvement compared to previous missions such as Envisat. When validating against gauge data we find RMS values of differences between the estimated lake levels and in-situ gauge measurements of only 8 cm or less, after bias correcting the estimated lake levels. To estimate the along-track mean values we apply a novel approach. Instead of attempting to identify and remove the polluted observations we use a mixture distribution to describe the observation noise, which prevents the polluted observations from biasing our final reconstructed time series. These results
demonstrate the promising possibilities of the upcoming mission Sentinel-3, which potentially will be able to provide accurate time series even for small lakes.

**General information**

State: Published
Organisations: National Space Institute, Geodesy
Authors: Nielsen, K. (Intern), Stenseng, L. (Intern), Andersen, O. B. (Intern), Villadsen, H. (Intern), Knudsen, P. (Intern)
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Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Remote Sensing of Environment
Volume: 171
ISSN (Print): 0034-4257
Ratings:

BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
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Scopus rating (2014): SJR 3.881 SNIP 3.477 CiteScore 7.21
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.438 SNIP 3.088 CiteScore 5.72
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.786 SNIP 2.789
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.443 SNIP 2.486
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Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.911 SNIP 2.986
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.322 SNIP 2.766
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.616 SNIP 3.257
Web of Science (2005): Indexed yes
Water levels of lakes and Rivers observed from space

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Nielsen, K. (Intern), Villadsen, H. (Intern), Stenseng, L. (Intern), Andersen, O. B. (Intern), Knudsen, P. (Intern)
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Place of publication: Lyngby
Publisher: Technical University of Denmark (DTU)
Article number: S-11
Main Research Area: Technical/natural sciences
Conference: DTU Sustain Conference 2015, Lyngby, Denmark, 17/12/2015 - 17/12/2015
Electronic versions: S11_DTU_Sustain_2015.pdf

Bibliographical note
Poster presentation
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015

Wave propagation simulation of radio occultations based on ECMWF refractivity profiles
This paper describes a complete radio occultation simulation environment, including realistic refractivity profiles, wave propagation modeling, instrument modeling, and bending angle retrieval. The wave propagator is used to simulate radio occultation measurements. The radio waves are propagated through a refractivity field which has been calculated with the use of numerical weather prediction models. The numerical weather prediction model used in this paper is a model from the European Centre for Medium-Range Weather Forecasts (ECMWF). The wave propagator has been used to simulate a number of radio occultations. The output from the wave propagator simulator is used as input to a Full Spectrum Inversion retrieval module which calculates geophysical parameters. These parameters can be compared to the ECMWF atmospheric profiles. The comparison can be used to reveal system errors and get a better understanding of the physics. The wave propagation simulations will in this paper also be compared to real measurements. These radio occultations have been exposed to the same atmospheric conditions as the radio occultations simulated by the wave propagator. This comparison reveals that precise radio occultations can be simulated when the simulations are based on wave propagation and refractivity field inputs from a numerical weather prediction model.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: von Benzon, H. (Intern), Høeg, P. (Intern)
Pages: 778-788
Publication date: 2015
Main Research Area: Technical/natural sciences
Waves in the core and mechanical core-mantle interactions

This Chapter focuses on time-dependent uid motions in the core interior, which can be constrained by observations of the Earth's magnetic eld, on timescales which are short compared to the magnetic diusion time. This dynamics is strongly inuenced by the Earth's rapid rotation, which rigidies the motions in the direction parallel to the Earth's rotation axis. This property accounts for the signicance of the core-mantle topography. In addition, the stiffening of the uid in the direction parallel to the rotation axis gives rise to a magnetic diusion layer attached to the core-mantle boundary, which would otherwise be dispersed by Alfvén waves. This Chapter complements the descriptions of large-scale ow in the core (8.04), of turbulence in the core (8.06) and of core-mantle interactions (8.12), which can all be found in this volume. We rely on basic magnetohydrodynamic theory, including the derivation of the induction equation from Ohm's law and Maxwell equations, as presented in Chapter (8.03).

General information
State: Published
Organisations: National Space Institute, Geomagnetism, Grenoble-Alpes University
Authors: Jault, D. (Ekstern), Finlay, C. (Intern)
Pages: 225-245
Publication date: 2015

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Title of host publication: Treatise on Geophysics : Core Dynamics
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Publisher: Elsevier
Editor: Schubert, G.
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Earth's core, Core-mantle topography, Torsional waves, Rossby waves, Quasi-geostrophy
DOIs: 10.1016/B978-0-444-53802-4.00150-0
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Westward tilt of low-latitude plasma blobs as observed by the Swarm constellation

In this study we investigate the three-dimensional structure of low-latitude plasma blobs using multi-instrument and multisatellite observations of the Swarm constellation. During the early commissioning phase the Swarm satellites were flying at the same altitude with zonal separation of about 0.5 degrees in geographic longitude. Electron density data from the three satellites constrain the blob morphology projected onto the horizontal plane. Magnetic field deflections around blobs, which originate from field-aligned currents near the irregularity boundaries, constrain the blob structure projected onto the plane perpendicular to the ambient magnetic field. As the two constraints are given for two noncoplanar surfaces, we can get information on the three-dimensional structure of blobs. Combined observation results suggest that blobs are contained within tilted shells of geomagnetic flux tubes, which are similar to the shell structure of equatorial plasma bubbles suggested by previous studies.

General information
State: Published
Organisations: National Space Institute, IT-Department, Measurement and Instrumentation Systems, Korea Astronomy and Space Science Institute, German Research Centre for Geosciences, Uppsala University
Authors: Park, J. (Ekstern), Luehr, H. (Ekstern), Michaelis, I. (Ekstern), Stolle, C. (Ekstern), Rauberg, J. (Ekstern), Buchert, S. (Ekstern), Gill, R. (Ekstern), Merayo, J. M. (Intern), Brauer, P. (Intern)
Pages: 3187-3197
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Geophysical Research: Space Physics
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 2.272 SNIP 1.475
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.36 SJR 2.369 SNIP 1.558
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.754 SNIP 1.605 CiteScore 3.39
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.853 SNIP 1.757 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.088 SNIP 1.809 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.917 SNIP 1.522 CiteScore 2.93
ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.018 SNIP 1.474 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.056 SNIP 1.753
Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 2.85 SNIP 1.738
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.826 SNIP 1.529
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.835 SNIP 1.471
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.034 SNIP 1.627
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.855 SNIP 1.417
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.984 SNIP 1.643
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.948 SNIP 1.847
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.784 SNIP 1.877
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 3.86 SNIP 1.692
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 3.94 SNIP 1.845
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 3.675 SNIP 1.711
Original language: English
DOIs:
10.1002/2014JA020965
X-ray optics in new instruments for astro- and astroparticle physics

Discovering new phenomena in physics require ever larger and more advanced instruments in order to detect either fundamental particles or energetic events in the universe. This thesis describes the work done on three separate X-ray telescopes, one for astrophysics and two for astroparticle physics; all of which makes use of grazing incidence reflecting X-ray optics.

Reflective coatings using various materials on Silicon Pore Optic (SPO) substrates were investigated for the European Athena large X-ray telescope mission. Ir/B₄C single bilayer and multilayer coatings were characterised and qualified for long term stability and reflectivity performance. A Cr sublayer under an Ir/B₄C coating was seen to mitigate the film stress; additionally, Ir coatings were found to show a smoothening effect when deposited onto a rough Cr surface. The coating production upscaling to 210,000 SPO substrates coated over a two year period is discussed and a multi chamber solution is described.

An X-ray telescope for the CAST helioscope at CERN was designed, optimised, produced and installed in order to improve the sensitivity of the helioscope. The installed telescope focuses X-rays, converted from axions through the Primakoff effect, into a detector area 400 times smaller than before. Measurements using an X-ray source shows the telescope behaving as calculated through ray tracing.

A successor to the CAST helioscope named the International AXion Observatory (IAXO) is in the definition phase and X-ray telescopes to the much larger instrument was designed. Software was developed to calculate the optimal focal length based on estimated telescope figure error and angular size of the sun.

A new software solution for the coating facility at DTU Space was developed using the SPEC software package, improving the flexibility and capability of the setup. The instruments connected to the coating chamber were all implemented. Coatings for the CAST X-ray telescope and Athena coating qualifications were done using the new software.

General information
State: Published
Organisations: National Space Institute, Astrophysics
Authors: Jakobsen, A. C. (Intern), Christensen, F. E. (Intern)
Number of pages: 177
Publication date: 2015

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Main Research Area: Technical/natural sciences
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Publication: Research › Ph.D. thesis – Annual report year: 2016

Spisekammer i tusmørkezonen

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State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
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Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015
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General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
Publication date: 26 Nov 2014

Publication information
Type: Blog
Source/Publisher: Ingeniøren
Main Research Area: Technical/natural sciences
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http://ing.dk/blog/ingen-hints-i-titlen-172522
Publication: Communication › Internet publication – Annual report year: 2014

Hvor mange bliver vi?

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 11
Publication date: 14 Nov 2014

Publication information
Pages (from-to): 11
Newspaper: Weekendavisen
Ratings:
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Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

DTUSAT 2 Close Approach Notification

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
Publication date: 3 Nov 2014

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Source/Publisher: Ingeniøren
Main Research Area: Technical/natural sciences
Links:
http://ing.dk/blog/dtusat-2-close-approach-notification-171510
Publication: Communication › Internet publication – Annual report year: 2014

Designing garbage-free reversible implementations of the integer cosine transform

Discrete linear transformations are important tools in information processing. Many such transforms are injective and therefore prime candidates for a physically reversible implementation into hardware. We present here reversible integer cosine transformations on n input integers. The resulting reversible circuit is able to perform both the forward transform and the inverse transform. The detailed structure of such a reversible design strongly depends on the odd prime factors of the determinant of the transform: whether those are of the form $2^k \pm 1$ or of the form $2^k \pm 2^l \pm 1$ or neither of these forms.

General information
State: Published
Organisations: National Space Institute, Department of Applied Mathematics and Computer Science, Algorithms and Logic, Ghent University, University of Copenhagen, University of Bremen, Nanzan University
Garbage-free multiplication, Integer cosine transform, Reversible computation

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Dronerne og folkeretten

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 7
Publication date: 12 Sep 2014

Publication information
Pages (from-to): 7
Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015
Og isen smelter

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 4
Publication date: 1 Aug 2014

Publiction information
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Newspaper: Weekendavisen
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

Hvem tog livet af de store dyr?

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Pages: 5
Publication date: 27 Jun 2014

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Newspaper: Weekendavisen
Ratings:
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Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

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Organisations: National Space Institute, Measurement and Instrumentation Systems
Authors: Fléron, R. (Intern)
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Source/Publisher: Ingeniøren
Main Research Area: Technical/natural sciences
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http://ing.dk/blog/tleerne-opdateret-169279
Publication: Communication › Internet publication – Annual report year: 2014

T-18 timer og 30 minutter

General information
State: Published
Organisations: National Space Institute, Measurement and Instrumentation Systems
Methods, Devices and Computer Program Products Providing for Establishing a Model for Emulating a Physical Quantity Which Depends on at Least One Input Parameter, and Use Thereof

The present invention proposes methods, devices and computer program products. To this extent, there is defined a set \( X \) including \( N \) distinct parameter values \( x_i \) for at least one input parameter \( x \), \( N \) being an integer greater than or equal to 1, first measured the physical quantity \( P_{m1} \) for each of the \( N \) distinct parameter values \( x_i \) of the at least one input parameter \( x \), while keeping all other input parameters fixed, constructed a Vandermonde matrix \( VM \) using the set of \( N \) parameter values \( x_i \) of the at least one input parameter \( x \), and computed the model \( W \) for emulating the physical quantity \( P \) based on the Vandermonde matrix and the first measured physical quantity according to the equation \( W = (VM^TVM)^{-1}VM^TP_{m1} \). The model is iteratively refined so as to obtained a desired emulation precision.; The model can later be used to emulate the physical quantity based on input parameters or logs taken from the field and thereby support device design optimization.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Musiige, D. (Ekstern), Laulagnet, V. (Ekstern), Anton, F. (Intern)
1ES 0033+595 found in a very high state by INTEGRAL

During recent Galactic Plane Scan survey observations (GPS, PI: A. Bazzano) performed between Dec 2, 2014 (08:47 UTC) and Dec 3, 2014 (00:26 UTC), INTEGRAL detected 1ES 0033+595 with both JEM-X and IBIS/ISGRI instruments. 1ES 0033+595 is a blazar near the Galactic plane belonging to the BL Lac type; the source has recently been reported as one of the 50 or so blazars detected at TeV energies (Aleksic et al. 2014, http://arxiv.org/abs/1410.7059v1 ). 1ES 0033+595 was found in the combined JMX1+2 mosaic (effective exposure of 3.1 ksec, 3-10 keV band) with a flux of 20 +/- 2 mCrab (3.4 x 10^-10 erg/cm2/s) corresponding to a 10 sigma significance. It is also detected at higher energies (in JEM-X2 only), with a flux of 21 +/-5 mCrab (or 2.5 x 10^-10 erg/cm2/s) at 4 sigma level (effective exposure of 1.2 ksec, 10-25 keV band). At even higher energies, IBIS/ISGRI found 1ES 0033+595 at a flux level of 13.6 +/-2 mCrab (10^-10 erg/cm2/s) in the 18-40 keV band (13 sec, about 7 sigma) while a 3 sigma upper limit of 11 mCrab (10^-10 erg/cm2/s) is provided in the 40-100 keV band.

Using data collected from the ASDC SED Builder tool (http://tools.asdc.asi.it/SED/) we notice that this is the highest X-ray flux so far reported for this BL Lac object. The source is routinely monitored by various instruments including the Swift/XRT telescope: an observation performed on Nov 23 2014 gives a 2-10 keV flux around 10^-10 erg/cm2/s indicating that 1ES0033+595 has been in a high flux state for sometime now. Multiwaveband observations of the source are strongly encouraged.
3D Hilbert Space Filling Curves in 3D City Modeling for Faster Spatial Queries

The advantages of three dimensional (3D) city models can be seen in various applications including photogrammetry, urban and regional planning, computer games, etc. They expand the visualization and analysis capabilities of Geographic Information Systems on cities, and they can be developed using web standards. However, these 3D city models consume much more storage compared to two dimensional (2D) spatial data. They involve extra geometrical and topological information together with semantic data. Without a proper spatial data clustering method and its corresponding spatial data access method, retrieving portions of and especially searching these 3D city models, will not be done optimally. Even though current developments are based on an open data model allotted by the Open Geospatial Consortium (OGC) called CityGML, its XML-based structure makes it challenging to cluster the 3D urban objects. In this research, the authors propose an opponent data constellation technique of space-filling curves (3D Hilbert curves) for 3D city model data representation. Unlike previous methods, that try to project 3D or n-dimensional data down to 2D or 3D using Principal Component Analysis (PCA) or Hilbert mappings, in this research, they extend the Hilbert space-filling curve to one higher dimension for 3D city model data implementations. The query performance was tested for single object, nearest neighbor and range search queries using a CityGML dataset of 1,000 building blocks and the results are presented in this paper. The advantages of implementing space-filling curves in 3D city modeling will improve data retrieval time by means of optimized 3D adjacency, nearest neighbor information and 3D indexing. The Hilbert mapping, which maps a sub-interval of the ([0,1]) interval to the corresponding portion of the d-dimensional Hilbert's curve, preserves the Lebesgue measure and is Lipschitz continuous. Depending on the applications, several alternatives are possible in order to cluster spatial data together in the third dimension compared to its clustering in 2D.
A 3D CZT high resolution detector for x- and gamma-ray astronomy

At DTU Space we have developed a high resolution three dimensional (3D) position sensitive CZT detector for high energy astronomy. The design of the 3D CZT detector is based on the CZT Drift Strip detector principle. The position determination perpendicular to the anode strips is performed using a novel interpolating technique based on the drift strip signals. The position determination in the detector depth direction, is made using the DOI technique based the detector cathode and anode signals. The position determination along the anode strips is made with the help of 10 cathode strips orthogonal to the anode strips. The position resolutions are at low energies dominated by the electronic noise and improve therefore with increased signal to noise ratio as the energy increases. The achievable position resolution at higher energies will however be dominated by the extended spatial distribution of the photon produced ionization charge. The main sources of noise contribution of the drift signals are the leakage current between the strips and the strip capacitance. For the leakage current, we used a metallization process that reduces the leakage current by means of a high resistive thin layer between the drift strip electrodes and CZT detector material. This method was applied to all the prototype detectors and was a very effective method to reduce the surface leakage current between the strips. The prototype detector was recently investigated at the European Synchrotron Radiation Facility, Grenoble which provided a fine 50 × 50 μm2 collimated X-ray beam covering an energy band up to 600 keV. The Beam positions are resolved very well with a ∼ 0.2 mm position resolution (FWHM) at 400 keV in all directions. © 2014 SPIE.
A broadband x-ray study of the Geminga pulsar with NuSTAR and XMM-Newton

We report on the first hard X-ray detection of the Geminga pulsar above 10 keV using a 150 ks observation with the Nuclear Spectroscopic Telescope Array (NuSTAR) observatory. The double-peaked pulse profile of non-thermal emission seen in the soft X-ray band persists at higher energies. Broadband phase-integrated spectra over the 0.2-20 keV band with NuSTAR and archival XMM-Newton data do not fit to a conventional two-component model of a blackbody plus power law, but instead exhibit spectral hardening above ~5 keV. We find that two spectral models fit the data well: (1) a blackbody (kT1 ~ 42 eV) with a broken power law (Γ1 ~ 2.0, Γ2 ~ 1.4 and Ebreak ~ 3.4 keV) and (2) two blackbody components (kT1 ~ 44 eV and kT2 ~ 195 eV) with a power-law component (Γ ~ 1.7). In both cases, the extrapolation of the Rayleigh-Jeans tail of the thermal component is consistent with the UV data, while the non-thermal component overpredicts the near-infrared data, requiring a spectral flattening at E ~ 0.05-0.5 keV. While strong phase variation of the power-law index is present below ~5 keV, our phase-resolved spectroscopy with NuSTAR indicates that another hard non-thermal component with Γ ~ 1.3 emerges above ~5 keV. The spectral hardening in non-thermal X-ray emission as well as spectral flattening between the optical and X-ray bands argue against the conjecture that a single power law may account for multi-wavelength non-thermal spectra of middle-aged pulsars.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Columbia University
Authors: Mori, K. (Ekstern), Gotthelf, E. V. (Ekstern), Dufour, F. (Ekstern), Kaspi, V. M. (Ekstern), Halpern, J. P. (Ekstern), Beloborodov, A. M. (Ekstern), An, H. (Ekstern), Bachetti, M. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Kouveliotou, C. (Ekstern), Pivovaroff, M. J. (Ekstern), Stern, D. (Ekstern), Zhang, W. W. (Ekstern)
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.26
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.8
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Accounting for imperfect forward modeling in geophysical inverse problems — Exemplified for crosshole tomography

Inversion of geophysical data relies on knowledge about how to solve the forward problem, that is, computing data from a given set of model parameters. In many applications of inverse problems, the solution to the forward problem is assumed to be known perfectly, without any error. In reality, solving the forward model (forward-modeling process) will almost always be prone to errors, which we referred to as modeling errors. For a specific forward problem, computation of crosshole tomographic first-arrival traveltimes, we evaluated how the modeling error, given several different approximate forward models, can be more than an order of magnitude larger than the measurement uncertainty. We also found that the modeling error is strongly linked to the spatial variability of the assumed velocity field, i.e., the a priori velocity model. We discovered some general tools by which the modeling error can be quantified and cast into a consistent formulation as an additive Gaussian observation error. We tested a method for generating a sample of the modeling error due to using a simple and approximate forward model, as opposed to a more complex and correct forward model. Then, a probabilistic model of the modeling error was inferred in the form of a correlated Gaussian probability distribution. The key to the method was the ability to generate many realizations from a statistical description of the source of the modeling error, which in this case is the a priori model. The methodology was tested for two synthetic ground-penetrating radar crosshole tomographic inverse problems. Ignoring the modeling error can lead to severe artifacts, which erroneously appear to be well resolved in the solution of the inverse problem. Accounting for the modeling error leads to a solution of the inverse problem consistent with the actual model. Further, using an approximate forward modeling may lead to a dramatic decrease in the computational demands for solving inverse problems.

General information

State: Published
Organisations: Center for Energy Resources Engineering, National Space Institute, Mathematical and Computational Geoscience, Department of Applied Mathematics and Computer Science, Aarhus University
Authors: Hansen, T. M. (Intern), Cordua, K. S. (Intern), Holm Jacobsen, B. (Ekstern), Mosegaard, K. (Intern)
Number of pages: 21
Pages: H1-H21
Publication date: 2014
Main Research Area: Technical/natural sciences
Accuracy assessment of global barotropic ocean tide models

The accuracy of state-of-the-art global barotropic tide models is assessed using bottom pressure data, coastal tide gauges, satellite altimetry, various geodetic data on Antarctic ice shelves, and independent tracked satellite orbit perturbations. Tide models under review include empirical, purely hydrodynamic ("forward"), and assimilative dynamical, i.e., constrained by observations. Ten dominant tidal constituents in the diurnal, semidiurnal, and quarter-diurnal bands are considered. Since the last major model comparison project in 1997, models have improved markedly, especially in shallow-water regions and also in the deep ocean. The root-sum-square differences between tide observations and the best models for eight major constituents are approximately 0.9, 5.0, and 6.5 cm for pelagic, shelf, and coastal conditions, respectively. Large intermodel discrepancies occur in high latitudes, but testing in those regions is impeded by the paucity of high-quality in situ tide records. Long-wavelength components of models tested by analyzing satellite laser ranging measurements suggest that several models are comparably accurate for use in precise orbit determination, but analyses of GRADE intersatellite ranging data show that all models are still imperfect on basin and subbasin scales, especially near Antarctica. For the M2 constituent, errors in purely hydrodynamic models are now almost comparable to the 1980-era Schwiderski empirical solution, indicating marked advancement in dynamical modeling. Assessing model accuracy using tidal currents remains problematic owing to uncertainties in in situ current meter estimates and the inability to isolate the barotropic mode. Velocity tests against both acoustic tomography and current meters do confirm that assimilative models perform better than purely hydrodynamic models. ©2014. American Geophysical Union.
Accuracy of the Temperature-Vegetation Dryness Index using MODIS under water-limited vs. energy-limited evapotranspiration conditions

Water deficit indices based on the spatial relationship between surface temperature (Ts) and NDVI, known as triangle approaches, are widely used for drought monitoring. However, their application has been recently questioned when the main factor limiting evapotranspiration is energy. Even though water is the main control in dryland ecosystems, these can also undergo periods of energy and temperature limitation. In this paper we aimed to: (i) evaluate the TVDI (Temperature-Vegetation Dryness Index) to estimate water deficits (e.g. ratio between actual and potential evapotranspiration), and heat surface fluxes using MODIS data; and (ii) provide insights about the factors most affecting the accuracy of results. Factors considered included the type of climatic control on evapotranspiration, AE, (i.e. water-limited vs. energy-limited), the quality of Tair estimates, the heterogeneity of land cover types and climatic variables in the region, or the algorithm to extract hydrological boundaries from the images. The TVDI was compared with eddy covariance (EC) data from two shrublands with different climatic controls for AE in South Spain. Evaluations showed that it could be used to estimate the water deficit when water was the main limiting factor (R=0.81-0.88; Mean Average Error, MAE=0.16-0.17) but not in energy-limited situations (R
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.5 SJR 3.121
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.92 SJR 3.035 SNIP 2.956
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.697 SNIP 3.044 CiteScore 7.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.881 SNIP 3.477 CiteScore 7.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.148 SNIP 2.982 CiteScore 5.6
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.449 SNIP 3.663 CiteScore 5.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.438 SNIP 3.088 CiteScore 5.72
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.786 SNIP 2.789
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.443 SNIP 2.486
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.29 SNIP 3.093
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.911 SNIP 2.986
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.322 SNIP 2.766
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.616 SNIP 3.257
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.295 SNIP 3.16
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.7 SNIP 2.892
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.171 SNIP 2.727
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.651 SNIP 2.092
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.046 SNIP 1.959
Scopus rating (1999): SJR 1.105 SNIP 1.494

Original language: English
Airborne gravimetry for geoid and GOCE

DTU-Space has since 1996 carried out large area airborne surveys over both polar, tropical and temperate regions, especially for geoid determination and global geopotential models. Recently we have started flying two gravimeters (LCR and Chekan-AM) side by side for increased reliability and redundancy. Typical gravity results are at the 2 mGal rms level, translating into 5-10 cm accuracy in geoid. However, in rough mountainous areas results can be more noisy, mainly due to long-period mountain waves and turbulence. In the paper we outline results of surveys and recent geoid determinations in Antarctica and Tanzania based on DTU-Space aerogravity and GOCE. In both cases the airborne data validate GOCE to very high degrees, and confirms the synergy of airborne gravity and GOCE. For Antarctica, the deep interior Antarctic survey (continued in 2013 from a remote field camp), shows that it is possible efficiently to cover even the most remote regions on the planet with good aerogravity. With the recent termination of the GOCE mission, it is therefore timely to initiate a coordinated, preferably international, airborne gravity effort to cover the polar gap south of 83° S; such a survey can in principle logistically be done in a single season.

All-optical OFDM system using a wavelength selective switch based transmitter and a spectral magnification based receiver

We demonstrate an AO-OFDM system with a WSS-based transmitter and time-lens based receiver for spectral magnification, achieving BER~10^-9 for a 28×10 Gbit/s DPSK AO-OFDM signal. Furthermore, the receiver performance for DPSK and DQPSK is investigated using Monte Carlo simulations.
An Equivalent Source Method for Modelling the Global Lithospheric Magnetic Field

We produce a new model of the global lithospheric magnetic field based on 3-component vector field observations at all latitudes from the CHAMP satellite using an equivalent source technique.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, Solar System Physics
Authors: Kother, L. K. (Intern), Hammer, M. D. (Intern), Finlay, C. (Intern), Olsen, N. (Intern)
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An Equivalent Source Method for Modelling the Global Lithospheric Magnetic Field
We present a new technique for modelling the global lithospheric magnetic field at Earth's surface based on the estimation of equivalent potential field sources. As a demonstration we show an application to magnetic field measurements made by the CHAMP satellite during the period 2009-2010 when it was at its lowest altitude and solar activity was also remarkably quiet. Both scalar and three component vector field data are utilized. Estimates of core and large-scale magnetospheric sources are removed from the measurements using the CHAOS-4 model. Quiet-time and night-side data selection criteria are also employed to minimize the influence of the ionospheric field. The model for the remaining lithospheric magnetic field consists of magnetic point sources (monopoles) arranged in an icosahedron grid. The corresponding source values are estimated using an iteratively reweighted least squares algorithm that includes model regularization and Huber weighting. Data error covariance matrices are implemented, including both the latitude dependence of data error variances and covariances between the vector field components due to unmodelled sources. Results show good consistency with the field structures obtained in the CHAOS-4 and MF7 models using more conventional spherical harmonic based approaches. Advantages of the equivalent source method include its local nature, allowing e.g. for regional grid refinement, and the ease of transforming to spherical harmonics when needed. Future applications will make use of Swarm data in combination with high resolution aeromagnetic measurements.

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ISI indexed (2013): ISI indexed no
An Equivalent Source Method for Modelling the Lithospheric Magnetic Field Using Satellite and Airborne Magnetic Data

We present a technique for modelling the lithospheric magnetic field based on estimation of equivalent potential field sources. As a first demonstration we present an application to magnetic field measurements made by the CHAMP satellite during the period 2009-2010. Three component vector field data are utilized at all latitudes. Estimates of core and large-scale magnetospheric sources are removed from the satellite measurements using the CHAOS-4 model. Quiet-time and night-side data selection criteria are also employed to minimize the influence of the ionospheric field. The model for the remaining lithospheric magnetic field consists of magnetic point sources (monopoles) arranged in an icosahedron grid with an increasing grid resolution towards the airborne survey area. The corresponding source values are estimated using an iteratively reweighted least squares algorithm that includes model regularization (either quadratic or maximum entropy) and Huber weighting. Data error covariance matrices are implemented, accounting for the dependence of data error variances on quasi-dipole latitudes. Results show good consistency with the CM5 and MF7 models for spherical harmonic degrees up to $n = 95$. Advantages of the equivalent source method include its local nature and the ease of transforming to spherical harmonics when needed. The method can also be applied in local, high resolution, investigations of the lithospheric magnetic field, for example where suitable aeromagnetic data is available. To illustrate this possibility, we present preliminary results from a case study combining satellite measurements and local airborne scalar magnetic measurements of the Norwegian coastline.

A New X-ray Transient, IGR J17451-3022, Discovered by INTEGRAL/JEM-X near the Galactic Centre

The JEM-X twin X-ray monitors on board the INTEGRAL satellite has detected a new X-ray transient during recent observations of the Galactic Centre and Bulge regions. The new source named IGR J17451-3022 has the following coordinates:

- **R.A. = 266.27**
- **Dec. = -30.38**

with a 2arcmin 90% confidence radius.

The source appeared in JEM-X 3-10 keV mosaic images obtained from the observation of the Galactic Bulge region and Galactic Center performed during INTEGRAL revolution 1448 between 2014 August 22 UTC 20:40 and August 24 UTC 07:16. It has since been detected at about the same constant level during subsequent INTEGRAL observations in revolutions 1449 (August 27 UTC 07:51 - August 28 UTC 04:38), 1450 (August 28 UTC 20:09 - August 31 UTC 07:02), and 1451 (August 31 UTC 19:50 - September 3 UTC 03:07). It was not detected during previous observations of the region taken on August 18 and 19 leading to a 3-10 keV flux upper limit of 3 mCrab.

We measure an average flux of 7 ±1 mCrab with only slight variations between 5 and 8 mCrab during the different above-mentioned observations. The source is not visible above 10 keV, leading to an upper limit of 1 mCrab between 10-25 keV. No significant time variation is seen in the source light-curve.
INTEGRAL will observe the Galactic Center region again between September 6 UTC 19:18 and September 8 UTC 20:31.

A 2-ksec target of opportunity with the Swift satellite has been executed on September 5 between UTC 15:27 and 18:32. The new INTEGRAL source is found with the XRT instrument, only 26 arcsec from the JEM-X position, at the enhanced position:

R.A. = 266.27824
Dec. = -30.37876

with a 90% error confidence of 2.1 arcsec.

Further analysis of the Swift data is on-going. We thank the Swift team for having performed this observation of the new transient source.

Multi-wavelength follow-up observations are encouraged to unveil the nature of IGR J17451-3022.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Technical University of Denmark, European Space Astronomy Centre and European Space Agency, Dr. Karl Remeis-Observatory and Erlangen Centre for Astroparticle Physics
Authors: Chenevez, J. (Intern), Vandbaek Kroer, L. (Ekstern), Budtz-Jørgensen, C. (Intern), Brandt, S. (Intern), Lund, N. (Intern), Westergaard, N. J. S. (Intern), Kuulkers, E. (Ekstern), Wilms, J. (Ekstern)
Number of pages: 1
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: The Astronomer's Telegram: ATel
Issue number: ATel #6451
Original language: English
X-ray, Request for observations, Transient
Links:
http://www.astronomerstelegram.org/?read=6451
Publication: Research › Journal article – Annual report year: 2014

Annual and interannual variability of scatterometer ocean surface wind over the South China Sea
To investigate the annual and interannual variability of ocean surface wind over the South China Sea (SCS), the vector empirical orthogonal function (VEOF) method and the Hilbert-Huang transform (HHT) method were employed to analyze a set of combined satellite scatterometer wind data during the period from December 1992 to October 2009. The merged wind data were generated from European Remote Sensing Satellite (ERS)-1/2 Scatterometer, NASA Scatterometer (NSCAT) and NASA's Quick Scatterometer (QuikSCAT) wind products. The first VEOF mode corresponds to a winter-summer mode which accounts for 87.3% of the total variance and represents the East Asian monsoon features. The second mode of VEOF corresponds to a spring-autumn oscillation which accounts for 8.3% of the total variance. To analyze the interannual variability, the annual signal was removed from the wind data set and the VEOFs of the residuals were calculated. The temporal mode of the first interannual VEOF is correlated with the Southern Oscillation Index (SOI) with a four-month lag. The second temporal interannual VEOF mode is correlated with the SOI with no time lag. The time series of the two interannual VEOFs were decomposed using the HHT method and the results also show a correlation between the interannual variability and El Niño-Southern Oscillation (ENSO) events.

General information
State: Published
Organisations: National Space Institute, Geodesy, Hohai University
Authors: Zhang, G. (Ekstern), Xu, Q. (Ekstern), Gong, Z. (Ekstern), Cheng, Y. (Intern), Wang, L. (Ekstern), Ji, Q. (Ekstern)
Number of pages: 7
Pages: 191-197
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Zhongguo Haiyang Daxue Xuebao (Ziran Kexue Ban)
Volume: 13
Issue number: 2
ISSN (Print): 1672-5174
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 0.77
Scopus rating (2015): CiteScore 0.58
Annual cycle in lakes and rivers from CryoSat-2 altimetry — The Brahmaputra river

A key concern of the CryoSat-2 orbit has been its long repeat period of 369 days, which is usually undesirable for river and lake monitoring. However, the results of this study show that CryoSat-2 data can indeed be used for such monitoring by utilizing the high spatial coverage and the sub-cycle period of 30 days. The performance of CryoSat-2/SIRAL altimetry for river level monitoring is investigated by studying river levels retrieved from Ganges and Brahmaputra. An evaluation of CryoSat-2 river levels from LRM, SAR and SARIn data is performed by comparing with Envisat data from the period in which the two missions overlapped (2010–2012). Time series constructed using simple linear interpolation are fitted with a model to compare the captured annual signals and amplitudes. The annual cycles seen in CryoSat-2 and Envisat altimetry data agree very well and provide confidence in using CryoSat-2 data to continue river level archives from satellite radar altimetry.

An overview of the applications for early warning and mapping of the flood events in New Brunswick

This paper gives an overview of the on-line flood warning implementation in the province of New Brunswick, Canada. The on-line flood warning applications are available via the “River Watch” website provided by the New Brunswick Department of Environment. Advanced GIS technology combined with hydrological modelling, provide a mapping and visualization tool that can be used by emergency managers and the general public to predict possible flood zones. The applications developed for “River Watch” support the processing of large amounts of digital terrain and hydrological data, which are then, quantified and displayed on digital maps allowing decision makers and the general population to comprehend and visualize the possible area and impact of the flooding. The WebGIS applications that are available from the “River Watch” web site provide snow reports and maps, flood warnings and interactive maps. The searchable historical database
containing reports about the impact of past floods and estimated damages provides a valuable insight into the past of the province of New Brunswick and the motivation for development of the system for flood prediction and management.

General information
State: Published
Organisations: National Space Institute, Geodesy, New Brunswick Emergency Measures Organization, New Brunswick Department of Environment
Authors: Mioc, D. (Intern), McGillivray, E. (Ekstern), Anton, F. (Intern), Mezouaghi, M. (Ekstern), Mofford, L. (Ekstern), Tang, P. T. (Ekstern)
Pages: 239-250
Publication date: 2014

Host publication information
Title of host publication: 4th International Conference on Flood Recovery, Innovation and Response
Volume: 184
Publisher: WIT Press
Series: WIT Transactions on Ecology and the Environment
Main Research Area: Technical/natural sciences
Conference: 4th International Conference on Flood Recovery, Innovation and Response, Poznan, Poland, 18/06/2014 - 18/06/2014
Flood management, Flood maps, Flood prediction
DOIs: 10.2495/friar140201
Source: Findlt
Source-ID: 2288867335
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

An ultraluminous X-ray source powered by an accreting neutron star
The majority of ultraluminous X-ray sources are point sources that are spatially offset from the nuclei of nearby galaxies and whose X-ray luminosities exceed the theoretical maximum for spherical infall (the Eddington limit) onto stellar-mass black holes(1,2). Their X-ray luminosities in the 0.5-10 kiloelectronvolt energy band range from 10(39) to 10(41) ergs per second(3). Because higher masses imply less extreme ratios of the luminosity to the isotropic Eddington limit, theoretical models have focused on black hole rather than neutron star systems(1,2). The most challenging sources to explain are those at the luminous end of the range (more than 10(40) ergs per second), which require black hole masses of 50-100 times the solar value or significant departures from the standard thin disk accretion that powers bright Galactic X-ray binaries, or both. Here we report broadband X-ray observations of the nuclear region of the galaxy M82 that reveal pulsations with an average period of 1.37 seconds and a 2.5-day sinusoidal modulation. The pulsations result from the rotation of a magnetized neutron star, and the modulation arises from its binary orbit. The pulsed flux alone corresponds to an X-ray luminosity in the 3-30 kiloelectronvolt range of 4.9 x 10(40) ergs per second(1). This association implies a luminosity of about 100 times the Eddington limit for a 1.4-solar-mass object, or more than ten times brighter than any known accreting pulsar. This implies that neutron stars may not be rare in the ultraluminous X-ray population, and it challenges physical models for the accretion of matter onto magnetized compact objects.

General information
State: Published
Organisations: National Space Institute, Astrophysics
Number of pages: 11
Pages: 202-204
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication information
Journal: Nature
Volume: 514
ISSN (Print): 0028-0836
Ratings:
Arctic sea level change over the past 2 decades from GRACE gradiometry and multi-mission satellite altimetry

The Arctic is still an extremely challenging region for the use of remote sensing for sea level studies. Despite the availability of 20 years of altimetry, only very limited sea level observations exist in the interior of the Arctic Ocean. However, with Cryosat-2 SAR altimetry the situation is changing and through development of tailored retrackers dealing with presence of sea ice within the radar footprint, we can now develop sea surface height and its variation in most of the Arctic Ocean. We have processed 3 years of Cryosat-2 data quantified as either Lead or Ocean data within the Cryosat-2 SAR mask in the Arctic Ocean. By carefully reprocessing and reediting conventional altimetry from ERS-1/ERS-2 and Envisat, we have now been able to derive a multi-decadal time series using far more remote sensing data in the interior of the Arctic Ocean than ever before. Through recently acquired gradiometer observations from the ESA GOCE mission, we
are now able to derive a mean dynamic topography of the Arctic Ocean with unprecedented accuracy to constrain the
Arctic Ocean circulation controlling sea level variations in the Arctic. We present both a new estimation of the mean ocean
circulation and new estimates of large scale sea level changes based on satellite data and perform an estimation of the
fresh waterstorage increase over the last decade using temporal gravity changes from the GRACE satellite.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Andersen, O. B. (Intern), Stenseng, L. (Intern), Sørensen, C. S. (Intern), Cheng, Y. (Intern), Knudsen, P. (Intern)
Number of pages: 1
Pages: 64
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Publisher: GeoUnion Alfred-Wegener-Stiftung
Editors: Lemke, P., Grosfeld, K., Treffeisen, R., Weigelt, M.
Article number: TP3-P-04
Main Research Area: Technical/natural sciences
Conference: International REKLIM Conference, Berlin, Germany, 06/10/2014 - 06/10/2014
Electronic versions:
Webversion_ges_p64_65_Andersen_et_al.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

Arctic sea-level reconstruction analysis using recent satellite altimetry
We present a sea-level reconstruction for the Arctic Ocean using recent satellite altimetry data. The model, forced by
historical tide gauge data, is based on empirical orthogonal functions (EOFs) from a calibration period; for this purpose,
newly retracked satellite altimetry from ERS-1 and -2 and Envisat has been used. Despite the limited coverage of these
datasets, we have made a reconstruction up to 82 degrees north for the period 1950–2010. We place particular emphasis
on determining appropriate preprocessing for the tide gauge data, and on validation of the model, including the ability to
reconstruct known data. The relationship between the reconstruction and climatic variables, such as atmospheric
pressure, and climate oscillations, including the Arctic Oscillation (AO), is examined.

General information
State: Published
Organisations: National Space Institute, Geodesy, Department of Applied Mathematics and Computer Science , Image
Analysis & Computer Graphics
Authors: Svendsen, P. L. (Intern), Andersen, O. B. (Intern), Nielsen, A. A. (Intern)
Publication date: 2014
Main Research Area: Technical/natural sciences

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Journal: Geophysical Research Abstracts
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Ratings:
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ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2009): BFI-level 1
Original language: English
Electronic versions:
EGU2014_14578.pdf
Links:
Source: PublicationPreSubmission
A spatial-spectral approach for deriving high signal quality eigenvectors for remote sensing image transformations

Spectral decorrelation (transformations) methods have long been used in remote sensing. Transformation of the image data onto eigenvectors that comprise physically meaningful spectral properties (signal) can be used to reduce the dimensionality of hyperspectral images as the number of spectrally distinct signal sources composing a given hyperspectral scene is generally much less than the number of spectral bands. Determining eigenvectors dominated by signal variance as opposed to noise is a difficult task. Problems also arise in using these transformations on large images, multiple flight-line surveys, or temporal data sets as computational burden becomes significant. In this paper we present a spatial-spectral approach to deriving high signal quality eigenvectors for image transformations which possess an inherently ability to reduce the effects of noise. The approach applies a spatial and spectral subsampling to the data, which is accomplished by deriving a limited set of eigenvectors for spatially contiguous subsets. These subset eigenvectors are compiled together to form a new noise reduced data set, which is subsequently used to derive a set of global orthogonal eigenvectors. Data from two hyperspectral surveys are used to demonstrate that the approach can significantly speed up eigenvector derivation, successfully be applied to multiple flight-line surveys or multi-temporal data sets, derive a representative eigenvector set for the full image data set, and lastly, improve the separation of those eigenvectors representing signal as opposed to noise. (C) 2013 Elsevier B.V. All rights reserved.
Asymmetries in core-collapse supernovae from maps of radioactive $^{44}$Ti in Cassiopeia A.

Asymmetry is required by most numerical simulations of stellar core-collapse explosions, but the form it takes differs significantly among models. The spatial distribution of radioactive $^{44}$Ti, synthesized in an exploding star near the boundary between material falling back onto the collapsing core and that ejected into the surrounding medium, directly probes the explosion asymmetries. Cassiopeia A is a young, nearby, core-collapse remnant from which $^{44}$Ti emission has previously been detected but not imaged. Asymmetries in the explosion have been indirectly inferred from a high ratio of observed $^{44}$Ti emission to estimated $^{56}$Ni emission, from optical light echoes, and from jet-like features seen in the X-ray and optical ejecta. Here we report spatial maps and spectral properties of the $^{44}$Ti in Cassiopeia A. This may explain the unexpected lack of correlation between the $^{44}$Ti and iron X-ray emission, the latter being visible only in shock-heated material. The observed spatial distribution rules out symmetric explosions even with a high level of convective mixing, as well as highly asymmetric bipolar explosions resulting from a fast-rotating progenitor. Instead, these observations provide strong evidence for the development of low-mode convective instabilities in core-collapse supernovae.

General information
State: Published
Organisations: National Space Institute, Astrophysics, IT-Department
Pages: 339-342
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature
Volume: 506
Issue number: 7488
ISSN (Print): 0028-0836
Ratings:
BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 13.33
Web of Science (2016): Indexed yes
Almost 35 years since their suggestion as a good solution to the strong CP-problem, axions remain one of the few viable candidates for the Dark Matter, although still eluding detection. Most of the methods for their detection are based on their coupling to photons, one of the most sensitive ones being the helioscope technique. We report on the current status of the CERN Axion Solar Telescope and the future International Axion Observatory (IAXO). Recent results from the second part of CAST phase II, where the magnet bores were filled with $^3$He gas at variable pressure achieving sensibilities on the axion mass up to $1.2 \text{ eV/c}^2$, are presented. Currently, CAST is expecting to improve its sensitivity to solar axions with rest mass below $0.02 \text{ eV/c}^2$ after the upgrade of the X-ray detectors and with the implementation of a second X-ray optic. At the same time, it is exploring other possibilities at the low energy physics frontier. On the other hand, IAXO, the fourth generation axion helioscope, aims to improve CAST’s performance in terms of axion-photon coupling by 1-1.5 orders of magnitude. The details of the project building a dedicated magnet, optics and X-ray detectors are given.

**General information**

**State:** Published

**Organisations:** National Space Institute, Astrophysics, Department of Physics, Neutrons and X-rays for Materials Physics, Universidad de Zaragoza

**Authors:** Jakobsen, A. C. (Intern), The CERN Axion Solar Telescope (CAST), The International Axion Observatory (IAXO)

**Number of pages:** 8
We present results from the coordinated broadband X-ray observations of the extreme ultraluminous X-ray source Holmberg IX X-1 performed by NuSTAR, XMM-Newton, and Suzaku in late 2012. These observations provide the first high-quality spectra of Holmberg IX X-1 above 10 keV to date, extending the X-ray coverage of this remarkable source up to ~30 keV. Broadband observations were undertaken at two epochs, between which Holmberg IX X-1 exhibited both flux and strong spectral variability, increasing in luminosity from $L_X = (1.90 \pm 0.03) \times 10^{40}$ erg s$^{-1}$ to $L_X = (3.35 \pm 0.03) \times 10^{40}$ erg s$^{-1}$. Neither epoch exhibits a spectrum consistent with emission from the standard low/hard accretion state seen in Galactic black hole binaries, which would have been expected if Holmberg IX X-1 harbors a truly massive black hole accreting at substantially sub-Eddington accretion rates. The NuSTAR data confirm that the curvature observed previously in the 3-10 keV bandpass does represent a true spectral cutoff. During each epoch, the spectrum appears to be dominated by two optically thick thermal components, likely associated with an accretion disk. The spectrum also shows some evidence for a nonthermal tail at the highest energies, which may further support this scenario. The available data allow for either of the two thermal components to dominate the spectral evolution, although both scenarios require highly nonstandard behavior for thermal accretion disk emission.
Case study of false alarms

General information

State: Published
Organisations: National Space Institute, Astrophysics
Authors: Leer, K. (Intern), Vennerstrøm, S. (Intern)
Number of pages: 1
Publication date: 2014
Event: Poster session presented at 11th European Space weather week, Liege, Belgium.
Main Research Area: Technical/natural sciences

Change detection in a time series of polarimetric SAR data

A test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution with an associated probability of finding a smaller value of the test statistic is introduced. Unlike tests based on pairwise comparisons between all temporally consecutive acquisitions the new omnibus test statistic and the probability measure
successfully detects change in two short series of L- and C-band polarimetric EMISAR data.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Conradsen, K. (Intern), Nielsen, A. A. (Intern), Skriver, H. (Intern)
Number of pages: 4
Pages: 136-139
Publication date: 2014

**Host publication information**
Title of host publication: Proceedings of the 2014 conference on Big Data from Space (BiDS’14)
Publisher: European Space Agency
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 103646227
Publication: Research - peer-review › Article in proceedings – Annual report year: 2014

**Change detection in polarimetric SAR data over several time points**
A test statistic for the equality of several variance-covariance matrices following the complex Wishart distribution is introduced. The test statistic is applied successfully to detect change in C-band EMISAR polarimetric SAR data over four time points.

**General information**
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, National Space Institute, Microwaves and Remote Sensing
Authors: Conradsen, K. (Intern), Nielsen, A. A. (Intern), Skriver, H. (Intern)
Pages: 4540-4543
Publication date: 2014

**Host publication information**
Title of host publication: Proceedings of the IEEE International Geoscience and Remote Sensing Symposium, IGARSS 2014
Publisher: IEEE
ISBN (Print): 978-1-4799-5775-0
Main Research Area: Technical/natural sciences
Geoscience
Source: FindIt
Source-ID: 272557531
Publication: Research - peer-review › Article in proceedings – Annual report year: 2014

**CM5: A pre-Swarm magnetic field model based upon the comprehensive modeling approach**
We have developed a model based upon the very successful Comprehensive Modeling (CM) approach using recent CHAMP, Ørsted, SAC-C and observatory hourly-means data from September 2000 to the end of 2013. This CM, called CM5, was derived from the algorithm that will provide a consistent line of Level-2 data products for the Swarm mission. This algorithm uses a special statistical treatment that allows certain parameter subsets to be determined from the best suited data subsets. Indeed, this allows for a co-estimation of parameters describing the magnetic field of the ionospheric Sq current system and the lithospheric with no contaminating leakage into the latter. The lithospheric field compares well with MF7 and CHAOS-4 at least to spherical harmonic degree 90. In addition, we have estimated the magnetic field generated by the oceanic M2 tidal constituent, which compares well with simulations using the known M2 tidal flow. This model will be useful for magnetic induction studies as well as providing a reference model for Swarm-based models coming soon.

**General information**
State: Published
Organisations: National Space Institute, Geomagnetism, University of Maryland, NASA Goddard Space Flight Center
Authors: Sabaka, T. (Ekstern), Olsen, N. (Intern), Tyler, R. (Ekstern)
Coastal Flooding Hazards due to storm surges and subsidence

Flooding hazard and risk mapping are major topics in low-lying coastal areas before even considering the adverse effects of sea level rise (SLR) due to climate change. While permanent inundation may be a prevalent issue, more often floods related to extreme events (storm surges) have the largest damage potential. Challenges are amplified in some areas due to subsidence from natural and/or anthropogenic causes. Subsidence of even a few mm/y may over time greatly impair the safety against flooding of coastal communities and must be accounted for in order to accomplish the economically most viable protection and management options.

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. (Intern), Knudsen, P. (Intern), Andersen, O. B. (Intern)
Number of pages: 1
Coastal flooding in Denmark – future outlook

Water loading from all directions due to river discharge, precipitation, groundwater and the sea state (i.e. mean and extreme water levels) need to be carefully considered when dealing with flooding hazards at the coast. Flooding hazard and risk mapping are major topics in low-lying coastal areas as before even considering the adverse effects of climate change and sea level rise (SLR). From an assessment of Danish sea extremes from historical evidence, tide gauge series, and space measurements, we discuss the current and future hazards, exposure, and vulnerability to flooding along the diverse Danish coastline in the transition between the Baltic Sea and the North Sea. The evaluation of the extreme statistics and their applicability in flooding hazard and risk management, and a presentation of the hazard and risk mapping performed through the implementation of the EU Floods Directive using the German XtremRisk approach, form the basis for projecting potential impacts of flooding due to climate change (SLR and increased storminess). Central to this impact assessment are also the evaluation of natural meteorological variability, robustness of the statistics, physical changes, local subsidence, land-use, protection measures a.o. that must be taken into account in order to evaluate current and future flooding hazards and management options. We provide examples from Danish case-studies underlining the necessity of including these factors and we outline an interdisciplinary approach to bring this knowledge together to enable a practice-oriented methodology that combines their effects and future sea extremes in hazard and risk mapping and climate change adaptation schemes in Denmark.

General information

State: Published
Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. (Intern), Knudsen, P. (Intern), Andersen, O. B. (Intern)
Number of pages: 1
Pages: 97
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Title of host publication: Proceedings of the International REKLIM conference. “Our Climate – Our Future, Regional perspectives on a global challenge”
Place of publication: Potsdam
Publisher: GeoUnion Alfred-Wegener-Stiftung
Editors: Lemke, P., Grosfeld, K., Treffeisen, R., Weigelt, M.
Article number: TP6-Q-15
Main Research Area: Technical/natural sciences
Conference: International REKLIM Conference, Berlin, Germany, 06/10/2014 - 06/10/2014
Electronic versions:
Webversion_ges_p97_sorensen_et_al.pdf
Source: PublicationPreSubmission
Source-ID: 118548230
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

Combined Inversion of Broadband and Short-Period Waveform Data for Regional Moment Tensors: A Case Study in the Alborz Mountains, Iran

In this study, we suggest a novel approach for the retrieval of regional moment tensors for earthquakes with small to moderate magnitudes. The first modification is the combined inversion of broadband and short-period waveform data. The broadband waveforms are inverted in a frequency range suitable for surface waves, whereas for the short-period data a frequency range suitable for body waves is applied. The second modification is the use of first-motion body-wave polarities to select the most probable solution out of all solutions from inversion. To combine three different criteria for selecting the most probable solution (i.e., residual from inversion, double-couple content of solution, number of nonmatching first-motion body-wave polarities), the L2 norm is applied to the normalized parameters. We chose five earthquakes within the Alborz mountains, Iran, as a case study (3.1≤Mw≤4.1). In this area, several factors exacerbate the difficulty of performing inversion for moment tensors, for example, a heterogeneous station network and large azimuthal gaps. We have demonstrated that our approach supplies reliable moment tensors when inversion from broadband data alone fails. In one case, we successfully retrieved a stable solution from short-period waveform data alone. Thus, our approach enables successful determination of seismic moment tensors wherever a sparse network of broadband stations has thus far prevented it.
Combining archeomagnetic and historical data to create a global magnetic field model of the Earth over the last 1000 years

General information
State: Published
Organisations: National Space Institute, Geomagnetism, Helmholtz-Zentrum Potsdam
Authors: Senftlieben, R. (Ekstern), Korte, M. (Ekstern), Finlay, C. C. (Intern)
Number of pages: 1
Publication date: 2014

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Title of host publication: Program and Abstract Volume - 14th international symposium on Study of Earth's Deep Interior (SEDI)
Article number: 517
Main Research Area: Technical/natural sciences
Conference: 14th international symposium on Study of Earth's Deep Interior (SEDI), Kanagawa, Japan, 03/08/2014 - 03/08/2014
Electronic versions: Senftlieben_SEDI_2014.pdf

Comparative Analysis of Photogrammetric Methods for 3D Models for Museums
The goal of this paper is to make a comparative analysis and selection of methodologies for making 3D models of historical items, buildings and cultural heritage and how to preserve information such as temporary exhibitions and archaeological findings. Two of the methodologies analyzed correspond to 3D models using Sketchup and Designing Reality. Finally, panoramic photography is discussed as a 2D alternative to 3D. Sketchup is a free-ware 3D drawing program and Designing Reality is a commercial program, which uses Structure from motion. For each program/method, the same comparative analysis matrix has been used. Prototypes are made partly or fully and evaluated from the point of view of preservation of information by a museum.

General information
State: Published
Organisations: National Space Institute, Geodesy, Technical University of Denmark
Authors: Hafstað Ármannsdottir, U. E. (Ekstern), Antón Castro, F. (Intern), Mioc, D. (Intern)
Pages: 149-154
Publication date: 2014

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Title of host publication: GEOProcessing 2014 : The Sixth International Conference on Advanced Geographic Information Systems, Applications, and Services
Publisher: IARIA
ISBN (Electronic): 978-1-61208-326-1
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 91600033

Conceptual design of the International Axion Observatory (IAXO)
The International Axion Observatory (IAXO) will be a forth generation axion helioscope. As its primary physics goal, IAXO will look for axions or axion-like particles (ALPs) originating in the Sun via the Primakoff conversion of the solar plasma photons. In terms of signal-to-noise ratio, IAXO will be about 4–5 orders of magnitude more sensitive than CAST, currently the most powerful axion helioscope, reaching sensitivity to axion-photon couplings down to a few × 10−12 GeV−1 and thus probing a large fraction of the currently unexplored axion and ALP parameter space. IAXO will also be sensitive to solar axions produced by mechanisms mediated by the axion-electron coupling gae with sensitivity — for the first time — to values of gae not previously excluded by astrophysics. With several other possible physics cases, IAXO has the potential to serve as a multi-purpose facility for generic axion and ALP research in the next decade. In this paper we present the conceptual design of IAXO, which follows the layout of an enhanced axion helioscope, based on a purpose-built 20 m-long 8-coils toroidal superconducting magnet. All the eight 60cm-diameter magnet bores are equipped with focusing x-ray optics, able to focus the signal photons into ∼ 0.2 cm2 spots that are imaged by ultra-low-background Micromegas x-ray detectors. The magnet is built into a structure with elevation and azimuth drives that will allow for solar tracking for ∼ 12 h each day.
Confidence and sensitivity of sea-level reconstructions

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Svendsen, P. L. (Intern), Andersen, O. B. (Intern), Nielsen, A. A. (Intern)
Pages: 6-7
Publication date: 2014
Workshop: WGOMD/SOP Workshop on Sea Level Rise, Ocean/Ice Shelf Interactions and Ice Sheets, Hobart, Australia, 18/02/2014 - 18/02/2014
Main Research Area: Technical/natural sciences

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ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
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Electronic versions:
Exchanges62.pdf
Links:
Source: PublicationPreSubmission
Source-ID: 96384988
Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2014

Confirmation of a high magnetic field in GRO J1008-57
GRO J1008-57 is a high-mass X-ray binary for which several claims of a cyclotron resonance scattering feature near 80 keV have been reported. We use NuSTAR, Suzaku, and Swift data from its giant outburst of 2012 November to confirm the existence of the 80 keV feature and perform the most sensitive search to date for cyclotron scattering features at lower energies. We find evidence for a 78(-2)(+3) keV line in the NuSTAR and Suzaku data at >4 sigma significance, confirming the detection using Suzaku alone by Yamamoto et al. A search of both the phase-averaged and phase-resolved data rules out a fundamental at lower energies with optical depth larger than 5% of the 78 keV line. These results indicate that GRO J1008-57 has a magnetic field of 6.7 x 10(12)(1 + z) G, the highest among known accreting pulsars.

General information
State: Published
Organisations: National Space Institute, Astrophysics
Number of pages: 7
Publication date: 2014
Main Research Area: Technical/natural sciences
Corrigendum to: Hydromagnetic quasi-geostrophic modes in rapidly rotating planetary cores (vol 229, pg 1, 2014)

General information
State: Published
Organisations: National Space Institute, Geomagnetism, Swiss Federal Institute of Technology, University Paris Diderot - Paris 7
Authors: Canet, E. (Ekstern), Finlay, C. (Intern), Fournier, A. (Ekstern)
Number of pages: 1
Pages: 60-60
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Physics of the Earth and Planetary Interiors
Volume: 234
ISSN (Print): 0031-9201
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.969 SJR 1.285
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.32 SJR 1.585 SNIP 1.077
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.114 SNIP 1.253 CiteScore 2.68
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.881 SNIP 1.291 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.239 SNIP 1.293 CiteScore 2.84
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.222 SNIP 1.088 CiteScore 2.36
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.4 SNIP 1.138 CiteScore 2.45
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.955 SNIP 1.241
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.803 SNIP 1.206
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.326 SNIP 1.224
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.381 SNIP 1.277
Scopus rating (2006): SJR 2.164 SNIP 1.298
Scopus rating (2005): SJR 2.218 SNIP 1.217
Scopus rating (2004): SJR 2.341 SNIP 1.668
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.668 SNIP 1.109
Scopus rating (2002): SJR 1.199 SNIP 1
CO₂-effekten er overvurderet

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Pages: 156-157
Publication date: 2014

Host publication information
Title of host publication: Plante Kongres: produktion, plan og miljø
Main Research Area: Technical/natural sciences
Conference: Plante Kongres 2014, Herning, Denmark, 14/01/2014 - 14/01/2014
Electronic versions:
Plante Kongres 2014.pdf

Bibliographical note
Plante Kongres 2014, Herning, pp. 156-157
Source: dtu
Source-ID: u::10467
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2014

Danmarks bevægelser har konsekvenser
Selv få millimeters sætningsforandringer om året kan påvirke faren for oversvømmelser og øge behovet for renovering af kloaknettet. Et forskningsprojekt med deltagelse af bl.a. DTU Space, Geodatastyrelsen og Kystdirektoratet kortlægger nu omfanget af Danmarks bevægelser og udvikler en metode til at integrere lokale sætninger i klimatilpasninger. Til gavn for fremtidige investeringer

General information
State: Published
Organisations: National Space Institute, Geodesy
Authors: Sørensen, C. S. (Intern), Knudsen, P. (Intern)
Pages: 50-51
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Teknik & Miljøe
Volume: December
ISSN (Print): 1902-2654
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Electronic versions:
Pages from TeknikMiljøe_12_2014_Danmarks_bevaegelser_2.pdf
Source: PublicationPreSubmission
Source-ID: 118548806
Publication: Communication › Journal article – Annual report year: 2015
Demonstration of multilayer reflective optics at photon energies above 0.6 MeV

Focusing optics operating in the soft gamma-ray photon energy range can advance a range of scientific and technological applications that benefit from the large improvements in sensitivity and resolution that true imaging provides. An enabling technology to this end is multilayer coatings. We show that very short period multilayer coatings deposited on super-polished substrates operate efficiently above 0.6 MeV. These experiments demonstrate that Bragg scattering theory established for multilayer applications as low as 1 eV continues to work well into the gamma-ray band. (C) 2014 Optical Society of America

General information
State: Published
Organisations: National Space Institute, Lawrence Livermore National Laboratory, European Synchrotron Radiation Facility
Authors: Brejnholt, N. F. (Intern), Soufli, R. (Ekstern), Descalle, M. (Ekstern), Fernandez-Perea, M. (Ekstern), Christensen, F. E. (Intern), Jakobsen, A. C. (Intern), Honkimaeki, V. (Ekstern), Pivovaroff, M. J. (Ekstern)
Pages: 15364-15369
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication Information
Journal: Optics Express
Volume: 22
Issue number: 13
ISSN (Print): 1094-4087
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.567 SJR 1.519
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.532 SNIP 1.544
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.91 SNIP 1.674 CiteScore 3.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.313 SNIP 2.124 CiteScore 4.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.337 SNIP 2.196 CiteScore 4.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.562 SNIP 2.108 CiteScore 3.85
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.58 SNIP 2.572 CiteScore 4.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.906 SNIP 2.428
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 3.039 SNIP 2.679
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.204 SNIP 2.423
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 3.284 SNIP 2.11
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.313 SNIP 2.336
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.819 SNIP 2.472
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.669 SNIP 2.217
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.745 SNIP 1.748
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.496 SNIP 1.42
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.98 SNIP 0.761
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.442 SNIP 0.843
Original language: English
OPTICS, NUCLEAR-MEDICINE, MISSION, Coatings, Gamma rays, Bragg scattering theory, Enabling technologies, Focusing optics, Gamma-ray photons, Multi-layer-coating, Photon energy, Reflective optics, Technological applications, Multilayers
Electronic versions:
oe_22_13_15364.pdf
DOIs:
10.1364/OE.22.015364
Source: FindIt
Source-ID: 268408480
Publication: Research - peer-review › Journal article – Annual report year: 2014

Den magnetiske misvisning i Danmark, Grønland og Færøerne: Geomagnetisme og misvisningskort for Danmark

General information
State: Published
Organisations: National Space Institute, Solar System Physics
Authors: Finlay, C. (Intern), Matzka, J. (Intern), Olsen, N. (Intern)
Pages: 79-80
Publication date: 2014

Host publication information
Title of host publication: Københavns Universitets Almanak 2014
Publisher: Københavns Universitet
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Dense Focal Plane Arrays for Pushbroom Satellite Radiometers
Performance of a dense focal plane array feeding an offset toroidal reflector antenna system is studied and discussed in the context of a potential application in multi-beam radiometers for ocean surveillance. We present a preliminary design of the array feed for the 5-m diameter antenna at X-band. This array is optimized to realize high antenna beam efficiency (~95%) over a wide scan range (±20°) with very low side-lobe and cross-polarization levels.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Chalmers University of Technology, HPS GmbH, European Space Agency, TICRA
Authors: Iupikov, O. A. (Ekstern), Ivashina, M. V. (Ekstern), Pontoppidan, K. (Ekstern), Cappellin, C. (Ekstern), Skou, N. (Intern), Søbjærg, S. S. (Intern), Ihle, A. (Ekstern), Hartmann, D. (Ekstern), Klooster, K. V. T. (Ekstern)
Detection of ionospheric signatures from GPS-derived total electron content maps

The processing of measurement data from satellite constellations such as Global Navigation Satellite Systems (GNSS), including the well-known Global Positioning System (GPS), have been successfully applied to virtually all areas of geophysical sciences. In this work, a method is described where Geographical Information Systems (GIS) are employed to build hourly ionospheric Total Electron Content (TEC) maps for 2011 over the southern Iberian Peninsula. The maps used GPS-derived geometryfree linear combinations attained from station data from the Algarve, Alentejo (Portugal), Andalusia, Murcia and Valencia (Spain) regions. Following the construction of the ionospheric maps, it was possible to relate these results to natural phenomena. The observed phenomena included diurnal and seasonal variations: daytime TEC maxima, nighttime TEC peaks, summer TEC value decreases, and spring and fall TEC maxima. After validation of these periodic phenomena, detection of non-periodic changes, such as solar flares and tectonic interactions with the ionosphere were attempted. The results showed a TEC increase following a selected solar flare event and a potential TEC build-up prior to the 2011 Lorca earthquake. Further studies could open up the possibility of building early warning systems. The presented methods, based on available software packages, are also of value in monitoring the effect of the ionosphere on radio signals, satellite and mobile communication, power grids, and for accurate GNSS navigation.

General information
State: Published
Organisations: National Space Institute, Geodesy, Universiidad de Cádiz
Authors: Durgonics, T. (Intern), Prates, G. (Ekstern), Berrocoso, M. (Ekstern)
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Geodetic Science
Volume: 4
Issue number: 1
ISSN (Print): 2081-9919
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
Original language: English
Earthquake precursors, geographic information systems, global positioning system, regional ionospheric maps, total electron content
Electronic versions:
jogs_2014_0011.pdf
DOIs:
10.2478/jogs-2014-0011
Links:
Source: FindIt
Source-ID: 268628012
Publication: Research - peer-review › Journal article – Annual report year: 2014
**Digital processor breadboard for RFI detection and mitigation in spaceborne radiometers**

The increasing problem with Radio Frequency Interference (RFI) in protected radiometer frequency bands has inspired the development and implementation of methods for detecting RFI. With increasing demands for next generation spaceborne radiometers, it becomes necessary to include RFI detection in such systems. Since input to these methods require much more data than traditional radiometer data, and since the downlink capacity for spaceborne systems are limited, RFI detection and mitigation must be implemented on-board thereby maintaining the low downlink data rate. The development of such a system is described in this paper.

**General information**

State: Published
Organisations: National Space Institute, IT-Department, Microwaves and Remote Sensing, Harp Technologies Ltd.
Authors: Kristensen, S. S. (Intern), Skou, N. (Intern), Kovanen, A. (Ekstern), Lahtinen, J. (Ekstern)
Number of pages: 4
Pages: 211-214
Publication date: 2014

**Host publication information**

Title of host publication: Proceedings of the IEEE International Geoscience and Remote Sensing Symposium, IGARSS 2014
Publisher: IEEE
ISBN (Electronic): 9781479957750
Main Research Area: Technical/natural sciences
Geoscience, Bandwidth, detection, Downlink, Field programmable gate arrays, Microwave radiometry, microwaves, mitigation, Radiofrequency interference, Radiometer, Radiometers, RFI, Stokes parameters
DOIs: 10.1109/IGARSS.2014.6946394
Source: FindIt
Source-ID: 272558329
Publication: Research - peer-review › Article in proceedings – Annual report year: 2014

**End-to-End simulation study of a full magnetic gradiometry mission**

In this paper, we investigate space magnetic gradiometry as a possible path for future exploration of the Earth's magnetic field with satellites. Synthetic observations of the magnetic field vector and of six elements of the magnetic gradient tensor are calculated for times and positions of a simulated low Earth orbiting satellite. The observations are synthesized from realistic models based upon a combination of the major sources contributing to the Earth's magnetic field. From those synthetic data, we estimate field models using either the magnetic vector field observations only or the full gradient tensor observations, and compare our estimated models with the known input model. The results indicate that gradient observations improve the determination of primarily the lithospheric field as well as of the high-degree secular variation. In addition, particular combinations of the individual tensor elements for specific ranges of spherical harmonic degree and order are used to derive a model which is compared with the input model in terms of vector and full tensor observations. This comparison shows that a certain combination of tensor elements improves the ability to resolve especially the high-degree lithospheric field.

**General information**

State: Published
Organisations: National Space Institute, Geomagnetism
Authors: Kotsiaros, S. (Intern), Olsen, N. (Intern)
Pages: 100-110
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Geophysical Journal International
Volume: 196
Issue number: 1
ISSN (Print): 0956-540X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Errors of Mean Dynamic Topography and Geostrophic Current Estimates in China's Marginal Seas from GOCE and Satellite Altimetry

The Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) and satellite altimetry can provide very detailed and accurate estimates of the mean dynamic topography (MDT) and geostrophic currents in China's marginal seas, such as, the newest high-resolution GOCE gravity field model GO-CONS-GCF-2-TIM-R4 and the new Centre National d'Etudes Spatiales mean sea surface model MSS_CNES_CLS_11 from satellite altimetry. However, errors and uncertainties of MDT and geostrophic current estimates from satellite observations are not generally quantified. In this paper, errors and uncertainties of MDT and geostrophic current estimates from satellite gravimetry and altimetry are investigated and evaluated in China's marginal seas. The cumulative error in MDT from GOCE is reduced from 22.75 to 9.89 cm when compared to the Gravity Recovery and Climate Experiment (GRACE) gravity field model ITG-Grace2010 results in the region. The errors of the geostrophic currents from GRACE are smaller than from GOCE with the truncation degrees 90 and 120. However, when the truncation degree is higher than 150, the GRACE mean errors increase rapidly and become significantly larger than the GOCE results. The geostrophic velocities based on GOCE-TIM4 have higher accuracy and spatial resolution, and the mean error is about 12.6 cm/s, which is more consistent with the in situ drifter's results than using GRACE data.

General information
State: Published
Organisations: National Space Institute, Geodesy, Chinese Academy of Sciences
Authors: Jin, S. (Ekstern), Feng, G. (Ekstern), Andersen, O. B. (Intern)
Number of pages: 12
Pages: 2544-2555
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Atmospheric and Oceanic Technology
Volume: 31
Issue number: 11
ISSN (Print): 0739-0572
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.228 SJR 1.285
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.37 SJR 1.547 SNIP 1.396
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.487 SNIP 1.362 CiteScore 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.311 SNIP 1.238 CiteScore 1.85
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.586 SNIP 1.369 CiteScore 2.13
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.085 SNIP 1.609 CiteScore 2.13
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.891 SNIP 1.413 CiteScore 2.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Estimation of PGR Induced Absolute Gravity Changes at Greenland GNET Stations

An important subject in the climate debate is the study of the major ice sheets mass balance. Knowledge of the mass balance provides understanding of changes in the relative sea-level (RSL). Several methods are used for mass balance studies but they are associated with large uncertainties. One reason for the uncertainty is the presence of the postglacial rebound (PGR) signal in the geodetic data used for mass balance estimates. Estimates of the PGR signal can be obtained by modelling and then being subtracted from the data to eliminate its influence. In this study, the PGR gravity signal will be investigated through modelling. The modelling of seven different scenarios shows that the PGR gravity signal in Greenland is less then 1 μ Gal/year (1 μ Gal=10 nm/s²). Repeated absolute gravity (AG) measurements at selected Greenland network (GNET) GPS sites were initiated in 2009. These data will in the future help constrain PGR and present-day ice mass changes. The data is collected with an A10 absolute gravimeter, which has an accuracy of 10 μ Gal (manufacturer specification). Here we will evaluate the modelled PGR gravity signal at selected GNET sites and conclude that the signal is significantly smaller then the gravity instruments accuracy and a long time is needed to detect it. Also, it can be expected that the elastic signal will be larger and other data like GPS is needed to separate the viscous and elastic signal.

General information

State: Published
Organisations: National Space Institute, Geodynamics, Geodesy
Authors: Nielsen, E. (Intern), Strykowski, G. (Intern), Forsberg, R. (Intern), Madsen, F. B. (Intern)
Pages: 97-102
Publication date: 2014

Host publication information

Title of host publication: Earth on the Edge: Science for a Sustainable Planet : Proceedings of the IAG General Assembly, Melbourne, Australia, June 28 - July 2, 2011
Volume: 139; Book Part II
Publisher: Springer
Editors: Rizos , C., Willis, P.
ISBN (Print): 978-3-642-37221-6
ISBN (Electronic): 978-3-642-37222-3

Series: International Association of Geodesy Symposia
ISSN: 0939-9585
Main Research Area: Technical/natural sciences
Greenland, Postglacial rebound, Absolute gravity
Estimation of the magnetic field gradient tensor using the Swarm constellation

For the first time, part of the magnetic field gradient tensor is estimated in space by the Swarm mission. We investigate the possibility of a more complete estimation of the gradient tensor exploiting the Swarm constellation. The East-West gradients can be approximated by observations from the lower pair of Swarm satellites, whereas the North-South gradients can be approximated by the first differences in the along-track direction. As a preliminary test, here we will present an analysis of along track differences of CHAMP vector observations. These show considerably smaller standard deviations compared to conventional vector observations at almost all latitudes. Analytical and numerical analysis of the spectral properties of the gradient tensor shows that specific combinations of the East-West and North-South gradients have almost identical signal content to the radial gradient. Gradient data are less contaminated by large scale fields produced in the magnetosphere and ionosphere and specific gradient combinations can lead to an improved determination of both the lithospheric field and the high degree secular variation.

Evaluation of SAMOSA3 adapted retracker using Cryosat-2 SAR altimetry data over the Arctic ocean

European Space Agency’s Cryosat-2 comes with the first ever SAR (Synthetic Aperture Radar) altimeter onboard a satellite. In this work precise sea surface heights and gravity fields are determined using Cryosat-2 SAR data. These determinations through satellite altimetry are difficult in the Arctic because of the presence of sea ice and coastal areas. Traditional retrackers generate erroneous results due to the superposition of echoes from the sea surface and sea ice. This work establishes an adaptation of the SAMOSA3 retracker as a suitable candidate; this model is improved and customized for the Arctic. Through this research it has been demonstrated that the SAMOSA3 retracker has a better performance as compared to other SAR retrackers when sea surface height and gravity field determination needs to be done. The performance evaluation of the SAMOSA3 retracker as compared to other retrackers has been done using sea surface height anomaly method and gravity field anomaly method.
Eventmageri i forskningen
Galathea 3 blev den hidtil største kombinerede forsknings- og formidlingsindsats, men der er ikke interesse for at evaluere indsatsen. Derfor bør forskerne selv overveje, om de skal deltage næste gang.

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Aktuel Naturvidenskab
Issue number: 4
ISSN (Print): 1399-2309
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Publication: Communication › Journal article – Annual report year: 2015

Fanget i isen

General information
State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Pages: 4-5
Publication date: 2014

Publication information
Pages (from-to): 4-5
Newspaper: Weekendavisen
No.: 10.01.2014
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences

Bibliographical note
First hard X-ray detection of the non-thermal emission around the Arches cluster: morphology and spectral studies with NuSTAR
The Arches cluster is a young, densely packed massive star cluster in our Galaxy that shows a high level of star formation activity. The nature of the extended non-thermal X-ray emission around the cluster remains unclear. The observed bright Fe Kα line emission at 6.4 keV from material that is neutral or in a low ionization state can be produced either by X-ray photoionization or by cosmic-ray particle bombardment or both. In this paper, we report on the first detection of the extended emission around the Arches cluster above 10 keV with the NuSTAR mission, and present results on its morphology and spectrum. The spatial distribution of the hard X-ray emission is found to be consistent with the broad region around the cluster where the 6.4 keV line is observed. The interpretation of the hard X-ray emission within the context of the X-ray reflection model puts a strong constraint on the luminosity of the possible illuminating hard X-ray source. The properties of the observed emission are also in broad agreement with the low-energy cosmic-ray proton excitation scenario.
First observations of transient luminous events in Indian sub-continent

The article offers information on the initial observations of flashes of lightning discharge observed above thunderstorms. It mentions that the transient luminous events (TLE) are classified on the basis of their geometrical shape and luminosity into Sprites, Halos and Blue Starters. It also focuses on the first sprite observed in the Indian subcontinent on April 11, 2012, whose optical measurements were conducted at Allahabad, India using the charge-coupled device camera system.

General information

State: Published
Organisations: National Space Institute, Solar System Physics
Number of pages: 2
Pages: 1107-1108
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information

Journal: Current Science
Volume: 107
Issue number: 7
ISSN (Print): 0011-3891
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.709 SJR 0.311
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Future spaceborne ocean missions using high sensitivity multiple-beam radiometers

Design considerations concerning a scanning as well as a push-broom microwave radiometer system are presented. Strict requirements to spatial and radiometric resolution leads to a multiple-beam scanner achieving good sensitivity through integration over many beams, or to a push-broom system where sensitivity is not a problem. Strict requirements to land contamination leads to a dense feed array system. Resource demands, especially power, are important issues, and first estimates are presented.

General information
State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, IT-Department, TICRA, Chalmers University of Technology, HPS GmbH, ESTEC
Authors: Skou, N. (Intern), Søbjærg, S. S. (Intern), Kristensen, S. S. (Intern), Cappellin, C. (Ekstern), Pontoppidan, K. (Ekstern), Ivashina, M. (Ekstern), Ihle, A. (Ekstern), Klooster, K. V. (Ekstern)
Number of pages: 4
Pages: 2546-2549
Publication date: 2014
Geoeffectiveness of Coronal Mass Ejections in the SOHO Era

The main objective of the study is to determine the probability distributions of the geomagnetic Dst index as a function of the coronal mass ejection (CME) and solar flare parameters for the purpose of establishing a probabilistic forecast tool for the geomagnetic storm intensity. Several CME and flare parameters as well as the effect of successive-CME occurrence in changing the probability for a certain range of Dst index values, were examined. The results confirm some of already known relationships between remotely-observed properties of solar eruptive events and geomagnetic storms, namely the importance of initial CME speed, apparent width, source position, and the associated solar flare class. In this paper we quantify these relationships in a form to be used for space weather forecasting in future. The results of the statistical study are employed to construct an empirical statistical model for predicting the probability of the geomagnetic storm intensity based on remote solar observations of CMEs and flares.

General information
State: Published
Organisations: National Space Institute, Astrophysics, University of Zagreb, Royal Observatory of Belgium, University of Graz
Number of pages: 34
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Solar Physics
ISSN (Print): 0038-0938
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.135 SJR 1.517
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.62 SJR 1.352 SNIP 1.247
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.234 SNIP 1.469 CiteScore 3.43
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.338 SNIP 1.427 CiteScore 3.37
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.946 SNIP 1.593 CiteScore 3.22
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.186 SNIP 1.191 CiteScore 2.25
ISI indexed (2012): ISI indexed yes
Geoid Model and Altitude at Mount Aconcagua Region (Argentina) from Airborne Gravity Survey

Aconcagua is part of the Southern Andes in the Argentine Province of Mendoza and it is the highest mountain in the Americas. The Aconcagua region is mostly inaccessible for land surveys. The existing gravity data are sparsely distributed, and mainly along the route currently used to climb the mountain. Gravity data are needed for applications such as geoid modeling, vertical datum determination and geological study. In 2010, a high-altitude survey (between 7,000 and 8,000 m above sea level), covering the entire area of Aconcagua was performed. This survey was done within the framework of IAG Project “Gravity and Geoid in South America”. Free Air anomalies were computed and compared to Earth Gravitational Model 2008 (EGM08), degree 2190 at the flight altitude. The residuals can be attributed to the fact that the airborne data carries a lot of new gravity information not represented in the EGM08 model. A geoid model was computed from those airborne gravity anomalies and land gravimetry data. A remove-restore method was used for terrain and global spherical harmonic reference models, with the residual gravity field signal downward continued by least-squares collocation, and the geoid and quasi-geoid computed by spherical Fourier methods. The N value at Aconcagua's summit was combined with the ellipsoidal height observed at the summit GPS station to obtain the orthometric height above sea level, confirming the most recent triangulated summit height of 6,960 m.

General information
State: Published
Organisations: National Space Institute, Geodynamics, Universidad Nacional de Rosario, Universidad Nacional de San Juan, Universidad Nacional de Cuyo
Authors: Cristina Pacino, M. (Ekstern), Jaeger, E. (Ekstern), Forsberg, R. (Intern), Olesen, A. (Intern), Miranda, S. (Ekstern), Lenzano, L. (Ekstern)
Pages: 179-185
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Volume: 141
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Editor: Marti, U.
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Series: International Association of Geodesy Symposia
ISSN: 0939-9585
Main Research Area: Technical/natural sciences
Geoid of Nepal from airborne gravity survey
An airborne gravity survey of Nepal was carried out December 2010 in a cooperation between DTU-Space, Nepal Survey Department, and NGA, USA. The entire country was flown with survey lines spaced 6 km with a King Air aircraft, with a varying flight altitude from 4 to 10 km. The survey operations were a major challenge due to excessive jet streams at altitude as well as occasional excessive mountain waves. Despite the large 400 mGal+ range of gravity anomaly changes from the Indian plains to the Tibetan Plateau, results appear accurate to a few mGal, with proper evaluation from cross-overs complicated by the varying flight altitudes. Using a downward continuation scheme based on least-squares collocation, a new geoid of Nepal is made by Fourier methods. The new geoid shows large changes to EGM08, illustrating the impact of the new data. The new geoid is compared to limited GPS-levelling data as well as recent GPS-heights of Mt. Everest. The new airborne data also provide an independent validation of GOCE gravity field results at the local ~100 km resolution scale.

**General information**
State: Published
Organisations: National Space Institute, Geodynamics, Ministry of Land Reform and Management
Authors: Forsberg, R. (Intern), Olesen, A. V. (Intern), Einarsson, I. (Intern), Manandhar, N. (Ekstern), Shreshta, K. (Ekstern)
Number of pages: 6
Pages: 521-527
Publication date: 2014
Glacier dynamics at Helheim and Kangerdlugssuaq glaciers, southeast Greenland, since the Little Ice Age

Observations over the past decade show significant ice loss associated with the speed-up of glaciers in southeast Greenland from 2003, followed by a deceleration from 2006. These short-term, episodic, dynamic perturbations have a major impact on the mass balance on the decadal scale. To improve the projection of future sea level rise, a long-term data record that reveals the mass balance beyond such episodic events is required. Here, we extend the observational record of marginal thinning of Helheim and Kangerdlugssuaq glaciers from 10 to more than 80 years. We show that, although the frontal portion of Helheim Glacier thinned by more than 100 m between 2003 and 2006, it thickened by more than 50 m during the previous two decades. In contrast, Kangerdlugssuaq Glacier underwent minor thinning of 40–50 m from 1981 to 1998 and major thinning of more than 100 m after 2003. Extending the record back to the end of the Little Ice Age (prior to 1930) shows no thinning of Helheim Glacier from its maximum extent during the Little Ice Age to 1981, while Kangerdlugssuaq Glacier underwent substantial thinning of 230 to 265 m. Comparison of sub-surface water temperature anomalies and variations in air temperature to records of thickness and velocity change suggest that both glaciers are highly sensitive to short-term atmospheric and ocean forcing, and respond very quickly to small fluctuations. On century timescales, however, multiple external parameters (e.g. outlet glacier shape) may dominate the mass change. These findings suggest that special care must be taken in the projection of future dynamic ice loss.
GOCE Data for Local Geoid Enhancement

The GOCE gradients, having a spatially dense data distribution, may potentially provide better predictions of the regional gravity field than those obtained using a spherical harmonic Earth Geopotential Model. The aim of this study is to develop a methodology to improve the use of GOCE gradients and to determine the Earth's gravity field with better accuracy than by using global models, which have been truncated at a specific harmonic degree and order. The method makes use of all available GOCE gradient data in addition to the global models and aims at improving the determination of Earth's gravitational field in regional areas. Subsequently, the calculated geoid is used together with measurements of sea surface height in a calculation of the Mean Dynamic Topography in regional geoid recovery from GOCE gradients, two methods are used, one of them being Least-Squares Collocation (LSC). The second method is developed as a part of this study, and it is based on the Reduced Point Mass (RPM) response. The results show that the RPM method and LSC method give very similar results when using the same data, i.e., the difference is insignificant when compared to the EGM2008 results. However, when all of the available GOCE gradient data are used with the RPM method, an improvement in the gravitational field determination is achieved. The enhanced geoid by the RPM method is then used for the improvement of the MDT in the North Atlantic region.

GPS based surface displacements – a proxy for discharge and sediment transport from the Greenland Ice Sheet

The elastic respond of the Earth's surface to mass changes has been measured with Global Positioning System (GPS). Mass loss as accumulated runoff and sediment transport from a 10000 km² segment of the Greenland Ice Sheet (GrIS) correlated very well (R²=0.83) with GPS measured uplift. Accumulated winter precipitation correlated fairly well with surface depression (R²=0.69). The relationships are based on seven years of runoff and sediment transport observations from the Watson River (2007–2013), winter precipitation from Kangerlussuaq Airport and GPS observations at Kellyville. GPS recordings of surface subsidence and uplift from 1996–2013 are used to calculate 18 years time series of annual runoff, sediment and solute transport and 10 winter precipitation. Runoff and related transport of sediment and solutes increase over the period, while winter precipitation (land depression) tends to decrease. Based on the entire GPS record (1996–2013), it is shown that until 2005–2006 the mass balance of this segment of the GrIS was rather stable – since then there has been an increasing loss of mass, culminating in 2012.
Gravity changes in mid-west Greenland from GOCE gravity model and gradient data using ground and airborne gravity

GOCE TRF (terrestrial reference frame) vertical anomalous gradients (Tzz) from two periods have been used to determine gravity anomalies changes in mid-west Greenland, where a large mass-loss has been detected using GRACE (Fig. 1). As additional data were used the GOCE DIR-3 model and ground gravity at the coast on solid rock, where no mass loss is expected. The methods of Least-Squares Collocation (LSC) and the Reduced Point Mass (RPM) methods have been used, however only LSC included the ground data.

Gravity inversion predicts the nature of the Amundsen basin and its continental borderlands near Greenland

The high-Arctic Eurekan Orogeny was caused by a northward movement of Greenland relative to North America and Eurasia during the latest Cretaceous to late Eocene. While the Eurekan N-S shortening is well-documented in Ellesmere Island, North Greenland and Svalbard, the nature of the event is largely unknown in the ice-covered Arctic Ocean to the north of Greenland. In this contribution, we show that the tectono-physiographic evolution of the oceanic Amundsen Basin, the continental Lomonosov Ridge and the Morris Jesup Rise were all affected by significant Eurekan compression. We present the results of 3-D gravity inversion for predicting the sediment thickness and basement geometry within the Amundsen Basin and along its borderlands. We use the recently published LOMGRAV-09 gravity compilation and adopt a process-oriented iterative cycle approach that minimizes misfit between an Earth model and observations. The sensitivity of our results to lateral variations in depth and density contrast of the Moho is further tested by a stochastic inversion. Within their limitations, the approach and setup used herein provides the first detailed model of the sediment thickness and basement geometry in the Arctic Ocean north of Greenland. Our preferred result, using a C25 breakup scenario of the Amundsen Basin, correlates well with seismic observations along existing and several new marine seismic profiles. Breakup-related rift basins are predicted along the Lomonosov Ridge and a broad depocentre is predicted above high-relief basement in the central Amundsen Basin. Significantly, an up to 7 km deep elongated sedimentary basin is predicted along the northern edge of the Morris Jesup Rise. This basin continues into the Klenova Valley south of the Lomonosov
Ridge and correlates with an offshore continuation of the Eurekan Mount Rawlinson Fault in Ellesmere Island. We compute the anomalous basement topography and show evidence of deformed oceanic and continental crust in relation to this fault zone (LKFZ), suggesting that pronounced Eurekan crustal shortening took place here.

**General information**

State: Published
Organisations: National Space Institute, Geomagnetism, Geodynamics, Geological Survey of Denmark and Greenland
Authors: Døssing, A. (Intern), Hansen, T. M. (Intern), Olesen, A. V. (Intern), Hopper, J. R. (Ekstern), Funck, T. (Ekstern)
Number of pages: 14
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 4.53 SJR 3.156 SNIP 1.554
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.499 SNIP 1.569 CiteScore 4.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.369 SNIP 1.79 CiteScore 4.84
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.613 SNIP 1.741 CiteScore 4.94
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.537 SNIP 1.712 CiteScore 4.35
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.944 SNIP 1.627 CiteScore 4.25
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.449 SNIP 1.656
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.77 SNIP 1.688
Scopus rating (2007): SJR 3.709 SNIP 1.714
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.758 SNIP 1.771
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.653 SNIP 1.615
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.39 SNIP 1.737
Gyre-driven decay of the geomagnetic dipole

General information
State: Published
Organisations: National Space Institute, Geomagnetism, University of Grenoble, University Paris Diderot - Paris 7
Authors: Finlay, C. C. (Intern), Aubert, J. (Ekstern), Gillet, N. (Ekstern)
Number of pages: 1
Publication date: 2014

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Title of host publication: Program and Abstract Volume - 14th international symposium on Study of Earth’s Deep Interior (SEDI)
Article number: 609
Main Research Area: Technical/natural sciences
Conference: 14th international symposium on Study of Earth’s Deep Interior (SEDI), Kanagawa, Japan, 03/08/2014 - 03/08/2014
Electronic versions:
Gyre_driven_decay.pdf
Source: PublicationPreSubmission
Source-ID: 105455921
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015

Hard X-ray spectral and timing properties of IGR J17454-2919 consistent with a black hole in the hard state

IGR J17454-2919 is a recently discovered X-ray transient that lies 24 arcminutes away from the Galactic Center (ATel #6530). NuSTAR observed the source starting at 2014 October 10, 9.17 h UT, and obtained an exposure time time of 29 ks. An inspection of the 3-79 keV light curve does not show any evidence for bursts or pulsations, but the NuSTAR count rate drops from 2.8 c/s to 2.4 c/s (rates are for one NuSTAR module with no deadtime correction). We performed spectral and timing analysis of the NuSTAR data. The energy spectrum is well described (reduced chi2 = 1.06 for 748 dof) by an absorbed power-law with an exponential cutoff and a broad, asymmetric, iron emission line. The column density is (3.3+/−0.6)e22 cm−2 (using Anders & Grevesse 1989 abundances; errors on all spectral parameters are 90% confidence), the photon index is 1.46+/−0.06, and the e-folding energy is >100 keV (with the "cutoffpl" model in XSPEC). The unabsorbed 3-79 keV flux is 3.96e-10 erg/cm2/s with a 0.8% error. At the Galactic center distance, this corresponds to an isotropic luminosity of 3e36 erg/s. The power spectrum consists of two components: a zero-centered Lorentzian peaking near 1 Hz and a power-law at lower frequencies. The Lorentzian has a width of 2 Hz and a fractional rms of 25+/−3%. The hard power-law index, the high energy of the cutoff, and the level of variability all are consistent with properties expected for an accreting black hole in the hard state. While we cannot completely rule out the possibility of a low magnetic field neutron star, a black hole is more likely.

General information
State: Published
Organisations: National Space Institute, Astrophysics, National Institute for Astrophysics, University of California at Berkeley, California Institute of Technology
Authors: Tendulkar, S. P. (Ekstern), Bachetti, M. (Ekstern), Tomsick, J. (Ekstern), Chenevez, J. (Intern), Harrison, F. (Ekstern)
Number of pages: 1
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
We describe the detection, interpretation, and removal of the signal resulting from interactions of high energy particles with the Planck High Frequency Instrument (HFI). There are two types of interactions: heating of the 0.1 K bolometer plate; and glitches in each detector time stream. The transient responses to detector glitch shapes are not simple single-pole exponential decays and fall into three families. The glitch shape for each family has been characterized empirically in flight data and these shapes have been used to remove glitches from the detector time streams. The spectrum of the count rate per unit energy is computed for each family and a correspondence is made to the location on the detector of the particle hit. Most of the detected glitches are from Galactic protons incident on the die frame supporting the micro-machined bolometric detectors. In the Planck orbit at L2, the particle flux is around 5 cm$^2$ s$^{-1}$ and is dominated by protons incident on the spacecraft with energy $> 39$ MeV, at a rate of typically one event per second per detector. Different categories of glitches have different signatures in the time stream. Two of the glitch types have a low amplitude component that decays over nearly 1 s. This component produces excess noise if not properly removed from the time-ordered data. We have used a glitch detection and subtraction method based on the joint fit of population templates. The application of this novel glitch subtraction method removes excess noise from the time streams. Using realistic simulations, we find that this method does not introduce signal bias into the Planck data.

**General Information**

State: Published

Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen

High-energy x-ray detection of G359.89–0.08 (SGR A–E): magnetic flux tube emission powered by cosmic rays?

We report the first detection of high-energy X-ray (E > 10 keV) emission from the Galactic center non-thermal filament G359.89–0.08 (Sgr A–E) using data acquired with the Nuclear Spectroscopic Telescope Array (NuSTAR). The bright filament was detected up to ∼50 keV during a NuSTAR Galactic center monitoring campaign. The featureless power-law spectrum with a photon index Γ ≈ 2.3 confirms a non-thermal emission mechanism. The observed flux in the 3-79 keV band is FX = (2.0 ± 0.1) × 10–12 erg cm–2 s–1, corresponding to an unabsorbed X-ray luminosity LX = (2.6 ± 0.8) × 1034 erg s–1 assuming a distance of 8.0 kpc. Based on theoretical predictions and observations, we conclude that Sgr A–E is unlikely to be a pulsar wind nebula (PWN) or supernova remnant-molecular cloud (SNR-MC) interaction, as previously hypothesized. Instead, the emission could be due to a magnetic flux tube which traps TeV electrons. We propose two possible TeV electron sources: old PWNe (up to ∼100 kyr) with low surface brightness and radii up to ∼30 pc or MCs illuminated by cosmic rays (CRs) from CR accelerators such as SNRs or Sgr A*.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Columbia University, Massachusetts Institute of Technology, Pontificia Universidade Católica, University of California, California Institute of Technology, NASA Jet Propulsion Laboratory, NASA Goddard Space Flight Center
Authors: Zhang, S. (Ekstern), Hailey, C. J. (Ekstern), Baganoff, F. K. (Ekstern), Bauer, F. E. (Ekstern), Boggs, S. E. (Ekstern), Craig, W. W. (Ekstern), Christensen, F. E. (Intern), Gotthelf, E. V. (Ekstern), Harrison, F. A. (Ekstern), Mori, K. (Ekstern), Nynka, M. (Ekstern), Stern, D. (Ekstern), Tomsick, J. A. (Ekstern), Zhang, W. W. (Ekstern)
Number of pages: 6
Publication date: 2014
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.26
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.8
High-energy X-ray imaging of the pulsar wind nebula MSH 15-52: constraints on particle acceleration and transport

We present the first images of the pulsar wind nebula (PWN) MSH 15−52 in the hard X-ray band (8 keV), as measured with the Nuclear Spectroscopic Telescope Array (NuSTAR). Overall, the morphology of the PWN as measured by NuSTAR in the 3−7 keV band is similar to that seen in Chandra high-resolution imaging. However, the spatial extent decreases with energy, which we attribute to synchrotron energy losses as the particles move away from the shock. The hard-band maps show a relative deficit of counts in the northern region toward the RCW 89 thermal remnant, with significant asymmetry. We find that the integrated PWN spectra measured with NuSTAR and Chandra suggest that there is a spectral break at 6 keV, which may be explained by a break in the synchrotron-emitting electron distribution at ~200 TeV and/or imperfect cross calibration. We also measure spatially resolved spectra, showing that the spectrum of the PWN softens away from the central pulsar B1509−58, and that there exists a roughly sinusoidal variation of spectral hardness in the azimuthal direction. We discuss the results using particle flow models. We find non-monotonic structure in the variation with distance of spectral hardness within 50 of the pulsar moving in the jet direction, which may imply particle and magnetic-field compression by magnetic hoop stress as previously suggested for this source. We also present two-dimensional maps of spectral parameters and find an interesting shell-like structure in the NH map. We discuss possible origins of the shell-like structure and their implications.

General information
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Organisations: National Space Institute, Astrophysics, McGill University, California Institute of Technology, North Carolina State University, University of California at Berkeley, Los Alamos National Laboratory, Columbia University, NASA Goddard Space Flight Center
High-resolution ice thickness and bed topography of a land-terminating section of the Greenland Ice Sheet

We present ice thickness and bed topography maps with high spatial resolution (250 to 500 m) of a land-terminating section of the Greenland Ice Sheet derived from combined ground-based and airborne radar surveys. The data have a total area of ~12000 km² and cover the whole ablation area of the outlet glaciers of Isunnguata Sermia, Russell, Leverett, Ørkendalen and Isorlersuup up to the long-term mass balance equilibrium line altitude at ~1600 m above sea level. The bed topography shows highly variable subglacial trough systems, and the trough of the Isunnguata Sermia Glacier is over-deepened and reaches an elevation of several hundreds of meters below sea level. The ice surface is smooth and only reflects the bedrock topography in a subtle way, resulting in a highly variable ice thickness. The southern part of our study area consists of higher bed elevations compared to the northern part. The covered area is one of the most studied regions of the Greenland Ice Sheet with studies of mass balance, dynamics, and supraglacial lakes, and our combined dataset can be valuable for detailed studies of ice sheet dynamics and hydrology. The compiled datasets of ground-based and airborne radar surveys are accessible for reviewers (password protected) at doi.pangaea.de/10.1594/pangaea.830314 and will be freely available in the final revised paper.

General information

State: Published
Organisations: National Space Institute, Microwaves and Remote Sensing, Geodesy, Geodynamics, Uppsala University, Aberystwyth University, Stockholm University
Authors: Lindbäck, K. (Ekstern), Pettersson, R. (Ekstern), Doyle, S. H. (Ekstern), Helanow, C. (Ekstern), Jansson, P. (Ekstern), Kristensen, S. S. (Intern), Stenseng, L. (Intern), Forsberg, R. (Intern), Hubbard, A. L. (Ekstern)
Pages: 331-338
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Publication information

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Volume: 6
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Scopus rating (2017): SNIP 2.62 SJR 4.885
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 7.28 SJR 4.928 SNIP 2.545
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 5.369 SNIP 3.072 CiteScore 7.07
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 4.718 SNIP 2.679 CiteScore 6.19
ISI indexed (2013): ISI indexed no
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Original language: English
TENDOkdlb2xvZ3k~, TENDOlNjaWVuY2U~, LCC:Geology, LCC:QE1-996.5, LCC:Science, LCC:Q
Electronic versions:
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10.5194/essd-6-331-2014
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History Matching Through a Smooth Formulation of Multiple-Point Statistics

We propose a smooth formulation of multiple-point statistics that enables us to solve inverse problems using gradient-based optimization techniques. We introduce a differentiable function that quantifies the mismatch between multiple-point statistics of a training image and of a given model. We show that, by minimizing this function, any continuous image can be gradually transformed into an image that honors the multiple-point statistics of the discrete training image. The solution to an inverse problem is then found by minimizing the sum of two mismatches: the mismatch with data and the mismatch with multiple-point statistics. As a result, in the framework of the Bayesian approach, such a solution belongs to a high posterior region. The methodology, while applicable to any inverse problem with a training-image-based prior, is especially beneficial for problems which require expensive forward simulations, as, for instance, history matching. We demonstrate the applicability of the method on a two-dimensional history matching problem. Starting from different initial models we
obtain an ensemble of solutions fitting the data and prior information defined by the training image. At the end we propose a closed form expression for calculating the prior probabilities using the theory of multinomial distributions, that allows us to rank the history-matched models in accordance with their relative posterior probabilities. © 2014 The Author(s).

**General information**
State: Published
Organisations: Center for Energy Resources Engineering, National Space Institute, Mathematical and Computational Geoscience, Geomagnetism, Danedanmark
Authors: Melnikova, Y. (Intern), Zunino, A. (Intern), Lange, K. (Ekstern), Cordua, K. S. (Intern), Mosegaard, K. (Intern)
Pages: 397-416
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.943 SJR 0.76
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.069 SNIP 1.558 CiteScore 2.08
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.455 SNIP 1.347 CiteScore 1.77
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.02 SNIP 1.504 CiteScore 2.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.839 SNIP 1.416 CiteScore 1.69
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.925 SNIP 1.379 CiteScore 1.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.761 SNIP 1.533 CiteScore 1.84
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.791 SNIP 1.234
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.613 SNIP 1.229
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.806 SNIP 1.171
Scopus rating (2007): SJR 0.558 SNIP 1.64
Scopus rating (2006): SJR 0.736 SNIP 1.505
Scopus rating (2005): SJR 0.685 SNIP 1.36
Scopus rating (2004): SJR 0.903 SNIP 1.196
Scopus rating (2003): SJR 0.709 SNIP 1.166
Scopus rating (2002): SJR 0.753 SNIP 1.224
Scopus rating (2001): SJR 0.493 SNIP 1.161
Scopus rating (2000): SJR 0.812 SNIP 1.315
Scopus rating (1999): SJR 0.758 SNIP 1.218
Original language: English
Earth and Planetary Sciences (all), Mathematics (miscellaneous), History matching, Inverse problems, Multiple-point statistics, Optimization

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Publication: Research - peer-review › Journal article – Annual report year: 2014

History Matching with Geostatistical Prior: A Smooth Formulation
We present a new method for solving the history matching problem by gradient-based optimization within a probabilistic framework. The focus is on minimizing the number of forward simulations and conserving geological realism of the solutions. Geological a priori information is taken into account by means of multipoint statistics borrowed from training images. Then production data and prior information are integrated into a single differentiable objective function, minimizer of which has a high posterior value. Solving the proposed optimization problem for an ensemble of different starting models, we obtain a set of solutions honouring both data and prior information.

General information
State: Published
Organisations: Center for Energy Resources Engineering, National Space Institute, Mathematical and Computational Geoscience, Department of Applied Mathematics and Computer Science, CERE – Center for Energy Resources Engineering
Authors: Melnikova, Y. (Intern), Lange, K. (Intern), Zunino, A. (Intern), Cordua, K. S. (Intern), Mosegaard, K. (Intern)
Pages: 703-707
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Main Research Area: Technical/natural sciences
Conference: 15th Annual Conference of the International Association for Mathematical Geosciences, Madrid, Spain, 02/09/2013 - 02/09/2013
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Source: dtu
Source-ID: u::10380
Publication: Research - peer-review › Article in proceedings – Annual report year: 2014

Helder kulden på varmen?

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Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 1
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HY-2A satellite altimetric data evaluation in the Arctic ocean

HY-2A ('HaiYang' denotes Ocean) was launched in August 2011. It payloads Ku and C bands radar altimeters with repeat cycles of 14 days (for three years) and 168 days. In the present study, we preliminary evaluate the HY-2 satellite altimetric data against SARAL/AltiKa and CryoSat-2 data in the Arctic Ocean. The results demonstrates that the HY-2 data shows higher standard variation and mean sea level than AltiKa and CryoSat-2 data during HY-2 cycle 49 (20130803 and 20130817) with more available sea level measurements than CryoSat-2 satellite altimetry. Moreover, consistent sea level variation is observed from AltiKa and CryoSat-2 monthly sea level time series.

Hydromagnetic quasi-geostrophic modes in rapidly rotating planetary cores

The core of a terrestrial-type planet consists of a spherical shell of rapidly rotating, electrically conducting, fluid. Such a body supports two distinct classes of quasi-geostrophic (QG) eigenmodes: fast, primarily hydrodynamic, inertial modes with period related to the rotation time scale and slow, primarily magnetic, magnetostrophic modes with much longer periods. Here, we investigate the properties of these hydromagnetic quasi-geostrophic modes as a function of non-dimensional parameters controlling the strength of the background magnetic field, the planetary rotation rate, and the amount of magnetic dissipation. We first present analytic solutions that illustrate the essential parameter dependences of the modes and provide a convenient benchmark for our numerical scheme. A comparison between known three-dimensional inertial modes in a sphere and our axially invariant QG modes shows encouraging agreement at low azimuthal wavenumbers, particularly for the slowest modes. The container geometry and background magnetic field structure are found to influence the radial structure of the modes, but not the scaling of their frequency with the control parameters. When the background magnetic field decreases towards the outer boundary in a spherical shell, QG modes tend to be compressed towards the outer boundary. Including magnetic dissipation, we find a continuous transition from diffusionless slow magnetic modes into quasi-free decay magnetic modes. During that transition (which is controlled by the magnitude of the Elsasser number), we find that slow magnetic modes weakly modified by diffusion exhibit a distinctive spiralling planform. When magnetic diffusion is significant (Elsasser number much smaller than unity), we find quasi-free decay slow magnetic modes whose decay time scale is comparable to, or shorter than, their oscillation time scale. Based on our analysis, we expect Mercury to be in a regime where the slow magnetic modes are of quasi-free decay type. Earth and possibly Ganymede, with their larger Elsasser numbers, may possess slow modes that are in the transition regime of weak diffusion, depending on the details of their poorly known internal magnetic fields. Fast QG modes, that are almost
unaffected by the background magnetic field, are expected in the cores of all three bodies.

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IGR J17454-2919: a new X-ray transient found by INTEGRAL/JEM-X close to the Galactic Center

The JEM-X twin X-ray monitors on board the INTEGRAL satellite have again detected a new X-ray transient during the latest observation of the Galactic Center region. The new source named IGR J17454-2919 is found less than 24 arcmin from the Galactic Center.

The source appears in both JEM-X 3-10 keV and 10-25 keV independent mosaic images of each monitor, obtained from the observations of the Galactic Bulge region and Galactic Center performed during INTEGRAL revolution 1460 between 2014 September 27 UTC 19:00 - 22:42, and from September 28 UTC 03:40 to September 30 UTC 01:44. It was not detected during any previous recent observations of the region leading to a 3-25 keV flux upper limit of 1 mCrab.

The average JEM-X fluxes are 6.5 ±1 mCrab (3-10 keV) and 8.2 ±1.7 mCrab (10-25 keV).

No significant time variation is seen in the source light-curve.

A Swift follow-up observation of 2 ksec exposure has been executed on October 2 between UTC 17:57 and 19:49. Though a PSF-fitted position cannot be obtained the new INTEGRAL source is clearly visible on the XRT image, only 10 arcsec from the JEM-X position, at:

R.A. = 266.366 equivalent to 17h45m28s
Dec. = -29.332 equivalent to -29d19m55s
with a 90% error confidence of 5 arcsec.

The XRT 0.3-10 keV PC-mode count-rate is 0.64 ±0.03 cnt/s.

Further analysis of the Swift data is on-going. We thank the Swift team for having performed this observation of the new transient source.

Multi-wavelength follow-up observations are encouraged to unveil the nature of IGR J17454-2919.

General information

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Impact of External Forcing on Glacier Dynamics at Jakobshavn Isbrae during 1840-2012

Greenland's main outlet glaciers have more than doubled their contribution to global sea-level rise over the past decade through acceleration of ice discharge. One of the triggering mechanisms is a reduction in resistance (buttressing) at the marine based glacier front (i.e. through reduced thickness or retreat of the floating tongue of a glacier) caused by enhanced calving or a longer-term thinning due to a mass deficit of the ice sheet. Recent findings indicate the reduced buttressing at the marine terminus is responsible for the recent dynamic changes observed in Greenland, but the controlling processes and triggering mechanisms are still unclear. Furthermore, our current understanding is almost entirely based on observations from a short-term record spanning only from a year to a decade, and is characterized by short-term fluctuations and therefore not representative for longer-term trends of several decade time scales. Here, we study the mechanisms controlling dynamic changes at the terminus of Jakobshavn Isbrae over a period of 172 years. The recent glacier acceleration began in late 1990s but there is evidence for glacier retreat of comparable magnitude in 1930s, when a similarly warm period occurred. To control the acceleration and retreat based on observed front positions during 1840-2012, we use an ocean model modifier that implements forcing at the ocean boundary using melange back pressure offsets. The mean temperature anomaly in west Greenland, the North Atlantic oscillation (NAO) winter index and the
Atlantic multidecadal oscillation (AMO) index anomalies for the period 1900-2012 sustain our modelling results. The modelled surface elevation changes near the front are considered and compared with observed surface elevation changes for the period 1880-2012. Furthermore, the modelled mass loss signal between 1997-2012 is validated based on ice mass change observations which we estimate using altimeter surveys from NASA's ATM flights during 1997-2012 supplemented with high-resolution Ice, Cloud and land Elevation Satellite (ICESat) data during 2003-2009 and Land, Vegetation and Ice Sensor (LVIS) data during 2007-2012. Our choice of ice sheet model comprises the Parallel Ice Sheet Model (PISM) and a continuous 172 years reconstruction of surface mass balance and its sub-components (Box, 2013).

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Improving the accuracy and reliability of MWD/magnetic-Wellbore-Directional surveying in the barents sea

The years ahead will see increased petroleum-related activity in the Barents Sea, with operations far off the coast of Norway. The region is at high geomagnetic latitude in the auroral zone, and therefore, directional drilling by use of magnetic reference will experience enlarged azimuth uncertainty compared with operations in the Norwegian and North Seas. Two main contributors to azimuth uncertainty are magnetic disturbances from electric currents in the ionosphere and axial magnetic interference from the drillstring. The former is more frequent in the Barents Sea than farther south, and the effect of the latter is increased because of diminished value of the magnetic horizontal component. Wellbore directional surveying for operations on the continental shelf in the North Sea and the Norwegian Sea rely on well-established procedures for near-real-time magnetic monitoring by use of onshore magnetic-reference stations. The different land and sea configuration, distant offshore oil and gas fields, higher geomagnetic latitude, and different behavior of the magnetic field require the procedures to be reassessed before being applied to the Barents Sea. To reduce drilling delays, procedures must be implemented to enable efficient management of magnetic disturbances. In some areas of the Barents Sea, the management requires new equipment to be developed and tested before drilling, such as seabed magnetometer stations. One simple way to reduce drillstring interference is increasing the amount of nonmagnetic steel in the bottomhole assembly (BHA). To maintain azimuth uncertainty at an acceptable level in northern areas, it is crucial that wellbore-directional-surveying requirements are given high priority and considered early during well planning. During the development phase of an oil and gas field, the planned wells must be assigned adequate positional-uncertainty models and, if possible, be designed in a direction that minimizes the wellbore directional uncertainty. ©2014 Society of Petroleum Engineers.
Improving the Pattern Reproducibility of Multiple-Point-Based Prior Models Using Frequency Matching

Some multiple-point-based sampling algorithms, such as the snesim algorithm, rely on sequential simulation. The conditional probability distributions that are used for the simulation are based on statistics of multiple-point data events obtained from a training image. During the simulation, data events with zero probability in the training image statistics may occur. This is handled by pruning the set of conditioning data until an event with non-zero probability is found. The resulting probability distribution sampled by such algorithms is a pruned mixture model. The pruning strategy leads to a probability distribution that lacks some of the information provided by the multiple-point statistics from the training image, which reduces the reproducibility of the training image patterns in the outcome realizations. When pruned mixture models are used as prior models for inverse problems, local re-simulations are performed to obtain perturbed realizations. Consequently, these local re-simulations lead to additional pruning in the set of conditioning data, which further deteriorates the pattern reproduction. To mitigate this problem, it is here suggested to combine the pruned mixture model with a frequency matching model. The multiple-point statistics of outcome realizations from this combined model has improved degree of match with the statistics from the training image. An efficient algorithm that samples this combined model is suggested. Finally, a tomographic cross-borehole inverse problem with prior information expressed by the combined (prior) model is used to demonstrate the effect of pattern reproducibility on the resolution of an inverse problem.
IMU Calibration and Validation in a Factory, Remote on Land and at Sea

This paper treats the IMU calibration and validation problem in three settings: Factory production line with the aid of a precision multi-axis turntable, in-the-field on land and at sea, both without specialist test equipment. The treatment is limited to the IMU calibration parameters of key relevance for gyro-compassing grade optical gyroscopes and force-rebalanced pendulous accelerometers: Scale factor, bias and sensor axes misalignments. Focus is on low-dynamic marine applications e.g., subsea construction and survey. Two different methods of calibration are investigated: Kalman smoothing using an Aided Inertial Navigation System (AINS) framework, augmenting the error state Kalman filter (ESKF) to include the full set of IMU calibration parameters and a least squares approach, where the calibration parameters are determined by minimizing the magnitude of the INS error differential equation output. A method of evaluating calibrations is introduced and discussed. The two calibration methods are evaluated for factory use and results compared to a legacy proprietary method as well as in-field calibration/verification on land and at sea. The calibration methods show similar navigation performance as the proprietary method. Furthermore it is shown that the AINS method can calibrate in-field on land and at sea without the use of a precision multi-axis turntable.

In-flight PSF calibration of the NuSTAR hard X-ray optics

We present results of the point spread function (PSF) calibration of the hard X-ray optics of the Nuclear Spectroscopic Telescope Array (NuSTAR). Immediately post-launch, NuSTAR has observed bright point sources such as Cyg X-1, Vela X-1, and Her X-1 for the PSF calibration. We use the point source observations taken at several off-axis angles together with a ray-trace model to characterize the in-orbit angular response, and find that the ray-trace model alone does not fit the observed event distributions and applying empirical corrections to the ray-trace model improves the fit significantly. We describe the corrections applied to the ray-trace model and show that the uncertainties in the enclosed energy fraction (EEF) of the new PSF model is less than or similar to 3 for extraction apertures of R greater than or similar to 60° with no significant energy dependence. We also show that the PSF of the NuSTAR optics has been stable over a period of similar to 300 days during its in-orbit operation.
Influence analysis of Arctic tide gauges using leverages

Reconstructions of historical sea level in the Arctic Ocean are fraught with difficulties related to lack of data, uneven distribution of tide gauges and seasonal ice cover. Considering the period from 1950 to the present, we attempt to identify conspicuous tide gauges in an automated way, using the statistical leverage of each individual gauge. This may be of help in determining appropriate procedures for data preprocessing, of particular importance for the Arctic area as the GIA is hard to constrain and many gauges are located on rivers. We use a model based on empirical orthogonal functions from a calibration period, in this preliminary case Drakkar ocean model data, which are forced using historical tide gauge data from the PSMSL database. The resulting leverage for each tide gauge may indicate that it represents a distinct mode of variability, or that its time series is perturbed in a way inappropriate for the reconstruction so that it should be removed from the reconstruction model altogether. Therefore, the characteristics of the high-leverage gauges are examined in detail.

General information

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Initial results from NuSTAR observations of the Norma arm

Results are presented for an initial survey of the Norma Arm gathered with the focusing hard X-Ray Telescope NuSTAR. The survey covers 0.2 deg(2) of sky area in the 3-79 keV range with a minimum and maximum raw depth of 15 ks and 135 ks, respectively. Besides a bright black-hole X-ray binary in outburst (4U 1630-47) and a new X-ray transient (NuSTAR J163433-473841), NuSTAR locates three sources from the Chandra survey of this region whose spectra are extended above 10 keV for the first time: CXOU J163329.5-473332, CXOU J163350.9-474638, and CXOU J163355.1-473804. Imaging, timing, and spectral data from a broad X-ray range (0.3-79 keV) are analyzed and interpreted with the aim of classifying these objects. CXOU J163329.5-473332 is either a cataclysmic variable or a faint low-mass X-ray binary. CXOU J163350.9-474638 varies in intensity on year-long timescales, and with no multi-wavelength counterpart, it could be a distant X-ray binary or possibly a magnetar. CXOU J163355.1-473804 features a helium-like iron line at 6.7 keV and is classified as a nearby cataclysmic variable. Additional surveys are planned for the Norma Arm and Galactic Center, and those NuSTAR observations will benefit from the lessons learned during this pilot study.
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Innovative Remote Sensing Using the International Space Station: GNSS Reflectometry with GEROS

The substorm current wedge (SCW) is a fundamental component of geomagnetic substorms. Models tend to describe the SCW as a simple line current flowing into the ionosphere toward dawn and out of the ionosphere toward dusk, linked by a westward electrojet. We use multispacecraft observations from perigee passes of the Cluster 1 and 4 spacecraft during a substorm on 15 January 2010, in conjunction with ground-based observations, to examine the spatial structuring and temporal variability of the SCW. At this time, the spacecraft traveled east-west azimuthally above the auroral region. We show that the SCW has significant azimuthal structure on scales of 100km at altitudes of 4000-7000km. We identify 26 individual current sheets in the Cluster 4 data and 34 individual current sheets in the Cluster 1 data, with Cluster 1 passing through the SCW 120-240s after Cluster 4 at 1300-2000km higher altitude. Both spacecraft observed large-scale regions of net upward and downward field-aligned current, consistent with the large-scale characteristics of the SCW, although sheets of oppositely directed currents were observed within both regions. We show that the majority of these current sheets were closely aligned to a north-south direction, in contrast to the expected east-west orientation of the preonset aurora. Comparing our results with observations of the field-aligned current associated with bursty bulk flows (BBFs), we conclude that significant questions remain for the explanation of SCW structuring by BBF-driven wedgelets. Our results therefore represent constraints on future modeling and theoretical frameworks on the generation of the SCW. Key Points

The substorm current wedge (SCW) has significant azimuthal structure. Current sheets within the SCW are north-south.
The substructure of the SCW raises questions for the proposed wedgelet scenario.
INTEGRAL detection of the multi-peaked emission from the Be/X-ray binary pulsar GRO J1008-57

Recent observations from the on-going INTEGRAL Galactic Plane Scanning programme (PI: A. Bazzano) have detected increasing X-ray flux from the Be/X-ray binary pulsar GRO J1008-57, confirming the re-brightening detected by MAXI/GSC (ATEL #6819).

The source was in the field of view of the IBIS and JEM-X instruments on-board INTEGRAL during revolutions 1483 (start time 2014-12-05T09:55 UTC) and 1485 (start time 2014-12-11T09:15). The hard X-ray fluxes, as detected by IBIS, have increased over the last week: in revolution 1483, GRO 1008-57 was detected with a flux of (21.6±1.7) mCrab in the 18-40 keV energy range (with an exposure time of 15 ks), later in revolution 1485 the source showed a flux of (53.4±1.9) mCrab (~4.7e-10 ergs cm-2 s-1) in the same energy range with an exposure time of 21 ks.

The JEM-X instrument detected GRO J1008-57 during revolution 1485, with a flux of 38.5 +/-3 mCrab (3-10 keV) and 70.5 +/-9 mCrab (10-25 keV), during a 4.9 ks effective exposure.

This is the third outburst peak observed from this source during the current X-ray activity which started in September (ATEL #6465, #6630, #6656, #6664, #6819). Multiple peaks are a complex morphology occurring in about 1/4 of the outbursts in Be/XRBs (e.g. Kretschmar et al., 2013, arXiv.1302.3434).

We will continue to monitor the source activity with INTEGRAL through the GPS programme until December 20th. Light curves and images can be found on the GPS webpages: http://gpsiasf.iasf-roma.inaf.it/
INTEGRAL/IBIS detects renewed activity from H 1417-624

During a recent INTEGRAL Galactic Plane Scanning observation (PI: A. Bazzano), started on 2014 January 19 at 07:51 UTC, IBIS/ISGRI detected renewed activity from the transient system H 1417-624. The source H 1417-624 was detected at about 10 sigma in the IBIS map 18-40 keV, with a flux of 14.5+/-1.5 mCrab (uncertainties at 90% c.l.) and a net exposure time of 25ks. The 40-100 keV IBIS/ISGRI 3-sigma upper limit is about 8 mCrab. During the previous INTEGRAL revolution 1375, started on 2014 January 16 at 07:55, the 3-sigma upper limit was 5 mCrab (18-40 keV), although the exposure time was 22ks. H 1417-624 is a Be X-ray Transient (Apparao et al. 1980, A&A 89, 249; Grindlay et al. 1984, ApJ 276, 621) showing a neutron star spin period of 17.54 s and an orbital period of 42.12 days (Finger et al. 1996, A&A Supp. Ser. 120, 209). It was previously detected in 1994 and 1995 (during a strong type II outburst lasting over 110 days; Finger et al. 1996), in 1999 by BATSE (Finger 1999, IAUC# 7313 and ATel #52 and #53, for the correct spin period), in 2008 July by INTEGRAL IBIS/ISGRI (ATel #1613) and in 2009 October by Fermi/GBM (ATel #2275) and by Swift/BAT (ATel #2276). Further INTEGRAL Galactic Plane Scanning observation are planned in the coming days. Results from the Galactic Plane Scanning are made publicly available at: http://gpsiasf.iasf-roma.inaf.it

INTEGRAL/JEM-X detection of a type-I X-ray burst from MAXI J1421-613

During the Galactic Plane Scan performed on 2014 January 10, the two JEM-X instruments on-board INTEGRAL detected a type-I X-ray burst from the newly discovered X-ray transient MAXI J1421-613 (ATels #5750, #5751, #5759) over the 5 ks in which the source was in the instruments field of view.

The onset of the burst occurred on 2014 January 10 at 19:05 UTC, and the total event as observed by JEM-X lasted for about 20 s (3-25 keV). The average spectrum of the burst could be roughly described by using a black-body model with temperature kT~1 keV. The corresponding flux was $1.7E^{-9}$ erg/cm^2/s (translating into a luminosity of 1.3E37 erg/s at 8 kpc; 3-10 keV). We estimated a persistent flux outside the burst of $7E^{-10}$ erg/cm^2/s (3-25 keV).

This detection reveals that MAXI J1421-613 is a newly discovered X-ray bursting transient source, thus hosting an accreting neutron star.
INTEGRAL/JEM-X sees enhanced activity in the Galactic center region: SAX J1747.0-2853 and IGR J17454-2919

During INTEGRAL observations of the Galactic Center region performed between 2014 October 18 UTC 16:43 and Oct. 20 UTC 18:36, the JEM-X monitor has detected the transient source and X-ray superburster SAX J1747.0-2853 in a new outburst. The last time this source has been seen in outburst was in February 2012 (see, e.g., ATels #3183 and #3930). The measured fluxes are:

- 14 ± 1 mCrab between 3-10 keV and 3.5 ± 2 mCrab between 10-25 keV.

In the same observation the new source IGR J17454-2919 (ATels #6530) and likely black hole candidate (ATel #6574) is also seen about a factor two brighter compared to previous observations at the following fluxes:

- 10 ± 1 mCrab between 3-10 keV and 15 ± 2 mCrab between 10-25 keV.

INTEGRAL observation of GRS 1739-278 in outburst

During the Galactic bulge monitoring observation (Atel #438) performed on 2014 March 19 from 11:00 to 14:42 (UTC), the black-hole candidate GRS 1739-278 (ATel #5986) was also seen by INTEGRAL. The source is detected by IBIS/ISGRI up to an energy of about 200 keV. The estimated ISGRI flux is 143+/-2 mCrab in the 18-40 keV energy band and 166+/-2 mCrab in the 40-100 keV energy band. The fluxes estimated from JEM-X are 60+/-4 mCrab in the 3-10 keV energy band and 104+/-8 mCrab in the 10-20 keV energy band.

Its averaged broad-band (3-200 keV) spectrum, extracted by using all available ISGRI and JEM-X data (total exposure time 12.6 ks), could be roughly described with a cut-off power-law model. The measured photon index is 1.4+/-0.2 and the energy cut-off is 90(20+40) keV (we fixed the absorption column density to the Galactic value expected in the direction of the source, i.e. 0.8E22 cm^-2). The 3-200 keV X-ray flux derived from the spectral fit is 5E-9 ergs/cm^2/s (not corrected for absorption).

This spectral shape is reminiscent of that displayed by black-hole candidates in the canonical hard state.
Further observations of the source with INTEGRAL are planned for March 28.

**General information**

State: Published
Organisations: National Space Institute, Astrophysics, University of Maryland Baltimore County, University of Geneva, European Space Astronomy Centre and European Space Agency, CAB/INTA-CSIC, APC, University of Southampton, National Institute for Astrophysics, University of Tokyo, SRON/CIA/ RU, NASA Goddard Space Flight Center, European Space Agency, University of Amsterdam
Number of pages: 1
Publication date: 2014
Main Research Area: Technical/natural sciences

**Links:**
http://www.astronomerstelegram.org/?read=5991

**Klimapause**

**General information**

State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Pages: 12-13
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ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences

**Bibliographical note**

Indlæg i Weekendavisen, Opinion, 10. januar 2014, pp. 12-13
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Publication: Communication › Newspaper article – Annual report year: 2014

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**General information**

State: Published
Organisations: National Space Institute, Center for Polar Activities
Authors: Pedersen, J. O. P. (Intern)
Number of pages: 71
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**Publication information**

Media of output: PowerPoint
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Main Research Area: Technical/natural sciences
Laser altimetry reveals complex pattern of Greenland Ice Sheet dynamics

Significance We present the first detailed reconstruction of surface elevation changes of the Greenland Ice Sheet from NASA’s laser altimetry data. Time series at nearly 100,000 locations allow the characterization of ice sheet changes at scales ranging from individual outlet glaciers to larger drainage basins and the entire ice sheet. Our record shows that continuing dynamic thinning provides a substantial contribution to Greenland mass loss. The large spatial and temporal variations of dynamic mass loss and widespread intermittent thinning indicate the complexity of ice sheet response to climate forcing, strongly enforcing the need for continued monitoring at high spatial resolution and for improving numerical ice sheet models.
LOTUS—Preparing Sentinel-3 Ocean and Land SAR Altimetry Processing for Copernicus

The Sentinel-3 satellite mission with its SRAL instrumentation contains new features compared to the conventional radar altimeter mission that form the basis for new innovative GMES products and applications that are not considered or implemented in the Copernicus services yet. To utilize the full potential of the new data source, new methods and processing chains need to be developed. Also, new potential Copernicus products should be developed that utilize the improved along-track resolution over both the oceans and over land. Then new operational processing, validation and delivery mechanisms need to be developed and implemented for generating the new dynamic products. A smooth transition from old to new products is important to ensure existing services. Finally, the take-up of the new Copernicus products by the value-adding sectors needs to be stimulated and demonstrated that they will be used for commercial activities. The main objectives of the LOTUS project is to prepare the take-up of data from Sentinels 3. In the initial phase, LOTUS will develop processing scheme for extracting high-resolution sea surface heights, wave heights and wind speeds from SAR mode data. Over land, the LOTUS will develop processing scheme for extracting high-resolution river and lake heights, soil moisture, and snow water equivalents. This presentation shows some preliminary results based on analyses using CRYOSAT data. Furthermore, new DEMO data sets are presented. These data sets facilitate the development of marine and hydrological services for Copernicus and the down-stream segment.

General information

State: Published
Organisations: National Space Institute, Geodesy, Department of Environmental Engineering, Water Resources Engineering, STARLAB, CLS, DHI Denmark, Newcastle University
Authors: Knudsen, P. (Intern), Andersen, O. B. (Intern), Jain, M. (Intern), Nielsen, K. (Intern), Stenseng, L. (Intern), Villadsen, H. (Intern), Egido, A. (Ekstern), Murenco, L. (Ekstern), Berry, P. (Ekstern), Moreau, T. (Ekstern), Thibaut, P. (Ekstern), Bauer-Gottwein, P. (Intern), Madsen, H. (Ekstern), Petersen, O. S. (Ekstern)
Number of pages: 1
Low Background Micromegas in CAST

Solar axions could be converted into x-rays inside the strong magnetic field of an axion helioscope, triggering the detection of this elusive particle. Low background x-ray detectors are an essential component for the sensitivity of these searches. We report on the latest developments of the Micromegas detectors for the CERN Axion Solar Telescope (CAST), including technological pathfinder activities for the future International Axion Observatory (IAXO). The use of low background techniques and the application of discrimination algorithms based on the high granularity of the readout have led to background levels below $10^{-6}$ counts/keV/cm²/s, more than a factor 100 lower than the first generation of Micromegas detectors. The best levels achieved at the Canfranc Underground Laboratory (LSC) are as low as $10^{-7}$ counts/keV/cm²/s, showing good prospects for the application of this technology in IAXO. The current background model, based on underground and surface measurements, is presented, as well as the strategies to further reduce the background level. Finally, we will describe the R&D paths to achieve sub-keV energy thresholds, which could broaden the physics case of axion helioscopes.
Low-Latitude Ionosphere and Thermosphere: Decadal Observations From the CHAMP Mission

Self-consistent physical models of an auroral flux tube are capable of calculating optical emissions and ionospheric state variables for a given set of magnetospheric drivers. The collocation of incoherent scatter radar (ISR) and photometric measurements provides a powerful framework for testing the internal consistency of such models. This chapter considers the invertibility of this forward process as it pertains to an auroral flux tube. It focuses on the problem of estimating the spectrum of primary electrons via inversion of auroral spectral brightnesses in the near infrared, where prompt and near-prompt emissions of atomic oxygen and molecular nitrogen provide maximum sensitivity to the incident energy spectrum over a limited and contiguous free spectral range. The chapter tests the internal consistency by comparing observed ISR state variables with predictions of the same variables derived by optical inversion.

General information
State: Published
Organisations: National Space Institute, Kyushu University
Authors: Stolle, C. (Intern), Liu, H. (Ekstern)
Pages: 259-272
Publication date: 2014

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Publisher: Wiley
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Source-ID: 2288727300
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Mapping future flooding hazards from sea extremes and subsidence

General information
State: Published
Organisations: National Space Institute, Geodesy, Danish Geodata Agency
Authors: Sørensen, C. S. (Intern), Vognsen, K. (Ekstern), Broge, N. (Ekstern), Knudsen, P. (Intern)
Number of pages: 1
Pages: 67
Publication date: 2014

Host publication information
Title of host publication: Clima change adaptation adapting to change: from research to decision-making : Abstracts
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Conference: 3rd Nordic International Conference on Climate Change Adaptation, Copenhagen, Denmark, 25/08/2014 - 25/08/2014
Electronic versions:
nicca_abstracts_p67.pdf
Source: PublicationPreSubmission
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2015

Mapping of the DOME-C area in Antarctica by an airborne L-band radiometer

A 350 × 350 km area near the Concordia station on the high plateau of Dome C in Antarctica has been mapped by an airborne L-band radiometer system. The area was expected to display a rather uniform brightness temperature close to the yearly mean temperature — well suited for calibration checks for spaceborne instruments like SMOS, Aquarius, and SMAP. The measured brightness temperatures shows unexpected variations like 8 K variation on an East-West profile through Concordia, and in certain cases a slope of almost 1 K per km. Comparing the measured brightness temperature map with bottom topography reveals a convincing correlation. Simulations show that variations in bedrock topography can indeed modulate the brightness temperature appropriately to explain the observed variations.
Marine gravity field for oil and mineral exploration — Improvements in the Arctic from CryoSat-2 SAR altimetry

The availability of CryoSat-2 with its coverage throughout the Arctic Ocean up to 88N is a quantum leap forward for altimetric gravity field modeling and here we have tried to quantify the improvement of Cryosat-2 to global and particularly Arctic altimetric gravity field modeling through a comparison with highly accurate marine gravity observations.

Mass loss from an ice-sheet drainage basin in West Greenland

General information
State: Published
Organisations: National Space Institute, Geodesy, Geodynamics, IT-Department, Microwaves and Remote Sensing, Geological Survey of Denmark and Greenland
Authors: Andersen, M. L. (Ekstern), Bech Andersen, S. (Ekstern), Stenseng, L. (Intern), Skourup, H. (Intern), Colgan, W. (Ekstern), Kristensen, S. S. (Intern), Merryman Boncori, J. P. (Intern), Ahlstrøm, A. P. (Ekstern), Fettweis, X. (Ekstern), Forsberg, R. (Intern), Citterio, M. (Ekstern), Box, J. E. (Ekstern), Fausto, R. S. (Ekstern)
Pages: 87-90
Publication date: 2014
Mathematical Properties Relevant to Geomagnetic Field Modeling

Geomagnetic field modeling consists in converting large numbers of magnetic observations into a linear combination of elementary mathematical functions that best describes those observations. The set of numerical coefficients defining this linear combination is then what one refers to as a geomagnetic field model. Such models can be used to produce maps. More importantly, they form the basis for the geophysical interpretation of the geomagnetic field, by providing the possibility of separating fields produced by various sources and extrapolating those fields to places where they cannot be directly measured. In this chapter, the mathematical foundation of global (as opposed to regional) geomagnetic field modeling is reviewed, and the spatial modeling of the field in spherical coordinates is focused. Time can be dealt with as an independent variable and is not explicitly considered. The relevant elementary mathematical functions are introduced, their properties are reviewed, and how they can be used to describe the magnetic field in a source-free (such as the Earth's neutral atmosphere) or source-dense (such as the ionosphere) environment is explained. Completeness and uniqueness properties of those spatial mathematical representations are also discussed, especially in view of providing a formal justification for the fact that geomagnetic field models can indeed be constructed from ground-based and satellite-borne observations, provided those reasonably approximate the ideal situation where relevant components of the field can be assumed perfectly known on spherical surfaces or shells at the time for which the model is to be recovered.

General information
State: Published
Organisations: National Space Institute, Geomagnetism, NASA Goddard Space Flight Center, University Paris Diderot - Paris 7
Authors: Sabaka, T. J. (Ekstern), Hulot, G. (Ekstern), Olsen, N. (Intern)
Number of pages: 37
Publication date: 2014

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ISBN (Electronic): 9783642277931
Main Research Area: Technical/natural sciences
DOIs: 10.1007/978-3-642-27793-1_17-2
Source: PublicationPreSubmission
Source-ID: 105456744
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Measured and modelled absolute gravity changes in Greenland
In glaciated areas, the Earth is responding to the ongoing changes of the ice sheets, a response known as glacial isostatic adjustment (GIA). GIA can be investigated through observations of gravity change. For the ongoing assessment of the ice sheets mass balance, where satellite data are used, the study of GIA is important since it acts as an error source. GIA consists of three signals as seen by a gravimeter on the surface of the Earth. These signals are investigated in this study. The ICE-5G ice history and recently developed ice models of present day changes are used to model the gravity change in Greenland. The result is compared with the initial measurements of absolute gravity (AG) change at selected Greenland Network (GNET) sites. We find that observations are highly influenced by the direct attraction from the ice and ocean. This is especially evident in the measurements conducted at the GNET station near the Helheim Glacier. The effect of the direct attraction diminishes at sites that are more than one degree from the source. Here, the dominant signal is the effect of the elastic signal from present day ice mass changes. We find agreement between the measured and modelled...
gravity changes at all but one site. This agreement only holds when the direct attraction is considered. For one site, there is no agreement, indicating that some improvements to the modelling results or the processing of the gravity data are needed. In addition, more AG measurements are needed to strengthen the time series of gravity change.

**General information**
- **State:** Published
- **Organisations:** National Space Institute, Geodynamics
- **Authors:** Nielsen, J. E. (Intern), Forsberg, R. (Intern), Strykowski, G. (Intern)
- **Pages:** 53-59
- **Publication date:** 2014
- **Main Research Area:** Technical/natural sciences

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- **Volume:** 73
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  - BFI (2018): BFI-level 1
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  - Web of Science (2017): Indexed Yes
  - BFI (2016): BFI-level 1
  - Scopus rating (2016): SJR 0.946 SNIP 1.183 CiteScore 2.03
  - BFI (2015): BFI-level 1
  - Scopus rating (2015): SJR 1.317 SNIP 1.066 CiteScore 2.17
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): SJR 1.288 SNIP 1.251 CiteScore 2.33
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): SJR 1.709 SNIP 1.523 CiteScore 2.96
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): SJR 1.502 SNIP 1.32 CiteScore 2.53
  - ISI indexed (2012): ISI indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 1.157 SNIP 1.092 CiteScore 1.96
  - ISI indexed (2011): ISI indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 1.013 SNIP 0.923
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 1.214 SNIP 1.409
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 1.263 SNIP 0.931
  - Scopus rating (2007): SJR 1.02 SNIP 0.985
  - Web of Science (2007): Indexed yes
  - Scopus rating (2006): SJR 1.316 SNIP 1.194
  - Web of Science (2006): Indexed yes
  - Scopus rating (2005): SJR 1.321 SNIP 1.389
  - Web of Science (2005): Indexed yes
  - Scopus rating (2004): SJR 1.015 SNIP 1.245
  - Scopus rating (2003): SJR 0.948 SNIP 0.873
  - Scopus rating (2002): SJR 0.789 SNIP 0.725
  - Web of Science (2002): Indexed yes
  - Scopus rating (2001): SJR 1.375 SNIP 0.93
Measuring the coronal properties of IC 4329A with NuSTAR

We present an analysis of a ~160 ks NuSTAR observation of the nearby bright Seyfert galaxy IC 4329A. The high-quality broadband spectrum enables us to separate the effects of distant reflection from the direct coronal continuum, and to therefore accurately measure the high-energy cutoff to be $E_{\text{cut}} = 178_{-40}^{+74}$ keV. The coronal emission arises from accretion disk photons Compton up-scattered by a thermal plasma, with the spectral index and cutoff being due to a combination of the finite plasma temperature and optical depth. Applying standard Comptonization models, we measure both physical properties independently using the best signal to noise obtained to date in an active galactic nucleus over the 3-79 keV band. We derive $kT_e = 37_{-6}^{+7}$ keV with $\tau = 1.25_{-0.10}^{+0.20}$ assuming a slab geometry for the plasma, and $kT_e = 33_{-6}^{+6}$ keV with $\tau = 3.41_{-0.38}^{+0.58}$ for a spherical geometry, with both having an equivalent goodness-of-fit.
Microwave interferometric radiometry in remote sensing: An invited historical review

The launch of the Soil Moisture and Ocean Salinity (SMOS) mission on 2 November 2009 marked a milestone in remote sensing for it was the first time a radiometer capable of acquiring wide field of view images at every single snapshot, a unique feature of the synthetic aperture technique, made it to space. The technology behind such an achievement was developed, thanks to the effort of a community of researchers and engineers in different groups around the world. It was only because of their joint work that SMOS finally became a reality. The fact that the European Space Agency, together with CNES (Centre National d'Etudes Spatiales) and CDTI (Centro para el Desarrollo Tecnologico e Industrial), managed to get the project through should be considered a merit and a reward for that entire community. This paper is an invited historical review that, within a very limited number of pages, tries to provide insight into some of the developments which, one way or another, are imprinted in the name of SMOS.
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.872 SJR 0.546
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.65 SJR 0.562 SNIP 1.165
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.031 SNIP 1.207 CiteScore 1.59
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.921 SNIP 1.262 CiteScore 1.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.866 SNIP 1.19 CiteScore 1.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.567 SNIP 0.852 CiteScore 1.16
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.473 SNIP 0.876 CiteScore 1.25
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.654 SNIP 0.838
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.67 SNIP 1.315
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.593 SNIP 0.873
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.583 SNIP 1.035
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.841 SNIP 1.196
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.799 SNIP 0.966
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.903 SNIP 1.348
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.64 SNIP 1.228
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.847 SNIP 1.317
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.214 SNIP 1.374
Scopus rating (2000): SJR 0.997 SNIP 0.895
Scopus rating (1999): SJR 0.901 SNIP 0.872

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Publication: Research - peer-review › Journal article – Annual report year: 2014
MINBAR: A comprehensive study of 6000+ thermonuclear shell flashes from neutron stars

Thermonuclear (type-I) X-ray bursts have been observed from accreting neutron stars since the early 1970s. These events serve as a valuable diagnostic tool to constrain the source distance; accretion rate; accreted fuel composition, and hence evolutionary status of the donor; and even the neutron star mass and radius. Additionally, large samples of bursts can serve to test models describing ignition and burning, and hence constrain the nuclear processes taking place. The Multi-Instrument Burst ARchive (MINBAR) is an effort to combine large samples of burst observations from BeppoSAX/WFC, RXTE/PCA, and INTEGRAL/JEM-X. We have searched observations of the approximately 100-known X-ray burst sources, and have accumulated more than 6000 events from 83 sources over the past 20 years. We describe the assembly of the catalogue, the analysis procedures, and the science outcomes and prospects. Notable results so far include a systematic analysis of short recurrence time bursts; evidence for accretion rate variation during bursts; studies of the burst behaviour of new transients; and long-duration bursts including super bursts.

General information
State: Published
Organisations: National Space Institute, Astrophysics, Monash University, European Space Astronomy Centre and European Space Agency
Authors: Galloway, D. (Ekstern), in't Zand, J. (Ekstern), Chenevez, J. (Intern), Keek, L. (Ekstern), Sanchez-Fernandez, C. (Ekstern), Kuulkers, E. (Ekstern), Worpel, H. (Ekstern), Lampe, N. (Ekstern)
Publication date: 2014
Modelling the behavior of the Jakobshavn glacier since the end of the Little Ice Age

Current model estimates of the Greenland Ice Sheet (GrIS) are almost entirely based on coarse grids (>10km) and constrained by climate models that span from 60s to present. To improve the projection of future sea level rise, a long-term data record that reveals the mass balance beyond decadal timescale is required. Here, we use a continuous 171 year reconstruction (since the end of the Little Ice Age) by J.E. Box of the Greenland Ice Sheet climatic surface mass balance and its sub-components to study the interaction between climate and the cryosphere originating in changes in the surface mass balance and dynamics of the GrIS over the last 171 years. Throughout our study, we use the Parallel Ice Sheet Model (PISM) capabilities. The initialization of the ice sheet is performed on a 5 km grid using paleo climatic forcing (-125 ka to present) based on a positive degree day (PDD) model. For a better overview and for the purpose of increasing the resolution to 1 km, our study focuses only on the Jakobshavn glacier. In order to determine the locations of the flow for the regional model, a drainage basin mask was extracted from the surface elevation data based on the gradient flow. While inside the basin mask the full PISM model is applied, outside the basin mask the boundary conditions are taken as captured by the whole Greenland initialization. Considering the surface mass balance reconstruction where the monthly accumulation rates are assumed to be 1/12 of the annual accumulation, a yearly 1850-2010 climatic forcing is applied in the regional run.

General information
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Organisations: National Space Institute, Geodesy, University of Alaska Fairbanks, University of Copenhagen, Geological Survey of Denmark and Greenland
Authors: Muresan, I. S. (Intern), Khroulev, C. (Ekstern), Khan, S. A. (Intern), Kjær, K. H. (Ekstern), Box, J. E. (Ekstern)
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ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2009): BFI-level 1
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Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2014

Multichannel surface clutter suppression: East Antarctica P-band SAR ice sounding in the presence of grating lobes

Ice sounding with radar is a well-established technique for the retrieval of ice depth, and provides information on ice structures and layering. Airborne radar ice sounders suffer from off-nadir surface clutter that masks the signal from bedrock and ice layers with unwanted but simultaneously received surface reflections. This is of importance for future satellite ice-sounding missions, as the spaceborne geometry leads to strong surface clutter even for deep subsurface returns. This paper presents analysis and comparison of different clutter-suppression techniques applied to data acquired with the European Space Agency’s P-band POLarimetric Airborne Radar Ice Sounder (POLARIS). The 4 m long antenna of POLARIS enables simultaneous reception of up to four across-track channels. It was operated in 2011 over Antarctica at a high flight altitude of 3200 m. Different coherent weighting techniques of the receive channels were used to suppress
the surface 'clutter'. However, with a channel spacing of 1.4 times the wavelength, the grating lobe imposes a limitation to
the off-nadir angular range in which clutter can be effectively attenuated. Results of ice sounding over Jutulstraumen
 glacier are described, where we demonstrate a clutter suppression of up to 10 dB.

**General information**
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Organisations: National Space Institute, Microwaves and Remote Sensing, IT-Department
Authors: Bekaert, D. (Ekstern), Gebert, N. (Ekstern), Lin, C. (Ekstern), Heliere, F. (Ekstern), Dall, J. (Intern), Kusk, A.
(Intern), Kristensen, S. S. (Intern)
Number of pages: 13
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ISSN (Print): 0260-3055
Ratings:
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.755 SJR 1.194
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.177 SNIP 0.949 CiteScore 2.31
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.287 SNIP 0.699 CiteScore 1.93
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.725 SNIP 0.89 CiteScore 2.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.635 SNIP 0.924 CiteScore 2.35
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.793 SNIP 1.064 CiteScore 2.38
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.963 SNIP 0.933 CiteScore 1.74
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.99 SNIP 0.766
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.94 SNIP 0.845
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.145 SNIP 0.677
Scopus rating (2007): SJR 0.829 SNIP 0.673
Scopus rating (2006): SJR 0.671 SNIP 0.496
Scopus rating (2005): SJR 1.291 SNIP 0.756
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.476 SNIP 0.965
Scopus rating (2003): SJR 0.936 SNIP 0.835
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.786 SNIP 0.811
Multimission satellite altimetric data validation in the Baltic Sea

The assessment of altimetric data is crucial for investigating the regional sea level variability. Few works have been performed to validate the altimetric data [1, 2] in the Baltic Sea. The exploring of multi-mission altimetric data in the Baltic Sea has yet to be published. The number of available altimetric measurements increases of 96% by replacing the radiometer wet troposphere correction with model based correction. The results indicate the high quality of the along-track altimetry measurements in the semi-closed sea, which shows good agreement with tide gauge data except in the shallow waters and ice-covered regions, such as Danish Straits and the Gulf of Bothnian.

General information
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Multimodel simulations of Arctic Ocean sea surface height variability in the period 1970-2009

The performance of several numerical ocean models is assessed with respect to their simulation of sea surface height (SSH) in the Arctic Ocean, and the main patterns of SSH variability and their causes over the past 40 years (1970-2009) are analyzed. In comparison to observations, all tested models broadly reproduce the mean SSH in the Arctic and reveal a good correlation with both tide gauge data and SSH anomalies derived from satellite observations. Although the models do not represent the positive Arctic SSH trend observed over the last two decades, their interannual-to-decadal SSH variability is in reasonable agreement with available measurements. Focusing on results from one of the models for a detailed analysis, it is shown that the decadal-scale SSH variability over shelf areas and deep parts of the Arctic Ocean have pronounced differences that are determined mostly by salinity variations. A further analysis of the three time periods 1987-1992, 1993-2002, and 2003-2009, corresponding to the transition times between cyclonic and anticyclonic regimes of the atmospheric circulation over the Arctic, revealed an unusual increase of SSH in the Amerasian basin during 2003-2009. Results from this model support the recent finding that the increase is caused mainly by changes in freshwater content brought about by the freshwater export through the Canadian Arctic Archipelago and increased Ekman pumping in the Amerasian basin and partly by lateral freshwater transport changes, leading to a redistribution of low-salinity shelf water. Overall, we show that present-day models can be used for investigating the reasons for low-frequency SSH variability in the region.
New constraints on Earth’s radial conductivity structure

We present a new model of Earth’s radial (1-D) conductivity structure at depths between 10 km and the core-mantle boundary. It is based on CM5, the latest version in the Comprehensive Model series that has been derived using 13 years (September 2000 to September 2013) of magnetic data collected by the three satellites Oersted, CHAMP and SAC-C and at the global network of geomagnetic observatories. CM5 describes contributions due to sources in core, lithosphere, ionosphere and magnetosphere (and corresponding induced parts) in form of spherical harmonic expansion (SHE) coefficients. Removing predictions of the core, lithospheric and ionospheric field contributions as given by CM5 from the observations, we determine time series of the dominating external and induced SHE coefficients of the magnetic potential due to the magnetospheric ring current. Scalar Q-responses are estimated from these coefficients. An iterative approach is used to correct the estimated responses for 3-D effects arising from lateral heterogeneities in the top 10 km. The corrected Q-responses are converted to C-responses; the latter are subsequently inverted for the layered 1-D mantle conductivity profile with the Newton method. The Hessian matrix of the misfit function, which is derived analytically, is used to estimate confidence limits for the conductivity of each layer. The resulting conductivity-depth profile is compared to 1-D conductivity models of Earth’s mantle recovered in previous studies.
New transfer functions for probing 3-D mantle conductivity from ground and sea
The C-response is a conventional transfer function in global electromagnetic induction research and is classically determined from local observations of magnetic variations in the vertical and the horizontal components. Its estimation and interpretation rely on the assumptions that the source of the considered variations is well approximated by a large-scale symmetric (magnetospheric) ring current that can be described by a single spherical harmonic, P10, and that conductivity in the Earth is only a function of depth. However, there is growing evidence for a more complex structure of the magnetospheric source. We investigate the variability of C-responses due to non-P10 contributions to the source. We show that this variability, which we denote as 'source effect' (as opposed to the well-known ocean effect), is significant and persists at all periods. If inverting estimated C-responses for mantle conductivity, this source effect will inevitably be mistaken for conductivity anomalies. To overcome the problem connected with the assumptions for deriving C-responses, we introduce new transfer functions that relate the local vertical component of the magnetic variation to different spherical harmonic coefficients describing the magnetospheric source. The latter are derived from observations of magnetic variations in the horizontal components. The new transfer functions are subsequently estimated with a robust multivariate data analysis tool. By analyzing 16 years of data, collected at the global network of geomagnetic observatories, we demonstrate that the new transfer functions exhibit a significant increase in coherence compared to C-responses, especially at high latitudes. The concept is easily extended to other data types. For example, by relating the voltage variations in abandoned submarine telecommunication cables to spherical harmonic coefficients in the same way as described above, one can define yet another array of transfer functions. In spite of the fact that the newly introduced transfer functions allow for a consistent treatment of a complex spatial structure of the source, the sparse and irregular distribution of geomagnetic observatories and submarine cables impedes a reliable inversion of these data for 3-D mantle conductivity on a global scale. However, in combination with matrix Q-responses estimated from Swarm satellite data, the new transfer functions can be used to probe the 3-D conductivity structure of Earth’s mantle.

Novel multi-beam radiometers for accurate ocean surveillance
Novel antenna architectures for real aperture multi-beam radiometers providing high resolution and high sensitivity for accurate sea surface temperature (SST) and ocean vector wind (OVW) measurements are investigated. On the basis of
the radiometer requirements set for future SST/OVW missions, conical scanners and push-broom antennas are compared. The comparison will cover reflector optics and focal plane array configuration.

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NuSTAR and INTEGRAL observations of a low/hard state of 1E1740.7-2942
The microquasar 1E1740.7-2942, also known as the "Great Annihilator", was observed by NuSTAR in the Summer of 2012. We have analyzed in detail two observations taken ~2 weeks apart, for which we measure hard and smooth spectra typical of the low/hard state. A few weeks later the source flux declined significantly. Nearly simultaneous coverage by INTEGRAL is available from its Galactic Center monitoring campaign lasting ~2.5 months. These data probe the hard state spectrum from 1E1740.7-2942 before the flux decline. We find good agreement between the spectra taken with IBIS/ISGRI and NuSTAR, with the measurements being compatible with a change in flux with no spectral variability. We present a detailed analysis of the NuSTAR spectral and timing data and upper limits for reflection of the high energy emission. We show that the high energy spectrum of this X-ray binary is well described by thermal Comptonization.

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AE Aquarii is a cataclysmic variable with the fastest known rotating magnetized white dwarf (P-spin = 33.08 s). Compared to many intermediate polars, AE Aquarii shows a soft X-ray spectrum with a very low luminosity (L-X similar to 10^31 erg s^-1). We have analyzed overlapping observations of this system with the NuSTAR and the Swift X-ray observatories in 2012 September. We find the 0.5-30 keV spectra to be well fitted by either an optically thin thermal plasma model with three temperatures of 0.75(-0.45)(+0.18), 2.29(-0.82)(+0.96), and 9.33(-2.18)(+6.07) keV, or an optically thin thermal plasma model with two temperatures of 1.00(-0.23)(+0.34) and 4.64(-0.84)(+1.58) keV plus a power-law component with photon index of 2.50(-0.23)(+0.17). The pulse profile in the 3-20 keV band is broad and approximately sinusoidal, with a pulsed fraction of 16.6% +/- 2.3%. We do not find any evidence for a previously reported sharp feature in the pulse profile.

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ASTRONOMY, X-RAY PULSATIONS, CATACLYSMIC VARIABLES, INTERMEDIATE POLARS, LINE DIAGNOSTICS, ACCRETION FLOWS, HOT PLASMA, XMM-NEWTON, EMISSION, TELESCOPE, SPECTRA, accretion, accretion disks, novae, cataclysmic variables, stars: individual (AE Aquarii), white dwarfs, X-rays: stars, accretion accretion disks, Novae cataclysmic variables, Stars: individual (AE Aquarii), White dwarfs, X-rays: stars
NuSTAR and XMM-Newton Observations of Luminous, Heavily Obscured, WISE-Selected Quasars at z ~ 2

We report on a NuSTAR and XMM-Newton program that has observed a sample of three extremely luminous, heavily obscured WISE-selected AGN at z~2 in a broad X-ray band (0.1 - 79 keV). The parent sample, selected to be faint or undetected in the WISE 3.4um (W1) and 4.6um (W2) bands but bright at 12um (W3) and 22um (W4), are extremely rare, with only ~1000 so-called W1W2-dropouts across the extragalactic sky. Optical spectroscopy reveals typical redshifts of z~2 for this population, implying rest-frame mid-IR luminosities of L(6um)~6e46 erg/s and bolometric luminosities that can exceed L(bol)~1e14 L(sun). The corresponding intrinsic, unobscured hard X-ray luminosities are L(2-10)~4e45 erg/s for typical quasar templates. These are amongst the most luminous AGN known, though the optical spectra rarely show evidence of a broad-line region and the selection criteria imply heavy obscuration even at rest-frame 1.5um. We designed our X-ray observations to obtain robust detections for gas column densities N(H)<1e24 /cm2. In fact, the sources prove to be fainter than these predictions. Two of the sources were observed by both NuSTAR and XMM-Newton, with neither being detected by NuSTAR and one being faintly detected by XMM-Newton. A third source was observed only with XMM-Newton, yielding a faint detection. The X-ray data require gas column densities N(H)>1e24 /cm2, implying the sources are extremely obscured, consistent with Compton-thick, luminous quasars. The discovery of a significant population of heavily obscured, extremely luminous AGN does not conform to the standard paradigm of a receding torus, in which more luminous quasars are less likely to be obscured. If a larger sample conforms with this finding, then this suggests an additional source of obscuration for these extreme sources.
NuSTAR detection of 4s Hard X-ray Lags from the Accreting Pulsar GS 0834-430

The NuSTAR hard X-ray telescope observed the transient Be/X-ray binary GS 0834-430 during its 2012 outburst. The source is detected between 3 – 79 keV with high statistical significance, and we were able to perform very accurate spectral and timing analysis. The phase-averaged spectrum is consistent with that observed in many other magnetized accreting pulsars. We fail to detect cyclotron resonance scattering features in either phase-averaged nor phase-resolved spectra that would allow us to constrain the pulsar's magnetic field. We detect a pulse period of ∼ 12.29 s in all energy bands. The pulse profile can be modeled with a double Gaussian and shows a strong and smooth hard lag of up to 0.3 cycles in phase, or about 4s between the pulse at ∼ 3 and >∼ 30 keV. This is the first report of such a strong lag in high-mass X-ray binary (HMXB) pulsars. Previously reported lags have been significantly smaller in phase and restricted to low-energies (E<10 keV). We investigate the possible mechanisms that might produce such lags. We find the most likely explanation for this effect to be a complex beam geometry.

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NuSTAR detection of high-energy X-ray emission and rapid variability from Sagittarius A* flares

Sagittarius A* harbors the supermassive black hole that lies at the dynamical center of our Galaxy. Sagittarius A* spends most of its time in a low luminosity emission state but flares frequently in the infrared and X-ray, increasing up to a few hundred fold in brightness for up to a few hours at a time. The physical processes giving rise to the X-ray flares are uncertain. Here we report the detection with the NuSTAR observatory in Summer and Fall 2012 of four low to medium amplitude X-ray flares to energies up to 79 keV. For the first time, we clearly see that the power-law spectrum of Sagittarius A* X-ray flares extends to high energy, with no evidence for a cutoff. Although the photon index of the absorbed power-law fits are in agreement with past observations, we find a difference between the photon index of two of the flares (significant at the 95% confidence level). The spectra of the two brightest flares (~55 times quiescence in the 2-10 keV band) are compared to simple physical models in an attempt to identify the main X-ray emission mechanism, but the data do not allow us to significantly discriminate between them. However, we confirm the previous finding that the parameters obtained with synchrotron models are, for the X-ray emission, physically more reasonable than those obtained with inverse Compton models. One flare exhibits large and rapid (...
NuSTAR discovery of a cyclotron line in KS 1947+300

We present a spectral analysis of three simultaneous Nuclear Spectroscopy Telescope Array and Swift/XRT observations of the transient Be-neutron star binary KS 1947+300 taken during its outburst in 2013/2014. These broadband observations were supported by Swift/XRT monitoring snapshots every three days, which we use to study the evolution of the spectrum over the outburst. We find strong changes of the power-law photon index, which shows a weak trend of softening with increasing X-ray flux. The neutron star shows very strong pulsations with a period of $P \approx 18.8$ s. The 0.8-79 keV broadband spectrum can be described by a power law with an exponential cutoff and a blackbody component at low energies. During the second observation we detect a cyclotron resonant scattering feature at 12.5 keV, which is absent in the phase-averaged spectra of observations 1 and 3. Pulse phase-resolved spectroscopy reveals that the strength of the feature changes strongly with pulse phase and is most prominent during the broad minimum of the pulse profile. At the same phases the line also becomes visible in the first and third observation at the same energy. This discovery implies that KS 1947+300 has a magnetic field strength of $B \approx 1.1 \times 10^{12} (1 + z) \text{ G}$, which is at the lower end of known cyclotron line sources.

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NuSTAR Discovery of a Cyclotron Line in the Be/X-ray Binary RX J0520.5-6932 During Outburst

We present spectral and timing analysis of NuSTAR observations of RX J0520.5$-$6932 in the 3-79 keV band collected during its outburst in January 2014. The target was observed on two epochs and we report the detection of a cyclotron resonant scattering feature with central energies of $E_{\text{CRSF}} = 31.3_{-0.7}^{+0.8}$ keV and $31.5_{-0.6}^{+0.7}$ keV during the two observations, respectively, corresponding to a magnetic field of $B \approx 2 \times 10^{12}$ G. The 3-79 keV luminosity of the system during the two epochs assuming a nominal distance of 50 kpc was $3.667\pm0.007\times10^{38}$ erg s$^{-1}$ and $3.983\pm0.007\times10^{38}$ erg s$^{-1}$. Both values are much higher than the critical luminosity of $\approx1.5\times10^{37}$ erg s$^{-1}$ above which a radiation dominated shock front may be expected. This adds a new object to the sparse set of three systems that have a cyclotron line observed at luminosities in excess of $10^{38}$ erg s$^{-1}$. A broad ($\sigma\approx0.45$ keV) Fe emission line is observed in the spectrum at a central energy of $6.58_{-0.05}^{+0.05}$ keV in both epochs. The pulse profile of the pulsar was observed to be highly asymmetric with a sharply rising and slowly falling profile of the primary peak. We also observed minor variations in the cyclotron line energy and width as a function of the rotation phase. As in observations of other cyclotron absorption line sources, there is a small ($\Delta\phi\lesssim0.1$) phase difference between the peak of the cyclotron energy variation and the peak of the flux variation.

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NuSTAR discovery of a luminosity dependent cyclotron line energy in Vela X-1

We present NuSTAR observations of Vela X-1, a persistent, yet highly variable, neutron star high-mass X-ray binary (HMXB). Two observations were taken at similar orbital phases but separated by nearly a year. They show very different 3-79 keV flux levels as well as strong variability during each observation, covering almost one order of magnitude in flux. These observations allow, for the first time ever, investigations on kilo-second time-scales of how the centroid energies of cyclotron resonant scattering features (CRSFs) depend on flux for a persistent HMXB. We find that the line energy of the harmonic CRSF is correlated with flux, as expected in the sub-critical accretion regime. We argue that Vela X-1 has a very narrow accretion column with a radius of around 0.4 km that sustains a Coulomb interaction dominated shock at the observed luminosities of $L_x \sim 3 \times 10^{36}$ erg/s. Besides the prominent harmonic line at 55 keV the fundamental line around 25 keV is clearly detected. We find that the strengths of the two CRSFs are anti-correlated, which we explain by photon spawning. This anti-correlation is a possible explanation for the debate about the existence of the fundamental line. The ratio of the line energies is variable with time and deviates significantly from 2.0, also a possible consequence of photon spawning, which changes the shape of the line. During the second observation, Vela X-1 showed a short off-state in which the power-law softened and a cut-off was no longer measurable. It is likely that the source switched to a different accretion regime at these low mass accretion rates, explaining the drastic change in spectral shape.

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NuSTAR discovery of a young, energetic pulsar associated with the luminous gamma-ray source Hess J1640-465

We report the discovery of a 206 ms pulsar associated with the TeV γ-ray source HESS J1640-465 using the Nuclear Spectroscopic Telescope Array (NuSTAR) X-ray observatory. PSR J1640-4631 lies within the shell-type supernova remnant (SNR) G338.3-0.0, and coincides with an X-ray point source and putative pulsar wind nebula (PWN) previously identified in XMM-Newton and Chandra images. It is spinning down rapidly with period derivative $9.758(44) \times 10^{-13}$, yielding a spin-down luminosity $4.4 \times 10^{36}$ erg s$^{-1}$, characteristic age 3350 yr, and surface dipole magnetic field strength $B_s = 1.4 \times 10^{13}$ G. For the measured distance of 12 kpc to G338.3-0.0, the 0.2-10 TeV luminosity of HESS J1640-465 is 6% of the pulsar's present. The Fermi source 1FHL J1640.5-4634 is marginally coincident with PSR J1640-4631, but we find no γ-ray pulsations in a search using five years of Fermi Large Area Telescope (LAT) data. The pulsar energetics support an evolutionary PWN model for the broadband spectrum of HESS J1640-465, provided that the pulsar's braking index is $n = 2$, and that its initial spin period was $P \sim 15$ ms.

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NuSTAR J033202-2746.8: direct constraints on the Compton reflection in a heavily obscured quasar at z = 2

We report Nuclear Spectroscopic Telescope Array (NuSTAR) observations of NuSTAR J033202-2746.8, a heavily obscured, radio-loud quasar detected in the Extended Chandra Deep Field-South, the deepest layer of the NuSTAR extragalactic survey (∼400 ks, at its deepest). NuSTAR J033202-2746.8 is reliably detected by NuSTAR only at E > 8 keV and has a very flat spectral slope in the NuSTAR energy band (Γ = 0.55−0.64+0.62; 3-30 keV). Combining the NuSTAR data with extremely deep observations by Chandra and XMM-Newton (4 Ms and 3 Ms, respectively), we constrain the broad-band X-ray spectrum of NuSTAR J033202-2746.8, indicating that this source is a heavily obscured quasar (NH = 5.6+−0.80.9 × 10^23 cm−2) with luminosity L_{10-40 keV} ≈ 6.4 × 10^{44} erg s−1. Although existing optical and near-infrared (near-IR) data, as well as follow-up spectroscopy with the Keck and VLT telescopes, failed to provide a secure redshift identification for NuSTAR J033202-2746.8, we reliably constrain the redshift z = 2.00 ± 0.04 from the X-ray spectral features (primarily from the iron K edge). The NuSTAR spectrum shows a significant reflection component (R = 0.55+−0.370.44), which was not constrained by previous analyses of Chandra and XMM-Newton data alone. The measured reflection fraction is higher than the R∼0 typically observed in bright radio-loud quasars such as NuSTAR J033202-2746.8, which has L_{1.4 GHz}=1027 W Hz−1. Constraining the spectral shape of active galactic nuclei (AGNs), including bright quasars, is very important for understanding the AGN population, and can have a strong impact on the
modeling of the X-ray background. Our results show the importance of NuSTAR in investigating the broad-band spectral properties of quasars out to high redshift.
NuSTAR J163433-4738.7: A Fast X-ray Transient in the Galactic Plane

During hard X-ray observations of the Norma spiral arm region by the Nuclear Spectroscopic Telescope Array (NuSTAR) in 2013 February, a new transient source, NuSTAR J163433-4738.7, was detected at a significance level of 8σ in the 3-10 keV bandpass. The source is consistent with having a constant NuSTAR count rate over a period of 40 ks and is also detected simultaneously by Swift at lower significance. The source is not significantly detected by NuSTAR, Swift, or Chandra in the days before or weeks after the discovery of the transient, indicating that the strong X-ray activity lasted between ~0.5 and 1.5 days. Near-infrared imaging observations were carried out before and after the X-ray activity, but we are not able to identify the counterpart. The combined NuSTAR and Swift energy spectrum is consistent with a power law with a photon index of (90% confidence errors), a blackbody with $kT = 1.2 \pm 0.3$ keV, or a Bremsstrahlung model with keV. The reduced-$\chi^2$ values for the three models are not significantly different, ranging from 1.23 to 1.44 for 8 degrees of freedom. The spectrum is strongly absorbed with cm$^{-2}$, cm$^{-2}$, and cm$^{-2}$, for the power-law, blackbody, and Bremsstrahlung models, respectively. Although the high column density could be due to material local to the source, it is consistent with absorption from interstellar material along the line of sight at a distance of 11 kpc, which would indicate an X-ray luminosity $>10^{34}$ erg s$^{-1}$. Although we do not reach a definitive determination of the nature of NuSTAR J163433-4738.7, we suggest that it may be an unusually bright active binary or a magnetar.
NuSTAR J163433-4738.7: A Fast X-ray Transient in the Galactic Plane

During hard X-ray observations of the Norma spiral arm region by the Nuclear Spectroscopic Telescope Array (NuSTAR) in 2013 February, a new transient source, NuSTAR J163433-4738.7, was detected at a significance level of 8-sigma in the 3-10 keV bandpass. The source is consistent with having a constant NuSTAR count rate over a period of 40 ks and is also detected simultaneously by Swift at lower significance. The source is not significantly detected by NuSTAR, Swift, or Chandra in the days before or weeks after the discovery of the transient, indicating that the strong X-ray activity lasted for between ~0.5 and 1.5 days. Near-IR imaging observations were carried out before and after the X-ray activity, but we are not able to identify the counterpart. The combined NuSTAR and Swift energy spectrum is consistent with a power-law with a photon index of $\Gamma = 4.1(\pm 1.5)(-1.0)$ (90% confidence errors), a blackbody with $kT = 1.2(\pm 0.3)$ keV, or a bremsstrahlung model with $kT = 3.0(\pm 2.1)(-1.2)$ keV. The reduced-chi2 values for the three models are not significantly different, ranging from 1.23 to 1.44 for 8 degrees of freedom. The spectrum is strongly absorbed with $NH = 2.8(\pm 2.3)(-1.4)e23$ cm$^{-2}$, $9(\pm 15)(-7)e22$ cm$^{-2}$, and $1.7(\pm 1.7)(-0.9)e23$ cm$^{-2}$, for the power-law, blackbody, and bremsstrahlung models, respectively. Although the high column density could be due to material local to the source, it is consistent with absorption from interstellar material along the line of sight at a distance of 11 kpc, which would indicate an X-ray luminosity $>1e34$ erg/s. Although we do not reach a definitive determination of the nature of NuSTAR J163433-4738.7, we suggest that it may be an unusually bright active binary or a magnetar.

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NuSTAR observations of heavily obscured quasars at z ~ 0.5

We present NuSTAR hard X-ray observations of three Type 2 quasars at z ≈ 0.4-0.5, optically selected from the Sloan Digital Sky Survey. Although the quasars show evidence for being heavily obscured, Compton-thick systems on the basis of the 2-10 keV to [O III] luminosity ratio and multiwavelength diagnostics, their X-ray absorbing column densities (NH) are poorly known. In this analysis, (1) we study X-ray emission at >10 keV, where X-rays from the central black hole are relatively unabsorbed, in order to better constrain NH. (2) We further characterize the physical properties of the sources through broad-band near-UV to mid-IR spectral energy distribution analyses. One of the quasars is detected with NuSTAR at >8 keV with a no-source probability of
NuSTAR observations of the bullet cluster: constraints on inverse Compton emission

The search for diffuse non-thermal inverse Compton (IC) emission from galaxy clusters at hard X-ray energies has been undertaken with many instruments, with most detections being either of low significance or controversial. Because all prior telescopes sensitive at $E > 10$ keV do not focus light and have degree-scale fields of view, their backgrounds are both high and difficult to characterize. The associated uncertainties result in lower sensitivity to IC emission and a greater chance of false detection. In this work, we present 266 ks NuSTAR observations of the Bullet cluster, which is detected in the energy range 3-30 keV. NuSTAR's unprecedented hard X-ray focusing capability largely eliminates confusion between diffuse IC and point sources; however, at the highest energies, the background still dominates and must be well understood. To this end, we have developed a complete background model constructed of physically inspired components constrained by extragalactic survey field observations, the specific parameters of which are derived locally from data in non-source regions of target observations. Applying the background model to the Bullet cluster data, we find that the spectrum is well-but not perfectly-described as an isothermal plasma with $kT = 14.2 \pm 0.2$ keV. To slightly improve the fit, a second temperature component is added, which appears to account for lower temperature emission from the cool core, pushing the primary component to $kT \sim 15.3$ keV. We see no convincing need to invoke an IC component to describe the spectrum of the Bullet cluster, and instead argue that it is dominated at all energies by emission from purely thermal gas. The conservatively derived 90% upper limit on the IC flux of $1.1 \times 10^{-12}$ erg s$^{-1}$ cm$^{-2}$ (50-100 keV), implying a lower limit on $B \gtrsim 0.2$ $\mu$G, is barely consistent with detected fluxes previously reported. In addition to discussing the possible origin of this discrepancy, we remark on the potential implications of this analysis for the prospects for detecting IC in galaxy clusters in the future.
NuSTAR Observations of the Magnetar 1E 2259+586

We report on new broad band spectral and temporal observations of the magnetar 1E 2259+586, which is located in the supernova remnant CTB 109. Our data were obtained simultaneously with the Nuclear Spectroscopic Telescope Array (NuSTAR) and Swift, and cover the energy range from 0.5-79 keV. We present pulse profiles in various energy bands and compare them to previous RXTE results. The NuSTAR data show pulsations above 20 keV for the first time and we report evidence that one of the pulses in the double-peaked pulse profile shifts position with energy. The pulsed fraction of the magnetar is shown to increase strongly with energy. Our spectral analysis reveals that the soft X-ray spectrum is well characterized by an absorbed double blackbody or blackbody plus power-law model in agreement with previous reports. Our new hard X-ray data, however, suggest that an additional component, such as a power law, is needed to describe the NuSTAR and Swift spectrum. We also fit the data with the recently developed coronal outflow model by Beloborodov for hard X-ray emission from magnetars. The outflow from a ring on the magnetar surface is statistically preferred over outflow from a polar cap.

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NuSTAR Observations of the State Transition of Millisecond Pulsar Binary PSR J1023+0038

We report NuSTAR observations of the millisecond pulsar-low-mass X-ray binary (LMXB) transition system PSR J1023+0038 from 2013 June and October, before and after the formation of an accretion disk around the neutron star. Between June 10 and 12, a few days to two weeks before the radio disappearance of the pulsar, the 3-79 keV X-ray spectrum was well fit by a simple power law with a photon index of $\Gamma = 1.17(-0.07)(+0.08)$ (at 90% confidence) with a 3-79 keV luminosity of $7.4 \pm 0.4 \times 10^{32}$ erg s$^{-1}$. Significant orbital modulation was observed with a modulation fraction of $36\% \pm 10\%$. During the October 19-21 observation, the spectrum is described by a softer power law ($\Gamma = 1.66(-0.05)(+0.06)$) with an average luminosity of $5.8 \pm 0.2 \times 10^{33}$ erg s$^{-1}$ and a peak luminosity of approximately $1.2 \times 10^{34}$ erg s$^{-1}$ observed during a flare. No significant orbital modulation was detected. The spectral observations are consistent with previous and current multiwavelength observations and show the hard X-ray power law extending to 79 keV without a spectral break. Sharp-edged, flat-bottomed dips are observed with widths between 30 and 1000 s and ingress and egress timescales of 30-60 s. No change in hardness ratio was observed during the dips. Consecutive dip separations are log-normal in distribution with a typical separation of approximately 400 s. These dips are distinct from dipping activity observed in LMXBs. We compare and contrast these dips to observations of dips and state changes in the similar transition systems PSR J1824-2452I and XSS J1227.0-4859 and discuss possible interpretations based on the transitions in the inner disk.

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**NuSTAR Observations of the State Transition of Millisecond Pulsar Binary PSR J1023+0038**

We report NuSTAR observations of the millisecond pulsar - low mass X-ray binary (LMXB) transition system PSR J1023+0038 from June and October 2013, before and after the formation of an accretion disk around the neutron star. Between June 10-12, a few days to two weeks before the radio disappearance of the pulsar, the 3-79 keV X-ray spectrum was well fit by a simple power law with a photon index of $\Gamma = 1.17 \pm 0.08$ (at 90% confidence) with a 3-79 keV luminosity of $7.4 \pm 0.4 \times 10^{32}$ erg/s. Significant orbital modulation was observed with a modulation fraction of $36\% \pm 10\%$. During the October 19-21 observation, the spectrum is described by a softer power law ($\Gamma = 1.66 \pm 0.06$) with an average luminosity of $5.8 \pm 0.2 \times 10^{33}$ erg/s and a peak luminosity of $\sim 1.2 \times 10^{34}$ erg/s observed during a flare. No significant orbital modulation was detected. The spectral observations are consistent with previous and current multi-wavelength observations and show the hard X-ray power law extending to 79 keV without a spectral break. Sharp edged, flat bottomed ‘dips’ are observed with widths between 30-1000 s and ingress and egress time-scales of 30-60 s. No change in hardness ratio was observed during the dips. Consecutive dip separations are log-normal in distribution with a typical separation of approximately 400 s. These dips are distinct from dipping activity observed in LMXBs. We compare and contrast these dips to observations of dips and state changes in the similar transition systems PSR J1824-2452I and XSS J1227.0-4859 and discuss possible interpretations based on the transitions in the inner disk.

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**NuSTAR Observations of X-ray Bursts from the Magnetar 1E 1048.1-5937**

We report the detection of eight bright X-ray bursts from the 6.5 s magnetar 1E 1048.1–5937, during a 2013 July observation campaign with the Nuclear Spectroscopic Telescope Array. We study the morphological and spectral properties of these bursts and their evolution with time. The bursts resulted in count rate increases by orders of magnitude, sometimes limited by the detector dead time, and showed blackbody spectra with kT $\sim$ 6-8 keV in the T 90 duration of 1-4 s, similar to earlier bursts detected from the source. We find that the spectra during the tail of the bursts can be modeled with an absorbed blackbody with temperature decreasing with flux. The burst flux decays followed a power law of index 0.8-0.9. In the burst tail spectra, we detect a $\sim$13 keV emission feature, similar to those reported in previous bursts from this source as well as from other magnetars observed with the Rossi X-ray Timing Explorer. We explore possible origins of the spectral feature such as proton cyclotron emission, which implies a magnetic field strength of $B \sim 2 \times 10^{15}$ G in the emission region. However, the consistency of the energy of the feature in different objects requires further explanation.

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NuSTAR results and future plans for magnetar and rotation‐powered pulsar observations

The Nuclear Spectroscopic Telescope Array (NuSTAR) is the first focusing hard X‐ray mission in orbit and operates in the 3–79 keV range. NuSTAR's sensitivity is roughly two orders of magnitude better than previous missions in this energy band thanks to its superb angular resolution. Since its launch in 2012 June, NuSTAR has performed excellently and observed many interesting sources including four magnetars, two rotation‐powered pulsars and the cataclysmic variable
AE Aquarii. NuSTAR also discovered 3.76-s pulsations from the transient source SGR J1745–29 recently found by Swift very close to the Galactic center, clearly identifying the source as a transient magnetar. For magnetar 1E 1841–045, we show that the spectrum is well fit by an absorbed blackbody plus broken power-law model with a hard power-law photon index of \(\sim 1.3\). This is consistent with previous results by INTEGRAL and RXTE. We also find an interesting double-peaked pulse profile in the 25–35 keV band. For AE Aquarii, we show that the spectrum can be described by a multi-temperature thermal model or a thermal plus non-thermal model; a multi-temperature thermal model without a non-thermal component cannot be ruled out. Furthermore, we do not see a spiky pulse profile in the hard X-ray band, as previously reported based on Suzaku observations. For other magnetars and rotation-powered pulsars observed with NuSTAR, data analysis results will be soon available. (© 2014 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)
NuSTAR reveals an intrinsically x-ray weak broad absorption line quasar in the ultraluminous infrared galaxy Markarian 231

We present high-energy (3-30 keV) NuSTAR observations of the nearest quasar, the ultraluminous infrared galaxy (ULIRG) Markarian 231 (Mrk 231), supplemented with new and simultaneous low-energy (0.5-8 keV) data from Chandra. The source was detected, though at much fainter levels than previously reported, likely due to contamination in the large apertures of previous non-focusing hard X-ray telescopes. The full band (0.5-30 keV) X-ray spectrum suggests the active galactic nucleus (AGN) in Mrk 231 is absorbed by a patchy and Compton-thin (cm⁻²) column. The intrinsic X-ray luminosity (L₀.₅ - 30 keV ~ 1.0 × 10⁴³ erg s⁻¹) is extremely weak relative to the bolometric luminosity where the 2-10 keV to bolometric luminosity ratio is ~0.03% compared to the typical values of 2%-15%. Additionally, Mrk 231 has a low X-ray-to-optical power law slope (αₜₐ₉ ~ -1.7). It is a local example of a low-ionization broad absorption line quasar that is intrinsically X-ray weak. The weak ionizing continuum may explain the lack of mid-infrared [O IV], [Ne V], and [Ne VI] fine-structure emission lines which are present in sources with otherwise similar AGN properties. We argue that the intrinsic X-ray weakness may be a result of the super-Eddington accretion occurring in the nucleus of this ULIRG, and may also be naturally related to the powerful wind event seen in Mrk 231, a merger remnant escaping from its dusty cocoon.

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NuSTAR Reveals the Comptonizing Corona of the Broad-Line Radio Galaxy 3C 382

Broad-line radio galaxies (BLRGs) are active galactic nuclei that produce powerful, large-scale radio jets, but appear as Seyfert 1 galaxies in their optical spectra. In the X-ray band, BLRGs also appear like Seyfert galaxies, but with flatter spectra and weaker reflection features. One explanation for these properties is that the X-ray continuum is diluted by emission from the jet. Here, we present two NuSTAR observations of the BLRG 3C 382 that show clear evidence that the continuum of this source is dominated by thermal Comptonization, as in Seyfert 1 galaxies. The two observations were separated by over a year and found 3C 382 in different states separated by a factor of $1.7$ in flux. The lower flux spectrum has a photon-index of $\Gamma=1.68^{+0.03}_{-0.02}$, while the photon-index of the higher flux spectrum is $\Gamma=1.78^{+0.02}_{-0.03}$. Thermal and anisotropic Comptonization models provide an excellent fit to both spectra and show that the coronal plasma cooled from $kT_e=330^{+30}_{-30}$ keV in the low flux data to $231^{+50}_{-88}$ keV in the high flux observation. This cooling behavior is typical of Comptonizing corona in Seyfert galaxies and is distinct from the variations observed in jet-dominated sources. In the high flux observation, simultaneous Swift data are leveraged to obtain a broadband spectral energy distribution and indicates that the corona intercepts $\sim 10\%$ of the optical and ultraviolet emitting accretion disk. 3C 382 exhibits very weak reflection features, with no detectable relativistic Fe
K$\alpha$ line, that may be best explained by an outflowing corona combined with an ionized inner accretion disk.

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Authors: Ballantyne, D. R. (Ekstern), Bollenbacher, J. M. (Ekstern), Brenneman, L. W. (Ekstern), Madsen, K. K. (Ekstern), Balokovic, M. (Ekstern), Boggs, S. E. (Ekstern), Christensen, F. E. (Intern), Craig, W. W. (Ekstern), Gandhi, P. (Ekstern), Hailey, C. J. (Ekstern), Harrison, F. A. (Ekstern), Lohfink, A. M. (Ekstern), Marinucci, A. (Ekstern), Markwardt, C. B. (Ekstern), Stern, D. (Ekstern), Walton, D. J. (Ekstern), Zhang, W. W. (Ekstern)

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NuSTAR study of hard X-ray morphology and spectroscopy of PWN G21.5-0.9

We present NuSTAR high-energy X-ray observations of the pulsar wind nebula (PWN)/supernova remnant G21.5-0.9. We detect integrated emission from the nebula up to similar to 40 keV, and resolve individual spatial features over a broad X-ray band for the first time. The morphology seen by NuSTAR agrees well with that seen by XMM-Newton and Chandra below 10 keV. At high energies, NuSTAR clearly detects non-thermal emission up to similar to 20 keV that extends along the eastern and northern rim of the supernova shell. The broadband images clearly demonstrate that X-ray emission from the North Spur and Eastern Limb results predominantly from non-thermal processes. We detect a break in the spatially integrated X-ray spectrum at similar to 9 keV that cannot be reproduced by current spectral energy distribution models, implying either a more complex electron injection spectrum or an additional process such as diffusion compared to what has been considered in previous work. We use spatially resolved maps to derive an energy-dependent cooling length scale, L(E) proportional to E⁻ᵐ with m = -0.21 +/- 0.01. We find this to be inconsistent with the model for the morphological evolution with energy described by Kennel & Coroniti. This value, along with the observed steepening in power-law index between radio and X-ray, can be quantitatively explained as an energy-loss spectral break in the simple scaling model of Reynolds, assuming particle advection dominates over diffusion. This interpretation requires a substantial departure from spherical magnetohydrodynamic, magnetic-flux-conserving outflow, most plausibly in the form of turbulent magnetic-field amplification.
We present Nuclear Spectroscopic Telescope Array (NuSTAR) 3-40 keV observations of the optically selected Type 2 quasar (QSO2) SDSS J1034+6001 or Mrk 34. The high-quality hard X-ray spectrum and archival XMM-Newton data can be fitted self-consistently with a reflection-dominated continuum and a strong Fe K alpha fluorescence line with equivalent width $> 1$ keV. Prior X-ray spectral fitting below 10 keV showed the source to be consistent with being obscured by Compton-thin column densities of gas along the line of sight, despite evidence for much higher columns from multiwavelength data. NuSTAR now enables a direct measurement of this column and shows that N-H lies in the Compton-thick (CT) regime. The new data also show a high intrinsic 2-10 keV luminosity of L_{2-10} similar to 10^{44} erg s^{-1}, in contrast to previous low-energy X-ray measurements where L_{2-10} less than or similar to 10^{43} erg s^{-1} (i.e., X-ray selection below 10 keV does not pick up this source as an intrinsically luminous obscured quasar). Both the obscuring column and the intrinsic power are about an order of magnitude (or more) larger than inferred from pre-NuSTAR X-ray spectral fitting. Mrk 34 is thus a "gold standard" CT QSO2 and is the nearest non-merging system in this class, in contrast to the other local CT quasar NGC 6240, which is currently undergoing a major merger coupled with strong star formation. For typical X-ray bolometric correction factors, the accretion luminosity of Mrk 34 is high enough to potentially power the total infrared luminosity. X-ray spectral fitting also shows that thermal emission related to star formation is unlikely to drive the observed bright soft component below similar to 3 keV, favoring photoionization instead.
Observation of early photons from gamma-ray bursts with the Lomonosov / UFFO-pathfinder

UFFO-pathfinder is a pioneering space mission to observe the early evolution of Gamma-ray Bursts using a fast slewing strategy. It consists of the Slewing Mirror Telescope, for rapid pointing at UV/optical wavelengths and the UFFO Burst Alert and Trigger Telescope. It has a total weight of ~ 20 kg and will be launched on-board the Russian Lomonosov satellite at the end of 2015. The instrumental details of UFFO-pathfinder and its performance are discussed briefly here.
Observation of early photons from gamma-ray bursts with the Lomonosov / UFFO-pathfinder

Observation of early photons from gamma-ray bursts with the Lomonosov / UFFO-pathfinder

Observations of MCG-5-23-16 with Suzaku, XMM-Newton and NuSTAR: Disk Tomography and Compton Hump Reverberation

MCG-5-23-16 is one of the first active galactic nuclei (AGNs) where relativistic reverberation in the iron K line originating in the vicinity of the supermassive black hole was found, based on a short XMM-Newton observation. In this work, we present the results from long X-ray observations using Suzaku, XMM-Newton, and NuSTAR designed to map the emission region using X-ray reverberation. A relativistic iron line is detected in the lag spectra on three different timescales, allowing the emission from different regions around the black hole to be separated. Using NuSTAR coverage of energies above 10 keV reveals a lag between these energies and the primary continuum, which is detected for the first time in an AGN. This lag is a result of the Compton reflection hump responding to changes in the primary source in a manner similar to the response of the relativistic iron K line.

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Optical stimulator for vision-based sensors

We have developed an optical stimulator system for vision-based sensors. The stimulator is an efficient tool for stimulating a camera during on-ground testing with scenes representative of spacecraft flights. Such scenes include starry sky, planetary objects, and other spacecraft. The optical stimulator is used as a test bench to simulate high-precision navigation by different types of camera systems that are used onboard spacecraft, planetary rovers, and for spacecraft rendezvous and proximity maneuvers. Careful hardware design and preoperational calibration of the stimulator result in high precision and long-term stability. The system can be continuously used over several days. By facilitating a full camera including optics in the loop, the stimulator enables the more realistic simulation of flight maneuvers based on navigation cameras than pure computer simulations or camera stimulations without the involvement of the actual optics.

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Planck 2013 results. IV. Low Frequency Instrument beams and window functions

This paper presents the characterization of the in-flight beams, the beam window functions and the associated errors for the Planck Low Frequency Instrument (LFI). Knowledge of the beam profiles is the key to determining their imprint on the transfer function from the observed to the actual sky anisotropy power spectrum. The main beam distortions affect the beam window function, complicating the reconstruction of the anisotropy power spectrum at high multipoles, whereas the sidelobes affect the low and intermediate multipoles. The in-flight assessment of the LFI main beams relied on the measurements performed during Jupiter observations. By stacking the data from Jupiter transits, the main beam profiles are measured down to -20 dB at 30 and 44 GHz, and down to -25 dB at 70 GHz. The main beam solid angles are determined to better than 0.2% at each LFI frequency band. To ensure a characterization of the main beam free from the radiometer noise, a dedicated tuning on the Planck pre-launch optical model is performed. This approach provides an optical model whose beams fully reproduce the measurements in the main beam region, but also allow us to describe the beams at power levels lower than can be reached by the Jupiter measurements themselves. The agreement between the simulated beams and the scanning beams is better than 1% at each LFI frequency band. The simulated beams are used for the computation of the window functions for the effective beams. The error budget in the window functions was estimated considering both main beam and sidelobe contributions, as well as taking into account the radiometer bandshapes. The total uncertainties in the effective beam window functions are: (at ell = 600) 2% and 1.2% at 30 and 44 GHz, respectively; and at ell = 1000, 0.7% at 70 GHz.

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Organisations: National Space Institute, Astrophysics, IT-Department
Planck 2013 results. V. LFI calibration

We discuss the methods employed to photometrically calibrate the data acquired by the Low Frequency Instrument on Planck. Our calibration is based on the Solar Dipole, caused by motion of the Solar System with respect to the CMB rest frame, which provides a signal of a few mK with the same spectrum as the CMB anisotropies and is visible throughout the mission. In this data release we rely on the characterization of the Solar Dipole as measured by WMAP. We also present preliminary results on the study of the Orbital Dipole, caused by the motion of the Planck spacecraft, which agree with the WMAP value of the Solar System speed to 0.2%. We compute the calibration constant for each radiometer roughly once per hour, in order to keep track of changes in the detectors’ gain. Since non-idealities in the optical response of the beams proved to be important, we implemented a fast convolution algorithm which considers the full beam response in estimating the signal generated by the dipole. Moreover, in order to further reduce the impact of residual systematics due to sidelobes, we estimated time variations in the calibration constant of the 30 GHz radiometers (the ones with the most important sidelobes) using the signal of an internal reference load at 4 K instead of the CMB dipole. We estimated the accuracy of the LFI calibration following two strategies: (1) we have run a set of simulations to assess the impact of statistical errors and systematic effects in the instrument and in the calibration procedure, and (2) we have performed a number of internal consistency checks on the data. Errors in the calibration of this Planck/LFI data release are expected to be about 0.6% at 44 and 70 GHz, and 0.8% at 30 GHz.

General information

State: Published
Organisations: National Space Institute, Astrophysics, IT-Department
Planck 2013 results. XI. All-sky model of thermal dust emission

This paper presents an all-sky model of dust emission from the Planck 353, 545, and 857 GHz, and IRAS 100 μm data. Using a modified blackbody fit to the data we present all-sky maps of the dust optical depth, temperature, and spectral index over the 353-3000 GHz range. This model is a good representation of the IRAS and Planck data at 5° between 353 and 3000 GHz (850 and 100 μm). It shows variations of the order of 30% compared with the widely-used model of Finkbeiner, Davis, and Schlegel. The Planck data allow us to estimate the dust temperature uniformly over the whole sky, down to an angular resolution of 5°, providing an improved estimate of the dust optical depth compared to previous all-sky dust model, especially in high-contrast molecular regions where the dust temperature varies strongly at small scales in response to dust evolution, extinction, and/or local production of heating photons. An increase of the dust opacity at 353 GHz, $\frac{T_{353}}{N_H}$, from the diffuse to the denser interstellar medium (ISM) is reported. It is associated with a decrease in the observed dust temperature, $T_{\text{obs}}$, that could be due at least in part to the increased dust opacity. We also report an excess of dust emission at HI column densities lower than $10^{20}$ cm$^{-2}$ that could be the signature of dust in the warm ionized medium. In the diffuse ISM at high Galactic latitude, we report an anticorrelation between $\frac{T_{353}}{N_H}$ and $T_{\text{obs}}$, while the dust specific luminosity, i.e., the total dust emission integrated over frequency (the radiance) per hydrogen atom, stays...
about constant, confirming one of the Planck Early Results obtained on selected fields. This effect is compatible with the view that, in the diffuse ISM, $T_{\text{obs}}$ responds to spatial variations of the dust opacity, due to variations of dust properties, in addition to (small) variations of the radiation field strength. The implication is that in the diffuse ISM $T_{353}$ is not as reliable a tracer of dust column density as we conclude it is in molecular clouds where the correlation of $T_{353}$ with dust extinction estimated using colour excess measurements on stars is strong. To estimate Galactic $E(B-V)$ in extragalactic fields at high latitude we develop a new method based on the thermal dust radiance, instead of the dust extinction estimated using colour excess measurements on stars.
Planck 2013 results. XII. Diffuse component separation

Planck has produced detailed all-sky observations over nine frequency bands between 30 and 857 GHz. These observations allow robust reconstruction of the primordial cosmic microwave background (CMB) temperature fluctuations over nearly the full sky, as well as new constraints on Galactic foregrounds, including thermal dust and line emission from molecular carbon monoxide (CO). This paper describes the component separation framework adopted by Planck for many cosmological analyses, including CMB power spectrum determination and likelihood construction on large angular scales, studies of primordial non-Gaussianity and statistical isotropy, the integrated Sachs-Wolfe effect, gravitational lensing, and searches for topological defects. We test four foreground-cleaned CMB maps derived using qualitatively different component separation algorithms. The quality of our reconstructions is evaluated through detailed simulations and internal comparisons, and shown through various tests to be internally consistent and robust for CMB power spectrum and cosmological parameter estimation up to l = 2000. The parameter constraints on ΛCDM cosmologies derived from these maps are consistent with those presented in the cross-spectrum based Planck likelihood analysis. We choose two of the CMB maps for specific scientific goals. We also present maps and frequency spectra of the Galactic low-frequency, CO, and thermal dust emission. The component maps are found to provide a faithful representation of the sky, as evaluated by simulations, with the largest bias seen in the CO component at 3%. For the low-frequency component, the spectral index varies widely over the sky, ranging from about beta = 4 to -2. Considering both morphology and prior knowledge of the low frequency components, the index map allows us to associate a steep spectral index (beta < -3.2) with strong anomalous microwave emission, corresponding to a spinning dust spectrum peaking below 20 GHz, a flat index of beta > -2.3 with strong free-free emission, and intermediate values with synchrotron emission.

General information

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Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Planck 2013 results. XIII. Galactic CO emission

Rotational transition lines of CO play a major role in molecular radio astronomy as a mass tracer and in particular in the study of star formation and Galactic structure. Although a wealth of data exists for the Galactic plane and some well-known molecular clouds, there is no available high sensitivity all-sky survey of CO emission to date. Such all-sky surveys can be constructed using the Planck HFI data because the three lowest CO rotational transition lines at 115, 230 and 345 GHz significantly contribute to the signal of the 100, 217 and 353 GHz HFI channels, respectively. Two different component separation methods are used to extract the CO maps from Planck HFI data. The maps obtained are then compared to one another and to existing external CO surveys. From these quality checks the best CO maps, in terms of signal to noise ratio and/or residual contamination by other emission, are selected. Three different sets of velocity-integrated CO emission maps are produced with different trade-offs between signal-to-noise, angular resolution, and reliability. Maps for the CO $J = 1 \rightarrow 0$, $J = 2 \rightarrow 1$, and $J = 3 \rightarrow 2$ rotational transitions are presented and described in detail. They are shown to be fully compatible with previous surveys of parts of the Galactic plane as well as with undersampled surveys of the high latitude sky. The Planck HFI velocity-integrated CO maps for the $J = 1 \rightarrow 0$, $J = 2 \rightarrow 1$, and $J = 3 \rightarrow 2$ rotational transitions provide an unprecedented all-sky CO view of the Galaxy. These maps are also of great interest to monitor potential CO contamination of the Planck studies of the cosmological microwave background.

General information

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Organisations: National Space Institute, Astrophysics, IT-Department, University of Copenhagen
Planck 2013 results. XIX. The integrated Sachs-Wolfe effect

Based on cosmic microwave background (CMB) maps from the 2013 Planck Mission data release, this paper presents the detection of the integrated Sachs-Wolfe (ISW) effect, that is, the correlation between the CMB and large-scale evolving gravitational potentials. The significance of detection ranges from 2 to 4σ, depending on which method is used. We investigated three separate approaches, which essentially cover all previous studies, and also break new ground. (i) We
correlated the CMB with the Planck reconstructed gravitational lensing potential (for the first time). This detection was
made using the lensing-induced bispectrum between the low-l and high-l temperature anisotropies; the correlation
between lensing and the ISW effect has a significance close to 2.5σ. (ii) We cross-correlated with tracers of large-scale
structure, which yielded a significance of about 3σ, based on a combination of radio (NVSS) and optical (SDSS) data. (iii)
We used aperture photometry on stacked CMB fields at the locations of known large-scale structures, which yielded and
confirms a 4σ signal, over a broader spectral range, when using a previously explored catalogue, but shows strong
discrepancies in amplitude and scale when compared with expectations. More recent catalogues give more moderate
results that range from negligible to 2.5σ at most, but have a more consistent scale and amplitude, the latter being still
slightly higher than what is expected from numerical simulations within Lambda CMD. Where they can be compared,
these measurements are compatible with previous work using data from WMAP, where these scales have been mapped
to the limits of cosmic variance. Planck's broader frequency coverage allows for better foreground cleaning and confirms
that the signal is achromatic, which makes it preferable for ISW detection. As a final step we used tracers of large-scale
structure to filter the CMB data, from which we present maps of the ISW temperature perturbation. These results provide
complementary and independent evidence for the existence of a dark energy component that governs the currently
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Planck 2013 results. XV. CMB power spectra and likelihood

This paper presents the Planck 2013 likelihood, a complete statistical description of the two-point correlation function of the CMB temperature fluctuations that accounts for all known relevant uncertainties, both instrumental and astrophysical in nature. We use this likelihood to derive our best estimate of the CMB angular power spectrum from Planck over three decades in multipole moment, covering 22500. The main source of uncertainty at 1500 is cosmic variance. Uncertainties in small-scale foreground modelling and instrumental noise dominate the error budget at higher \( \ell \). For \( \ell \leq 50 \), our likelihood exploits all Planck frequency channels from 30 to 353 GHz, separating the cosmological CMB signal from diffuse Galactic foregrounds through a physically motivated Bayesian component separation technique. At 50, we employ a correlated Gaussian likelihood approximation based on a fine-grained set of angular cross-spectra derived from multiple detector combinations between the 100, 143, and 217 GHz frequency channels, marginalising over power spectrum foreground templates. We validate our likelihood through an extensive suite of consistency tests, and assess the impact of residual foreground and instrumental uncertainties on the final cosmological parameters. We find good internal agreement among the high-cross-spectra with residuals below a few K^2 at 1000, in agreement with estimated calibration uncertainties. We compare our results with foreground-cleaned CMB maps derived from all Planck frequencies, as well as with cross-spectra derived from the 70 GHz Planck map, and find broad agreement in terms of spectrum residuals and cosmological parameters. We further show that the best-fit CDM cosmology is in excellent agreement with preliminary PlanckEE and TE polarisation spectra. We find that the standard CDM cosmology is well constrained by Planck from the measurements at 1500. One specific example is the spectral index of scalar perturbations, for which we report a 5.4 deviation from scale invariance, \( n = 1 \). Increasing the multipole range beyond 1500 does not increase our accuracy for the CDM parameters, but instead allows us to study extensions beyond the standard model. We find no indication of significant departures from the CDM framework. Finally, we report a tension between the Planck best-fit CDM model and the low-spectrum in the form of a power deficit of 510% at 40, with a statistical significance of 2.53. Without a theoretically motivated model for this power deficit, we do not elaborate further on its cosmological implications, but note that this is our most puzzling finding in an otherwise remarkably consistent data set.

General information

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Planck 2013 results. XXII. Constraints on inflation

We analyse the implications of the Planck data for cosmic inflation. The Planck nominal mission temperature anisotropy measurements, combined with the WMAP large-angle polarization, constrain the scalar spectral index to be $n_s = 0.9603 \pm 0.0073$, ruling out exact scale invariance at over 5 sigma. Planck establishes an upper bound on the tensor-to-scalar ratio of $r < 0.11$ (95% CL). The Planck data thus shrink the space of allowed standard inflationary models preferring potentials with $V'' < 0$. Exponential potential models, the simplest hybrid inflationary models, and monomial potential models of degree $n \geq 2$ do not provide a good fit to the data. Planck does not find statistically significant running of the scalar spectral index, obtaining $dn_s/d\ln k = -0.0134 \pm 0.0090$. We verify these conclusions through a numerical analysis, which makes no slowroll approximation, and carry out a Bayesian parameter estimation and model-selection analysis for a number of inflationary models including monomial, natural, and hilltop potentials. For each model, we present the Planck...
constraints on the parameters of the potential and explore several possibilities for the post-inflationary entropy generation epoch, thus obtaining nontrivial data-driven constraints. We also present a direct reconstruction of the observable range of the inflaton potential. Unless a quartic term is allowed in the potential, we find results consistent with second-order slow-roll predictions. We also investigate whether the primordial power spectrum contains any features. We find that models with a parameterized oscillatory feature improve the fit by $\Delta \chi^2/\text{eff} \approx 10$; however, Bayesian evidence does not prefer these models. We constrain several single-field inflation models with generalized Lagrangians by combining power spectrum data with Planck bounds on $f_{\text{NL}}$. Planck constrains with unprecedented accuracy the amplitude and possible correlation (with the adiabatic mode) of non-decaying isocurvature fluctuations. The fractional primordial contributions of cold dark matter (CDM) isocurvature modes of the types expected in the curvaton and axion scenarios have upper bounds of 0.25% and 3.9% (95% CL), respectively. In models with arbitrarily correlated CDM or neutrino isocurvature modes, an anticorrelated isocurvature component can improve the $\chi^2/\text{eff}$ by approximately 4 as a result of slightly lowering the theoretical prediction for the $\ell < 40$ multipoles relative to the higher multipoles. Nonetheless, the data are consistent with adiabatic initial conditions.

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Planck 2013 results. XXI. Power spectrum and high-order statistics of the Planck all-sky Compton parameter map

We have constructed the first all-sky map of the thermal Sunyaev-Zeldovich (tSZ) effect by applying specifically tailored component separation algorithms to the 100 to 857 GHz frequency channel maps from the Planck survey. This map shows an obvious galaxy cluster tSZ signal that is well matched with blindly detected clusters in the Planck SZ catalogue. To characterize the signal in the tSZ map we have computed its angular power spectrum. At large angular scales (l < 60), the major foreground contaminant is the diffuse thermal dust emission. At small angular scales (l > 500) the clustered cosmic infrared background and residual point sources are the major contaminants. These foregrounds are carefully modelled and subtracted. We thus measure the tSZ power spectrum over angular scales 0.17 degrees less than or similar to theta less than or similar to 3.0 degrees that were previously unexplored. The measured tSZ power spectrum is consistent with that expected from the Planck catalogue of SZ sources, with clear evidence of additional signal from unresolved clusters and, potentially, diffuse warm baryons. Marginalized band-powers of the Planck tSZ power spectrum and the best-fit model are given. The non-Gaussianity of the Compton parameter map is further characterized by computing its 1D probability distribution function and its bispectrum. The measured tSZ power spectrum and high order statistics are used to place constraints on sigma(8).

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Planck 2013 results. XXX. Cosmic infrared background measurements and implications for star formation

We present new measurements of cosmic infrared background (CIB) anisotropies using Planck. Combining HFI data with IRAS, the angular auto- and cross-frequency power spectrum is measured from 143 to 3000 GHz, and the auto-bispectrum from 217 to 545 GHz. The total areas used to compute the CIB power spectrum and bispectrum are about 2240 and 4400 deg², respectively. After careful removal of the contaminants (cosmic microwave background anisotropies, Galactic dust, and Sunyaev-Zeldovich emission), and a complete study of systematics, the CIB power spectrum is measured with unprecedented signal to noise ratio from angular multipoles ∫ ∼150 to 2500. The bispectrum due to the clustering of dusty, star-forming galaxies is measured from ∫ ∼ 130 to 1100, with a total signal to noise ratio of around 6, 19, and 29 at 217, 353, and 545 GHz, respectively. Two approaches are developed for modelling CIB power spectrum anisotropies. The first approach takes advantage of the unique measurements by Planck at large angular scales, and models only the linear part of the power spectrum, with a mean bias of dark matter haloes hosting dusty galaxies at a given redshift weighted by their contribution to the emissivities. The second approach is based on a model that associates star-forming galaxies with dark matter haloes and their subhaloes, using a parametrized relation between the dust-processed infrared luminosity and (sub-) halo mass. The two approaches simultaneously fit all auto- and cross-power spectra very well. We find that the star formation history is well constrained up to redshifts around 2, and agrees with recent estimates of the obscured star-formation density using Spitzer and Herschel. However, at higher redshift, the accuracy of the star formation history measurement is strongly degraded by the uncertainty in the spectral energy distribution of CIB galaxies. We also find that the mean halo mass which is most efficient at hosting star formation is log (Meff/ MΩ) = 12.6 and that CIB galaxies have warmer temperatures as redshift increases. The CIB bispectrum is steeper than that expected from the power spectrum, although well fitted by a power law; this gives some information about the contribution of massive haloes to the CIB bispectrum. Finally, we show that the same halo occupation distribution can fit all power spectra simultaneously. The precise measurements enabled by Planck pose new challenges for the modelling of CIB anisotropies, indicating the power of using CIB anisotropies to understand the process of galaxy formation.

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Planck 2013 results. XXXI. Consistency of the Planck data

The Planck design and scanning strategy provide many levels of redundancy that can be exploited to provide tests of internal consistency. One of the most important is the comparison of the 70 GHz (amplifier) and 100 GHz (bolometer) channels. Based on different instrument technologies, with feeds located differently in the focal plane, analysed independently by different teams using different software, and near the minimum of diffuse foreground emission, these channels are in effect two different experiments. The 143 GHz channel has the lowest noise level on Planck, and is near the...
minimum of unresolved foreground emission. In this paper, we analyse the level of consistency achieved in the 2013 Planck data. We concentrate on comparisons between the 70, 100, and 143 GHz channel maps and power spectra, particularly over the angular scales of the first and second acoustic peaks, on maps masked for diuse Galactic emission and for strong unresolved sources. Dierence maps covering angular scales from 8 to 150 are consistent with noise, and show no evidence of cosmic microwave background structure. Including small but important corrections for unresolved-source residuals, we demonstrate agreement (measured by deviation of the ratio from unity) between 70 and 100 GHz power spectra averaged over 70 ≤∫≥ 390 at the 0.8% level, and agreement between 143 and 100 GHz power spectra of 0.4% over the same face. These values are within and consistent with the overall uncertainties in calibration given in the Planck 2013 results. We also present results based on the 2013 likelihood analysis showing consistency at the 0.35% between the 100, 143, and 217 GHz power spectra. We analyse calibration procedures and beams to determine what fraction of these dierences can be accounted for by known approximations or systematic errors that could be controlled even better in the future, reducing uncertainties still further. Several possible small improvements are described.

Subsequent analysis of the beams quantifies the importance of asymmetry in the near sidelobes, which was not fully accounted for initially, aecting the 70/100 ratio. Correcting for this, the 70, 100, and 143 GHz power spectra agree to 0.4% over the first two acoustic peaks. The likelihood analysis that produced the 2013 cosmological parameters incorporated uncertainties larger than this. We show explicitly that correction of the missing near sidelobe power in the HFI channels would result in shifts in the posterior distributions of parameters of less than 0.3σ except for A_s, the amplitude of the primordial curvature perturbations at 0.05 Mpc^{-1}, which changes by about 1. We extend these comparisons to include the sky maps from the complete nine-year mission of the Wilkinson Microwave Anisotropy Probe (WMAP), and find a roughly 2% dierence between the Planck and WMAP power spectra in the region of the first acoustic peak.

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Planck intermediate results: XIII. Constraints on peculiar velocities

Using Planck data combined with the Meta Catalogue of X-ray detected Clusters of galaxies (MCXC), we address the study of peculiar motions by searching for evidence of the kinetic Sunyaev-Zeldovich effect (kSZ). By implementing various filters designed to extract the kSZ generated at the positions of the clusters, we obtain consistent constraints on the radial peculiar velocity average, root mean square (rms), and local bulk flow amplitude at different depths. For the whole cluster sample of average redshift 0.18, the measured average radial peculiar velocity with respect to the cosmic microwave background (CMB) radiation at that redshift, i.e., the kSZ monopole, amounts to 72 ± 60 km s⁻¹. This constitutes less than 1% of the relative Hubble velocity of the cluster sample with respect to our local CMB frame. While the linear ΛCDM prediction for the typical cluster radial velocity rms at z = 0.15 is close to 230 km s⁻¹, the upper limit imposed by Planck data on the cluster subsample corresponds to 800 km s⁻¹ at 95% confidence level, i.e., about three times higher. Planck data also set strong constraints on the local bulk flow in volumes centred on the Local Group. There is no detection of bulk flow as measured in any comoving sphere extending to the maximum redshift covered by the cluster sample. A blind search for bulk flows in this sample has an upper limit of 254 km s⁻¹ (95% confidence level) dominated by CMB confusion and instrumental noise, indicating that the Universe is largely homogeneous on Gpc scales. In this context, in conjunction with supernova observations, Planck is able to rule out a large class of inhomogeneous void models as alternatives to dark energy or modified gravity. The Planck constraints on peculiar velocities and bulk flows are thus consistent with the ΛCDM scenario. © 2014 ESO.
Planck intermediate results. XIV. Dust emission at millimetre wavelengths in the Galactic plane

We use Planck HFI data combined with ancillary radio data to study the emissivity index of the interstellar dust emission in the frequency range 100-353 GHz, or 3-0.8 mm, in the Galactic plane. We analyse the region $l = 20$ degrees-44 degrees and vertical bar $b$ vertical bar.

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Organisations: National Space Institute, Astrophysics, IT-Department, Cardiff University, University of Paris-Sud - University of Paris XI, University Paris Diderot - Paris 7, Kavli Institute for Cosmology Cambridge, University of Salamanca, International School for Advanced Studies, Universite de Toulouse, Universidad de Cantabria, California Institute of Technology, University of Granada, Pierre and Marie Curie University - University of Paris VI, National Institute for Astrophysics, University of Manchester, University of Toronto, University of California at Berkeley, Télécim ParisTech, University Joseph Fourier, Princeton University, Academia Sinica Taiwan, Niels Bohr Institute, Imperial College of Science, Technology and Medicine, La Sapienza - Università di Roma, European Space Astronomy Centre and European Space Agency, Max Planck Institute, University of Oslo, Observatoire de Paris, National Institute for Nuclear Physics, European Space Agency, Lawrence Berkeley National Laboratory, University of Padua, University of Roma 'Tor Vergata', Universite Paris-Sud, National University of Ireland, University of Southern California, Institute for Space Sciences, Univ Space Res Assoc, Stratosphér Observ Infrared Astron, Moffett Field, CA 94035 USA, Instituto de Astrofísica de Canarias, University College London, Russian Academy of Sciences, French National Centre for Scientific Research, Commissariat Energie Atomique, University of California, Santa Barbara, European Southern Observatory, University of Helsinki, University of British Columbia

Anomalous microwave emission (AME) is believed to be due to electric dipole radiation from small spinning dust grains. The aim of this paper is a statistical study of the basic properties of AME regions and the environment in which they emit. We used WMAP and Planck maps, combined with ancillary radio and IR data, to construct a sample of 98 candidate AME sources, assembling SEDs for each source using aperture photometry on 1°-smoothed maps from 0.408 GHz up to 3000 GHz. Each spectrum is fitted with a simple model of free-free, synchrotron (where necessary), cosmic microwave background (CMB), thermal dust, and spinning dust components. We find that 42 of the 98 sources have significant (>5σ) excess emission at frequencies between 20 and 60 GHz. An analysis of the potential contribution of optically thick free-free emission from ultra-compact Hii regions, using IR colour criteria, reduces the significant AME sample to 27 regions. The spectrum of the AME is consistent with model spectra of spinning dust. Peak frequencies are in the range 20–35 GHz except for the California nebula (NGC1499), which appears to have a high spinning dust peak frequency of (50 ± 17) GHz. The AME regions tend to be more spatially extended than regions with little or no AME. The AME intensity is strongly correlated with the sub-millimetre/IR flux densities and comparable to previous AME detections in the literature.
emissivity, defined as the ratio of AME to dust optical depth, varies by an order of magnitude for the AME regions. The AME regions tend to be associated with cooler dust in the range 14–20 K and an average emissivity index, βd, of +1.8, while the non-AME regions are typically warmer, at 20–27 K. In agreement with previous studies, the AME emissivity appears to decrease with increasing column density. This supports the idea of AME originating from small grains that are known to be depleted in dense regions, probably due to coagulation onto larger grains. We also find a correlation between the AME emissivity (and to a lesser degree the spinning dust peak frequency) and the intensity of the interstellar radiation field, G0. Modelling of this trend suggests that both radiative and collisional excitation are important for the spinning dust emission. The most significant AME regions tend to have relatively less ionized gas (free-free emission), although this could be a selection effect. The infrared excess, a measure of the heating of dust associated with H ii regions, is typically >4 for AME sources, indicating that the dust is not primarily heated by hot OB stars. The AME regions are associated with known dark nebulae and have higher 12 μm/25 μm ratios. The emerging picture is that the bulk of the AME is coming from the polycyclic aromatic hydrocarbons and small dust grains from the colder neutral interstellar medium phase.

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Planck intermediate results: XVII. Emission of dust in the diffuse interstellar medium from the far-infrared to microwave frequencies

The dust-Hi correlation is used to characterize the emission properties of dust in the diffuse interstellar medium (ISM) from far infrared wavelengths to microwave frequencies. The field of this investigation encompasses the part of the southern sky best suited to study the cosmic infrared and microwave backgrounds. We cross-correlate sky maps from Planck, the Wilkinson Microwave Anisotropy Probe (WMAP), and the diffuse infrared background experiment (DIRBE), at 17 frequencies from 23 to 3000 GHz, with the Parkes survey of the 21 cm line emission of neutral atomic hydrogen, over a contiguous area of 7500 deg2 centred on the southern Galactic pole. We present a general methodology to study the dust-Hi correlation over the sky, including simulations to quantify uncertainties. Our analysis yields four specific results. (1) We map the temperature, submillimetre emissivity, and opacity of the dust per H-atom. The dust temperature is observed to be anti-correlated with the dust emissivity and opacity. We interpret this result as evidence of dust evolution within the diffuse ISM. The mean dust opacity is measured to be \( (7.1 \pm 0.6) \times 10^{-27} \text{ cm}^2 \text{ H}^{-1} \times (\nu/353 \text{ GHz})^{1.53 \pm 0.03} \) for 100 \( \leq \nu \leq 353 \) GHz. This is a reference value to estimate hydrogen column densities from dust emission at submillimetre and millimetre wavelengths. (2) We map the spectral index \( \beta_{\text{mm}} \) of dust emission at millimetre wavelengths (defined here as \( \nu \leq 353 \text{ GHz} \)), and find it to be remarkably constant at \( \beta_{\text{mm}} = 1.51 \pm 0.13 \). We compare it with the far infrared spectral index \( \beta_{\text{FIR}} \) derived from greybody fits at higher frequencies, and find a systematic difference, \( \beta_{\text{mm}} - \beta_{\text{FIR}} = -0.15 \), which suggests that the dust spectral energy distribution (SED) flattens at \( \nu \leq 353 \text{ GHz} \). (3) We present spectral fits of the microwave emission correlated with Hi from 23 to 353 GHz, which separate dust and anomalous microwave emission (AME). We show that the flattening of the dust SED can be accounted for with an additional component with a blackbody spectrum. This additional component, which accounts for \( (26 \pm 6)\% \) of the dust emission at 100GHz, could represent magnetic dipole emission. Alternatively, it could account for an increasing contribution of carbon dust, or a flattening of the emissivity of amorphous silicates, at millimetre wavelengths. These interpretations make different predictions for the dust
polarization SED. (4) We analyse the residuals of the dust-Hi correlation. We identify a Galactic contribution to these residuals, which we model with variations of the dust emissivity on angular scales smaller than that of our correlation analysis. This model of the residuals is used to quantify uncertainties of the CIB power spectrum in a companion Planck paper.© ESO 2014.

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Planck intermediate results: XVI. Profile likelihoods for cosmological parameters

We explore the 2013 Planck likelihood function with a high-precision multi-dimensional minimizer (Minuit). This allows a refinement of the CDM best-fit solution with respect to previously-released results, and the construction of frequentist confidence intervals using profile likelihoods. The agreement with the cosmological results from the Bayesian framework is excellent, demonstrating the robustness of the Planck results to the statistical methodology. We investigate the inclusion of neutrino masses, where more significant differences may appear due to the non-Gaussian nature of the posterior mass distribution. By applying the Feldman-Cousins prescription, we again obtain results very similar to those of the Bayesian methodology. However, the profile-likelihood analysis of the cosmic microwave background (CMB) combination (Planck+WP+highL) reveals a minimum well within the unphysical negative-mass region. We show that inclusion of the Planck CMB-lensing information regularizes this issue, and provide a robust frequentist upper limit $\sigma_{\nu m} \leq 0.26$ eV (95% confidence) from the CMB+lensing+BAO data combination. © ESO 2014.

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Preparing the optics technology to observe the hot universe

With the selection of "The hot and energetic Universe" as science theme for ESA's second large class mission (L2) in the Cosmic Vision programme, work is focusing on the technology preparation for an advanced X-ray observatory. The core enabling technology for the high performance mirror is the Silicon Pore Optics (SPO) [1 to 23], a modular X-ray optics technology, which utilises processes and equipment developed for the semiconductor industry. The paper provides an overview of the programmatic background, the status of SPO technology and gives an outline of the development roadmap and activities undertaken and planned by ESA on optics, coatings [24 to 30] and test facilities [31, 33].
Rapid bedrock uplift in the Antarctic Peninsula explained by viscoelastic response to recent ice unloading

Since 1995 several ice shelves in the Northern Antarctic Peninsula have collapsed and triggered ice-mass unloading, invoking a solid Earth response that has been recorded at continuous GPS (cGPS) stations. A previous attempt to model the observation of rapid uplift following the 2002 breakup of Larsen B Ice Shelf was limited by incomplete knowledge of the pattern of ice unloading and possibly the assumption of an elastic-only mechanism. We make use of a new high resolution dataset of ice elevation change that captures ice-mass loss north of 66°S to first show that non-linear uplift of the Palmer cGPS station since 2002 cannot be explained by elastic deformation alone. We apply a viscoelastic model with linear Maxwell rheology to predict uplift since 1995 and test the fit to the Palmer cGPS time series, finding a well constrained upper mantle viscosity but less sensitivity to lithospheric thickness. We further constrain the best fitting Earth model by including six cGPS stations deployed after 2009 (the LARISSA network), with vertical velocities in the range 1.7 to 14.9 mm/yr. This results in a best fitting Earth model with lithospheric thickness of 100–140 km and upper mantle viscosity of $6 \times 10^{17}$–$2 \times 10^{18}$ Pas – much lower than previously suggested for this region. Combining the LARISSA time series with the Palmer cGPS time series offers a rare opportunity to study the time-evolution of the low-viscosity solid Earth response to a well-captured ice unloading event.
Relations between Arctic large-scale TEC changes and scintillations over Greenland

The increasing dependence on GNSS-based methods and technologies for global or regional navigation and communication has raised concerns about the impact of space weather on these systems. Temporal and spatial ionosphere variations caused by driving forces, such as changes in solar radiation, solar wind, and the Earth’s magnetic field contribute to errors in satellite navigation positioning and communication systems. In this study we will focus on the impact of space weather in the Arctic region related to total electron content (TEC) and scintillation changes. Measurements from the GNSS network of stations in Greenland are analyzed and geophysical variables such as TEC, amplitude scintillation indices ($S_4$), and phase scintillation indices ($\sigma_\phi$), are calculated together with 2D/3D electron density and scintillation maps. For the TEC we applied data from the Greenland GNET network of stations – consisting of 62 stations, while the scintillations data are based on 50 Hz sampled data from a set of sites on the west coast of Greenland (i.e., Thule, Sisimiut, and Kangerlussuaq). The GNSS-derived data is augmented by ground-based geomagnetic measurements, such as the Dst-index and magnetic H-component data obtained from the Greenland magnetic stations. Extreme ionosphere events will be presented and the underlying geophysical process will be identified and discussed. Especially results where large-scale gradients in the regional TEC are compared with the growth of scintillations. We will identify crucial elements and parameters (such as the auroral oval and the auroral electrojet), driving these changes in the Greenland TEC, $S_4$ and $\sigma_\phi$ distributions, in order to come up with appropriate algorithms and tools for monitoring and predicting Arctic TEC and scintillation large-scale patterns.

Relativistic Electrons in Electric Discharges

Thunderstorms generate bursts of X- and Gamma radiation. When observed from spacecraft, the bursts are referred to as “Terrestrial Gamma-ray Flashes” (TGFs). They are bremsstrahlung from energetic electrons accelerated in thunderstorm electric fields. The TGFs were first observed in the 90ties at the time when also gigantic electric discharges were observed at 10-90 km altitude in the stratosphere and mesosphere, the so called “jets” and “sprites”, commonly referred to as “Transient Luminous Events” (TLEs). TGFs were first thought connected to TLEs, but later research has pointed to lightning discharges as the source. The “Atmosphere-Space Interactions Monitor” (ASIM) for the International Space Station in 2016, led by DTU Space, and the French microsatellite TARANIS, also with launch in 2016, will identify with certainty the source of TGFs. In preparation for the missions, the Ph.D. project has developed a Monte Carlo module of a simulation code to model the formation of avalanches of electrons accelerated to relativistic energies, and the generation of bremsstrahlung through interactions with the neutral atmosphere. The code will be used in the analysis of data from the two space missions. We have studied the electron acceleration and photon generation in a constant electric field under a variety of conditions. These include the energy and number of seed electrons, electric field and altitude. We found that the distributions of avalanche electrons and photons are insensitive to these conditions, with exception of the electric field magnitude where the photon distribution becomes progressively more forward directed for increasing field magnitude. However, exploring photon transport to the top of the atmosphere, the angular beaming properties were found to wash out because of Compton scattering. However, we only explored the properties of the complete number of photons reaching space, not the distribution at specific locations as in the case of a satellite. With this reservation we conclude that it is not
possible to deduce much information from a satellite measurement of the photons alone on the conditions of the source region. With one exception: the spectral hardness increases with altitude of the source, again caused by reduced Compton scattering with altitude. Applying the code to a thunderstorm cloud we further found that an impulsive electric field of about 5 times the local breakdown field appears plausible for TGF generation, because it minimizes the electron avalanche time and length and the total electric potential required.

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**Remotely sensed soil temperatures beneath snow-free skin-surface using thermal observations from tandem polar-orbiting satellites: An analytical three-time-scale model**
Subsurface soil temperature is a key variable of land surface processes and not only responds to but also modulates the interactions of energy fluxes at the Earth’s surface. Thermal remote sensing has traditionally been regarded as incapable of detecting the soil temperature beneath the skin-surface. This study shows that thermal remote sensing can be used to estimate soil temperatures. Our results provide insights into thermal observations collected with tandem polar-orbiting satellites when used toward obtaining soil temperatures under clear-sky conditions without the use of any ground-based information or field-measured soil properties. We designed an analytical three-time-scale (3-scale, for short) model, dividing the annual cycle of soil temperatures into three subcycles: the annual temperature cycle (ATC), which represents the daily-averaged temperature; the diurnal temperature cycle (DTC), which represents the instantaneous temperature; and the weather-change temperature cycle (WTC), which is divided into two parts to represent both the daily-averaged (WTCAvg) and the instantaneous temperature (WTClinst). The DTC and WTCinst were further parameterized into four undetermined variables, including the daily-averaged temperature, thermal inertia, upward surface flux factor, and day-to-day change rate. Thus, under clear-sky conditions, the four thermal measurements in a diurnal cycle recorded with tandem polar-orbiting satellites are sufficient for reconstructing the DTC of both land surface and soil temperatures. Polar-orbiting satellite data from MODIS are used to show the model’s capability. The results demonstrate that soil temperatures with a spatial resolution of 1km under snow-free conditions can be generated at any time of a clear-sky day. Validation is performed by using a comparison between the MODIS-inverted and ground-based soil temperatures. The comparison shows that the accuracy of inverted soil temperatures lies between 0.3 and 2.5K with an average of approximately 1.5K. These results open a new frontier in the application of thermal remote sensing wherein soil temperatures with high spatial and temporal resolutions can be remotely estimated. © 2013 Elsevier Inc.

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Reservoir Modeling Combining Geostatistics with Markov Chain Monte Carlo Inversion

We present a study on the inversion of seismic reflection data generated from a synthetic reservoir model. Our aim is to invert directly for rock facies and porosity of the target reservoir zone. We solve this inverse problem using a Markov chain Monte Carlo (McMC) method to handle the nonlinear, multi-step forward model (rock physics and seismology) and to provide realistic estimates of uncertainties. To generate realistic models which represent samples of the prior distribution, and to overcome the high computational demand, we reduce the search space utilizing an algorithm drawn from geostatistics. The geostatistical algorithm learns the multiple-point statistics from prototype models, then generates proposal models which are tested by a Metropolis sampler. The solution of the inverse problem is finally represented by a collection of reservoir models in terms of facies and porosity, which constitute samples of the posterior distribution.

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Response of passive microwave sea ice concentration algorithms to thin ice

The influence of sea ice thickness brightness temperatures and ice concentrations retrieved from passive microwave observations is quantified, using horizontally homogeneous sea ice thickness retrievals from ESA's SMOS sensor observations at high incidence angles. Brightness temperatures are influenced by thickness below 18 cm (89GHz) and 50 cm (1.4 GHz). Ice concentration retrievals reduced by ice thickness below 0.17 m and 0.33 m, with higher frequency algorithms being less influenced.

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Projects:

UAV based geophysics
National Space Institute
Period: 01/05/2018 → 30/04/2021
Number of participants: 3
Phd Student:
Kolster, Mick Emil (Intern)
Supervisor:
Olsen, Nils (Intern)
Main Supervisor:
Dassing Andreasen, Arne (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Modelling of lightning attachment to moving structures
National Space Institute
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Phd Student:
Niknezhad, Mojtaba (Intern)
Supervisor:
Köhn, Christoph (Intern)
Neubert, Torsten (Intern)
Main Supervisor:
Chanrion, Olivier (Intern)

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Project: PhD

Polar Ionospheric Currents and Geomagnetic Field Modelling
National Space Institute
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Phd Student:
Kloss, Clemens (Intern)
Supervisor:
Olsen, Nils (Intern)
Main Supervisor:
Finlay, Chris (Intern)

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Analysis of simultaneous TGFs and optical emissions observed by ASIM and ISS-LIS
National Space Institute
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Phd Student:
Heumesser, Matthias (Intern)
Supervisor:
Chanrion, Olivier (Intern)
Köhn, Christoph (Intern)
Main Supervisor:
Neubert, Torsten (Intern)

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Project: PhD

Geodetic measurements of present-day Greenland ice sheet mass balance
National Space Institute
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
Phd Student:
Dahl-Jensen, Trine S. (Intern)
Supervisor:
Andersen, Ole Baltazar (Intern)
Knudsen, Per (Intern)
Main Supervisor:
Khan, Shfaqat Abbas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Analysis of Lightning and TLEs observed by ASIM and LIS on the International Space Station
National Space Institute
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Dimitriadou, Krystallia (Intern)
Supervisor:
Chanrion, Olivier (Intern)
Köhn, Christoph (Intern)
Main Supervisor:
Neubert, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Analysis of space and ground observations of thunderstorms
National Space Institute
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Tomicic, Maja (Intern)
Supervisor:
Köhn, Christoph (Intern)
Neubert, Torsten (Intern)
Main Supervisor:
Chanrion, Olivier (Intern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**A study of neutron star's extreme physics with X-ray bursts**
National Space Institute  
Period: 01/12/2017 → 30/11/2020  
Number of participants: 3  
Phd Student:  
Alizai, Khaled (Intern)  
Supervisor:  
Brandt, Søren (Intern)  
Main Supervisor:  
Chenevez, Jérôme (Intern)

**Detecting and Characterizing exoplanet systems**
National Space Institute  
Period: 01/12/2017 → 30/09/2020  
Number of participants: 3  
Phd Student:  
Tronsgaard Rasmussen, René (Intern)  
Supervisor:  
Hornstrup, Allan (Intern)  
Main Supervisor:  
Buchhave, Lars A. (Intern)

**Leak detection in water supply pipes using drone-borne sensor tecnology**
Department of Environmental Engineering  
Water Resources Engineering  
National Space Institute  
Geodesy  
Department of Applied Mathematics and Computer Science  
Image Analysis & Computer Graphics  
Dronelnspektion ApS  
Drone Systems ApS  
Aarhus Water  
Solrød Vandværk  
HOFOR A/S  
VandCenter Syd  
Period: 16/11/2017 → 30/06/2018  
Number of participants: 4
Coastal Hazard Risk Reduction and Management
Department of Management Engineering
Systems Analysis
National Space Institute
Geodesy
Agency for Data Supply and Efficiency (SDFE)
Danish Coastal Authority
Danish Meteorological Institute
DHI
Skive Kommune
Ringkøbing-Skjern Kommune
Aabenraa Kommune
Helmholtz-Zentrum Geesthacht
Smith Innovation
Period: 01/11/2017 → 30/10/2020
Number of participants: 4
Acronym: COHERENT
Project participant:
Larsen, Morten Andreas Dahl (Intern)
Drews, Martin (Intern)
Sørensen, Carlo Sass (Intern)
Project Manager, academic:
Halsnæs, Kirsten (Intern)

Financing sources
Source: Public research council
Name of research programme: Innovation Fund Denmark
Web address: https://innovationsfonden.dk/en
Amount: 10,000,000.00 Danish Kroner
Year of approval: 2017

Relative positioning and attitude from UAVs
National Space Institute
Period: 01/11/2017 → 31/10/2020
Number of participants: 3
Phd Student:
Hu, Xiao (Intern)
Supervisor:
Jakobsen, Jakob (Intern)
Main Supervisor:
Knudsen, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Advanced Landing, Interception and Exploration Navigation through Sensorfusion

National Space Institute

Period: 01/10/2017 → 30/09/2020

Number of participants: 3

PhD Student: Christensen, Lukas Alexander Mads (Intern)

Supervisor: Jørgensen, John Leif (Intern)

Main Supervisor: Merayo, José M.G. (Intern)

Financing sources

Source: Internal funding (public)

Name of research programme: Institut stipendie (DTU)

Project: PhD

Testbed in Aarhus for Precision Positioning and Autonomous Systems

The demand for basic infrastructures in modern society are increasing in line with the desire for increased growth and efficiency. Testbed in Aarhus for Precision Positioning and Autonomous Systems - TAPAS is a science and research project aimed at contributing to the implementation of the Danish digital initiatives 5.3, including the implementation of "Industry 4.0".

Geodetic reference systems already form a basic infrastructure that provides the basis for precision positioning and navigation using Global Navigation Satellite Systems (GNSS). Available systems of today are based primarily on GPS, with supplement of local Real Time Kinematic (RTK) systems.

Additional global GNSS systems are these years being implemented. This includes GLONASS (Russia), BeiDou (China) and not least Galileo (the European version of a GNSS). Systems, which are now forming the basis for new terrestrial networks and the basis for both faster and better position determination. The project's goal is establish a sound ground based network test bed, to support and test new advanced technological developments with a need for fast, efficient and flexible precision positioning. Hence, existing and new applications as well as new autonomous systems can use the TAPAS network reference and be easily initialized, integrated and used in real time.

TAPAS will be designed as a geodetic innovation platform, in form of physical and virtual networks in Aarhus. Initially, TAPAS will initially focus on the area around Aarhus city and harbor as a test bed for in situ trials.

The ambition is to achieve the full potential of GALILEO and evaluate this system's quality in relation to GPS. Further, and in particular, to achieve unprecedented precision positioning in real-time.

Autonomous systems constitute a very large growth area within a wide range of business areas such as transport, agriculture, environment and urban development. Infrastructures that support autonomous platforms. E.g. automated vehicles and machines, drones, marine units, etc. Systems inseparably linked to geodetic reference systems, RTK and associated communications networks (Wi-Fi, 5G mm.).

TAPAS is going to be developed, to accommodate both new geodetic and autonomous reference systems, as well as current and future communication networks. I.e. this innovation research platform attempts to integrate these systems, test concrete initiatives and utilize satellite-based Earth observation data.

The TAPAS network and associated functionality and research, is initially going to be implemented as an Alpha version within the available funding from SDFE in 2017 and in 2018. Pending the successful outcome of TAPAS Alpha and the research introduced using TAPAS Alpha. The plan is hereafter to expand the network and its capabilities in succeeding versions starting with a TAPAS Beta. TAPAS Beta has to rely on new funding being available to the project. However, intention is initially to use the basic network of TAPAS Alpha as a research platform to carry out defined technology demonstrations, but also to extend the network geographical area with additional GNSS Stations pending available funding options.

National Space Institute

Geodesy

Innovation and Research-based consultancy

Agency for Data Supply and Efficiency (SDFE)
Remote sensing of land ice

National Space Institute
Period: 01/09/2017 → 31/08/2020
Number of participants: 3
Phd Student:
Andersen, Natalia Havelund (Intern)
Supervisor:
Simonsen, Sebastian Bjerregaard (Intern)
Main Supervisor:
Sørensen, Louise Sandberg (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

The role of coating composition on the development of the optics for the Athena X-ray Observatory

National Space Institute
Period: 15/06/2017 → 14/06/2020
Number of participants: 3
Phd Student:
Svendsen, Sara Buur (Intern)
Supervisor:
Christensen, Finn Erland (Intern)
Main Supervisor:
Della Monica Ferreira, Desiree (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Using satellite altimetry to predict future sea level fingerprints

National Space Institute
Period: 15/05/2017 → 14/05/2020
Number of participants: 3
Phd Student:
Ludwigsen, Carsten Ankjær (Intern)
Supervisor:
Khan, Shfaqat Abbas (Intern)
Main Supervisor:
Andersen, Ole Baltazar (Intern)
Science and Innovation with Thunderstorms
SAINT is a Marie Curie project of 15 Ph.D. students and 19 academic and industrial partners funded by the EU H2020 programme. SAINT will study the physics of thunderstorm processes and their effects on the atmosphere, and new concepts of lightning detection and protection. SAINT will analyze data from the ASIM instruments on the International Space Station with observations of thunderstorm from the ground, laboratory experiments, and with modelling and simulations.

National Space Institute
Astrophysics and Atmospheric Physics
Period: 01/03/2017 → 01/03/2021
Number of participants: 10
Acronym: SAINT
Number of related Ph.D. students: 15
Project participant:
Ebert, Ute (Ekstern)
Füllekrug, Martin (Ekstern)
Østgaard, Nikolai (Ekstern)
Nijdam, Sander (Ekstern)
Vazquez, Francisco Gordillo (Ekstern)
Soula, Serge (Ekstern)
Montanya, Joan (Ekstern)
Lorenzo-Prado, Victor P. (Ekstern)
Bennet, Alec (Ekstern)

Regn med Thyborøn
Thyborøn is challenged by water from all sides. Rain from above, the North Sea and Limfjord from the sides and a rising groundwater level from below. Lemvig Municipality Lemvig and Water & Wastewater participate in Rain & Cities to develop their cooperation so that they together with the citizens can deal with the major challenges that the city face. The combination of more rainfall, higher sea levels, increasing groundwater levels and a flat terrain, makes floods a challenge. The existing storm water system has been functioning for many years, but due to climate change, the system is not sustainable in the future and there is a need for new thinking. The complexity requires close cooperation between the municipality of Lemvig and Lemvig Water & Wastewater. By participating in Rain & Cities will have the opportunity to develop their long-term cooperation, develop solutions to handle rain water on the surface and through the calculation tool ‘splask’ to build a common knowledge base on the economy in several different alternative projekter. In particular, Lemvig Municipality and Lemvig Water & Wastewater focus on a new large stormwater basin. The basin is strategically placed in the context of Thyborøn Fritidscenter, serves as focal point for the city's population, and close to the city campground. There is plenty of scope for thinking basin along with recreational functions and turn Thyborøn challenging location for an exciting story that can arouse interest among both residents, students and tourists. In addition to the specific project area by Thyborøn Fritidscenter, participation in Rain & Cities also form the basis for identifying other possible collaborative projects in Thyborøn where investments by the municipality and the water company can match. Project is developed in close cooperation with the Central Denmark Region's EU project Coast to Coast Climate Challenge, Klimatorium in Lemvig and Aqua Globe in Skanderborg. The collaboration provides, inter alia, good opportunities for communication and to involve students, researchers and technicians.

National Space Institute
Geodesy

Lemvig municipality
Lemvig Water and Wastewater
Region of Central Denmark
Ramboll Group AS
Agency for Data Supply and Efficiency (SDFE)

Skanderborg Utility
Period: 01/03/2017 → 31/12/2017
Number of participants: 2
Number of related Ph.D. students: 1
Project participant:
Sørensen, Carlo Sass (Intern)
Knudsen, Per (Intern)

Relations
Related projects:
Coastal flooding hazards due to storm surges and subsidence
Project

Near Term Commercial Space Resource Operations and Utilisation
National Space Institute
Period: 15/02/2017 → 12/02/2019
Number of participants: 4
Phd Student:
Culton, John (Intern)
Supervisor:
Andersen, Niels (Intern)
Chytka, Trina (Ekstern)
Main Supervisor:
Jørgensen, John Leif (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Coast to Coast Climate Challenge
The project is supported by the LIFE program by about 52 million kr. and has a total budget of approximately 90 million in addition to construction costs in connection with the realization of the many solutions developed during the project.

The overall objective
The project is led by Central Denmark Region, in close cooperation with the other 30 partners will work to create a climate resilient region by:
• formulating a shared vision among local players, and by
• implement local climate change adaptation plans targeted as the necessary analyzes and activities coordinated, and the
• Identify and improve the resources and capabilities among citizens, municipalities, utilities and companies in the water industry.

The project is implemented in a number of sub-projects (24 pcs.) And horizontal activities. Various partners have brought subprojects into the C2C CC.

Main contributions to subprojects C9, C17, C21.

National Space Institute
Geodesy
Region of Central Denmark
Lemvig municipality
Lemvig Water and Wastewater
Period: 01/01/2017 → 31/12/2022
Number of participants: 1
adaptation, innovation, water, sustainability
Acronym: c2c cc
Project participant:
Sørensen, Carlo Sass (Intern)

Relations
Activities:
Kick off Coast to Coast Climate Challenge

Project

Measurements and modelling of Arctic coastal environments
National Space Institute
Period: 15/11/2016 → 14/11/2019
Number of participants: 4
Phd Student:
Monteban, Dennis (Intern)
Supervisor:
Ingeman-Nielsen, Thomas (Intern)
Lubbad, Raed (Ekstern)
Main Supervisor:
Pedersen, Jens Olaf Pepke (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Copernicus Evolution and Applications with Sentinel Enhancements and Land Effluents for Shores and Seas
National Space Institute
Geodesy
Period: 01/11/2016 → 01/11/2019
Number of participants: 3
Altimetry, Wind, Waves
Acronym: CEASELESS
Project participant:
Stenseng, Lars (Intern)
Steffensen, Stefan Emil (Intern)
Knudsen, Per (Intern)

Project

STROBE-X: X-ray Timing and Spectroscopy Mission
STROBE-X is a NASA probe-class observatory designed for X-ray timing and spectroscopy in the 0.2{30 keV band, with huge collecting area and good spectral resolution. It is optimized for the study of matter in the most extreme conditions found in the Universe and addresses several key science areas including:

Probing matter spiraling into black holes (BHs) to explore the effects of strong-field general relativity and measure the masses and spins of BHs.

X-ray reverberation mapping of BH accretion flows across all mass scales, from stellar-mass BHs in our Galaxy to supermassive BHs in active galactic nuclei.

Fully determining the ultradense matter equation of state by measuring the neutron star (NS) mass-radius relation using > 20 pulsars over an extended mass range.

Exploring cosmic chemical evolution by measuring bulk metallicity of ~100 high-redshift (z > 2) galaxy clusters. Continuously surveying the dynamic X-ray sky with large duty cycle and high spectral and time resolution to characterize source behavior over a vast range of time scales, and to enable multi-wavelength and multi-messenger studies through cross-correlation with high cadence surveys at other wavelengths and in gravitational waves and neutrinos.

National Space Institute
Astrophysics and Atmospheric Physics
Facilitation for production of coated X-Ray mirror plates

National Space Institute
Period: 01/02/2016 → 31/01/2019
Number of participants: 4
PhD Student:
Massahi, Sonny (Intern)
Supervisor:
Collon, Maximilien J. (Ekstern)
Hornstrup, Allan (Intern)
Main Supervisor:
Christensen, Finn Erland (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Management plan for development of sustainable fisheries for blue mussels, cockles and oysters in the Danish Wadden Sea (39357)
The aim of this project is to develop options for a sustainable fishery for blue mussels, oysters and cockles in the Wadden Sea both within and outside the Natura 2000 site. This is achieved by estimation of stock sizes of blue mussels, cockles and Pacific oysters within the Natura 2000 site as well as cockles and razor clams in relevant fishing areas outside Natura 2000 site. Furthermore, new and more cost-effective methods for monitoring each target species will be developed and tested. Finally, a management plan for sustainable fishing for mussels, cockles and oysters in the Wadden Sea will be provided.

The effect of the project will be that within 3 years, one or more sustainable fisheries for mussels, cockles and oysters will be initiated in the Wadden Sea, as well as a scientific documentation of important fishing grounds for shellfish is provided to counter potential closures of significant areas for shellfish fishing due to spoil dumping. In addition, new and more cost-effective methods for stock assessments will be developed. In conclusion, this will result in a scientific based management
of the shellfish fishery in the Wadden Sea, which will be beneficial for the shellfish fishery.

The project is coordinated by DTU Aqua.

The project is funded by Ministry of Environment and Food of Denmark and the European Maritime and Fisheries Fund (EMFF).

National Institute of Aquatic Resources
Danish Shellfish Centre
National Space Institute
Fiskeriselskabet Cardium

Period: 11/01/2016 → 14/07/2018
Number of participants: 3
Research area: Shellfish and seaweed
Project participant:
Petersen, Jens Kjerulf (Intern)
Nielsen, Mette Møller (Intern)

Project Coordinator:
Nielsen, Pernille (Intern)

High resolution gravity and bathymetry from recent satellite altimetry

National Space Institute

Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Abulaitijiang, Adili (Intern)
Supervisor:
Knudsen, Per (Intern)
Stenseng, Lars (Intern)

Main Supervisor:
Andersen, Ole Baltazar (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Sea ice thickness and classification measurement from Space

National Space Institute

Period: 15/12/2015 → 14/12/2018
Number of participants: 3
Phd Student:
Di Bella, Alessandro (Intern)
Supervisor:
Skourup, Henriette (Intern)
Main Supervisor:
Forsberg, René (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

The ASIM Science Data Center
The ASDC develops science data products to the internation science community from the instrument data of the ASIM payload on the International Space Center.

National Space Institute
However, OL tracking relies on accurate models of the Doppler frequency, which receivers on board COSMIC satellites when tracking low altitude troposphere scintillation signals [e.g., Ao et al., 2009; RO signals traversing the moist lower troposphere. Open loop (OL) tracking is implemented as an alternative for LEO RO ionosphere, their platform dynamics, and limited onboard processing resources. Similar challenges are encountered for 2013. RO receivers on LEO platforms face more serious challenges due to their extensive signal path through the

Peng et al., 2012; Psiaki et al., 2007; Xu et al., 2014; Xu and Morton, 2015; Yin et al., 2014; Zhang and Morton, 2010, applications [e.g., Carroll et al, 2014; Humphreys et al., 2010; Kassabian and Morton, 2013, 2014; Mao and Morton, 2013; ionospheric scintillation effects and to generate accurate estimations of scintillation signal parameters for ground-based

amplitude fading and random carrier phase variations [Morton et al., 2014]. A conventional GNSS receiver carrier phase processing algorithms When propagating through ionosphere irregularities caused by space weather conditions and plasma. This proposal aims to address these three challenges. 1.1.1 Challenge 1: Multi-GNSS RO Receiver Processing Algorithms

multi-GNSS resources to accurately detect, localize, and characterize disturbances and irregularities in the ionospheric coverage at a low cost. There are, however, many challenges remaining in effectively utilizing the tremendous amount of space-based communication and satellite navigation, they have also provided a powerful means of passively sensing the environment that created these effects. In the past two decades, global navigation satellite systems (GNSS) signals have been widely used for ionospheric monitoring through the establishment of numerous ground-based receiver networks and satellite-based radio occultation (RO) systems [e.g., Basu et al., 2002; Komjathy et al., 2010; Mannucci et al., 1999; Rocken et al., 2000]. Transmitted from medium Earth orbit (MEO) or geostationary Earth orbit (GEO) satellites near 20,000 km altitude, the number of open multiconstellation GNSS (multi-GNSS) signals with well-defined structures has been increasing at an accelerated rate. By 2020, there will be over 160 GNSS satellites broadcasting over 400 signals across the L band, nearly double the number today [Betz, 2013], providing increased measurement accuracy with global coverage at a low cost. There are, however, many challenges remaining in effectively utilizing the tremendous amount of multi-GNSS resources to accurately detect, localize, and characterize disturbances and irregularities in the ionospheric plasma. This proposal aims to address these three challenges. 1.1.1 Challenge 1: Multi-GNSS RO Receiver Signal Processing Algorithms

When propagating through ionosphere irregularities caused by space weather conditions and ionospheric internal mechanisms, GNSS signals experience scintillation effects characterized by simultaneous deep amplitude fading and random carrier phase variations [Morton et al., 2014]. A conventional GNSS receiver carrier phase lock loop (PLL) is not designed to handle such stress. A number of algorithms have been developed to mitigate ionospheric scintillation effects and to generate accurate estimations of scintillation signal parameters for ground-based applications [e.g., Carroll et al, 2014; Humphreys et al., 2010; Kassabian and Morton, 2013, 2014; Mao and Morton, 2013; Peng et al., 2012; Psiaki et al., 2007; Xu et al., 2014; Xu and Morton, 2015; Yin et al., 2014; Zhang and Morton, 2010, 2013]. RO receivers on LEO platforms face more serious challenges due to their extensive signal path through the ionosphere, their platform dynamics, and limited onboard processing resources. Similar challenges are encountered for RO signals traversing the moist lower troposphere. Open loop (OL) tracking is implemented as an alternative for LEO RO receivers on board COSMIC satellites when tracking low altitude troposphere scintillation signals [e.g., Ao et al., 2009; Beyerle et al., 2003; Sokolovskiy, 2001]. However, OL tracking relies on accurate models of the Doppler frequency, which
are difficult to establish during ionospheric scintillation and over extended time period. Since accurate carrier parameters are fundamental measurement quantities in RO applications, novel GNSS receiver tracking algorithms with improved robustness and accuracy are needed to maintain lock on scintillating signals and to generate accurate carrier phase and Doppler estimations for signals traversing ionospheric plasma irregularities and the lower troposphere. 1.1.2 Challenge 2: Ionosphere Irregularities Localization Using RO Measurements GNSS receiver tracking loop outputs, such as a signal’s carrier phase and Doppler frequency, need to undergo inversion processes in order to obtain ionospheric and atmospheric profiles. The most widely used RO inversion algorithm to obtain ionosphere electron density (Ne) profiles is the Abel transform, despite several assumptions that introduce large errors [Hajj and Romans, 1998; Schreiner et al., 1999; Yue et al., 2010, 2011]. To improve the accuracy of ionospheric ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—-3 profiles, ground-based observations and/or ionosphere models have been used to remove the spherical symmetry assumption [e.g., García-Fernández et al., 2003; Hernandez-Pajares et al., 2000; Jakowski et al., 2002; Schreiner et al., 1999]. Innovative approaches, such as the maximum entropy method [Hyssell, 2007], and the use of data assimilation models to remove the F region error contributions [Nicoll et al., 2009; Yue et al., 2011] have improved E and lower F region profile retrievals. There are, however, few studies in the literature that address retrieval of F region ionospheric irregularities from RO measurements. And, irregularities observed in RO signals are not always located at the tangent point along the raypath of the signal. Because the existence of F layer irregularities seriously violates the horizontal homogeneity assumption in the Abel inversion process, Ne profiles with irregularity features can only provide a qualitative indication that significant structures or inhomogeneity exists near the occultation area. Accurate location of the irregularities cannot be obtained from the retrieved Ne profiles. A promising approach to localize irregularities at high altitude is physics-based backpropagation of the complex electromagnetic (EM) fields recorded by LEO satellites along the raypath. In this approach, the irregularity is treated as an equivalent phase screen [e.g., Sokolovskiy, 2000; Sokolovskiy et al., 2002; Vorob’ev et al., 1999]. Sokolovskiy et al. [2002] applied 2-D back-propagation to high-rate RO signals collected from GPS/MET to localize a number of ionospheric irregularities in the F layer and above 1000 km. The results were not validated due to lack of colocated data and the rapidly changing state of the ionosphere. The method is also limited by the assumption that the amplitude modulation induced by the irregularities must be small inside the irregularity volume. Recently, Carrano et al. [2014] successfully demonstrated a technique to back-propagate strong GPS amplitude and phase scintillation signals from ground-based receiver measurements to construct phase screens. Correlated RO receiver and ground-based common volume observations of amplitude and phase scintillation are needed to validate and improve the physics-based techniques and evaluate the accuracy of the irregularity estimations. 1.1.3 Challenge 3: Polar Ionospheric Irregularity Characterization Through Interferometry The polar ionosphere has direct access to the interplanetary space and the magnetosphere, and consequently mostly prone to space weather effects. During active solar conditions, the Sun dumps massive magnetized plasma and kinetic energy into the terrestrial environment. A geomagnetic storm is a manifestation of the response of the Earth’s upper atmosphere and the polar ionosphere more directly. During geomagnetic storms, the polar ionosphere is substantially distorted compared to the quiet-time characteristics, exhibiting rapid spatial and temporal fluctuations of the ionization content and altered refraction index. Consequently, the phase and amplitude of GNSS signals propagating through the polar ionosphere exhibit scintillation effects [Jiao et al., 2013; Skone et al., 2008, 2009]. Figure 1 shows an example of the geomagnetic field disturbances and affected GNSS satellite signals at Gakona, AK on July 15, 2012. Generation of ionospheric irregularities is mostly due to storm-time free energy from plasma density gradients, external electric fields, particle precipitations, velocity shears, field-aligned currents, etc. The irregularities have broadband scales and accordingly interact selectively and differently with different GNSS signals. Comprehensive studies of the polar ionospheric interaction with and reaction to solar and geomagnetic activities require a large network of receivers that could track all visible multi-GNSS satellites at all times to produce interferometric imaging of the ionosphere. The results of Challenges 1 and 2 discussed above are critical to perform accurate estimates of temporal and spatial variability of ionospheric irregularities. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—-3 Figure 1. Geomagnetic field variations and percent of GNSS satellite signals exhibiting scintillation effects at Gakona, Alaska, on July 15, 2012. 1.2 Objectives and Expected Significance GPS RO limb-sounding techniques have evolved in parallel with the advancement of GNSS from a proof-of-concept to operational systems that provide global weather forecasting, climate monitoring, and ionosphere studies. The COSMIC-2 constellation will utilize the latest advancements in multi-GNSS through its tri-GNSS receivers to track open signals from GPS, GLONASS, and Galileo satellites. This new generation of RO systems is expected to increase the number of atmospheric and ionospheric profiles by an order of magnitude, and to drastically improve their measurement resolution. To maximize these anticipated benefits, we propose studies to achieve the following objectives by addressing the challenges presented above: Objective 1: Develop robust and accurate multi-GNSS receiver tracking algorithms to handle strong ionospheric and lower tropospheric RO scintillation signals. Objective 2: Develop data-driven, physics-based methodologies to accurately localize ionospheric irregularities and simulate RO scintillation signals. Objective 3: Perform mixed-scale multi-GNSS interferometry to characterize polar ionospheric irregularities with unprecedented spatial and time resolutions. Objective 1 will be achieved by exploiting space, time, frequency, and constellation diversity of modern multi-GNSS signals. In recent years, we have established a unique event-driven wideband multi-GNSS data collection network [Jiao et al., 2014; Morton et al., 2014; Peng and Morton, 2012; Pelgrum et al., 2011; Taylor et al., 2012] at strategically selected locations shown in Figure 2. The network has amassed a large amount of data containing strong ionospheric scintillation. These data, as well as simulated RO signals and wideband RO samples to be collected from Haleakala, a high elevation mountaintop in Hawaii, will be used to characterize scintillation signal structures and support algorithm development and performance evaluation. Objective 2 addresses the challenges to localize the irregularities at high altitudes. Our proposed data-driven, physics-based technique is based on joint processing of common volume RO and ground-based GNSS measurements. The process will start with identification of ionospheric scintillation from a ground-based network and from RO profiles obtained using Abel inversion algorithm. Back-propagation of EM fields from both ground-based receiver
arrays and space-based RO receivers will be implemented to localize equivalent phase screens of 0 2 4 6 8 10 12 14 16 18 20 22 24 0 3 6 0 100 -800 0 800 Time (Hours) Number of SV Percent B Field Variation (nT) H D Z No. SV Above 30o Elevation No. SV Affected Percent of SV Affected 0 2 4 6 8 10 12 14 16 18 20 22 24 0 3 6 0 100 -800 0 Time (Hours) Number of SV Percent B Field Variation (nT) H D Z No. SV Affected Percent of SV Affected ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NHNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—4 irregularities and quantitatively validate the results. The proliferation of multi-GNSS signals in space may provide multi-dimensional characterization of ionospheric irregularities, and be used to further constrain the RO inversion algorithm to improve the accuracy of retrieved ionospheric profiles. Forward propagation of GNSS signals through identified equivalent phase screens will allow us to validate the back-propagation algorithm and generate simulated multi-GNSS RO scintillation signals for algorithm testing and evaluations. Figure 2. Event-driven wideband multi-GNSS data collection networks established and/or operated by the proposal team. The horizontal and vertical labels are geodetic latitude and longitude in degrees. Objective 3 will be accomplished by utilizing measurements from multi-scale multi-GNSS networks at northern hemisphere high latitudes to establish interferometric imaging of the spatial and temporal evolution of the dynamic ionosphere. The majority of our ground-based multi-GNSS receiver arrays are also co-located at major ionosphere research facilities where active RF sounding instruments, incoherent scatter radars, and optical imagers are available to augment the GNSS measurements and provide validation support. The results obtained from achieving objective 1 and 2 will allow us to utilize RO measurements to further refine and validate the interferometric images. The high-resolution interferometry results will make it possible to characterize the production, distribution, and evolution of ionospheric irregularities. The proposed activities will enable us to develop more accurate, efficient, and robust GNSS RO systems for next-generation remote sensing applications and to demonstrate the usefulness of combining space-based and ground-based multi-GNSS measurements for distributed sensing of the dynamic ionosphere. Accurate representations of ionospheric profiles are important not only for ionospheric investigations, they also impact the quality of corresponding lower atmospheric profiles, and affect characterization of perturbations that are driven by other natural and manmade processes occurring at the Earth’s surface. The objectives of the proposed work are therefore in line with the NRA’s goal of seeking innovative approaches to the development of GNSS remote sensing techniques and algorithms to advance Earth system science objectives. Gakona Alaska Arecibo, Puerto Rico Hong Kong Singapore Jicamarca, Peru Ascension Island Established Sites Planned Sites Magnetic equator ±15 Magnetic latitude 50% Auroral oval 90% Auroral oval Background map and geomagnetic boundaries of interests courtesy of James Secan, Northwest Research Associates, Inc. Poker Flat Sonderstrom Greenland Haleakala Hawaii Colorado Resolute Bay Canada Temporary Sites ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NHNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—5 1.3 Technical Approach and Methodology We propose the following three tasks aimed to achieve the objectives outlined above. 1.3.1 Task 1 - Developing Robust and Accurate Multi-GNSS RO Receiver Tracking Algorithms to Handle Ionospheric and Lower Tropospheric RO Scintillation Signals Accurate carrier phase tracking of strong scintillation signals is a challenging task because of the conflicting design criteria imposed by simultaneous deep amplitude fading and high carrier dynamics. For this reason, most groundbased GNSS receiver networks established to monitor ionosphere scintillations do not perform well during strong scintillations. To address this issue, we developed an event-driven multi-GNSS intermediate frequency (IF) data collection system. Figure 3 shows the schematic of the system. A conventional ionosphere scintillation monitoring (ISM) receiver continuously processes multi-constellation signals. An array of wideband RF front ends samples IF inputs and temporarily stores the data in circular buffers. If the ISM receiver detects scintillation, our custom designed trigger software retrieves the circular buffer contents to a permanent storage system. The stored data are postprocessed using our custom receiver tracking software. Figure 4 shows an example of phase scintillation index for GPS PRN24 L1, L2C, and L5 signals over Ascension Island on March 10, 2013. The ISM receiver (solid lines) has numerous carrier phase cycle slips and lost lock of signals. In contrast, our software-defined radio (SDR) algorithms were able to maintain lock of the same signals recorded by the IF data collections system (dotted lines). Figure 4. GPS Phase scintillation index for L1, L2, and L5 signals during a strong scintillation event. The solid lines are outputs of an ionospheric scintillation-monitoring (ISM) receiver. The dotted lines are postprocessed results from recorded IF data using our software-defined radio (SDR) carrier tracking algorithms. From [Morton 21:00 21:05 21:10 21:15 21:20 et al., 2014]. 0 10 20 30 40 50 60 70 80 90 100 0 Time (HH:MM) Ascension Island. March 10, 2013. GPS PRN 24 SDR ISM L1 L2 L5 Cycle slip or loss of lock Figure 3. Schematic of event-driven wideband reconfigurable multi-GNSS data collection system. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NHNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—6 We designed several novel GNSS receiver carrier-tracking algorithms to handle strong scintillations for ground-based receivers. For example, Peng et al. [2012] presented a mixed PLL and a vector tracking loop (VTL) algorithm in which undisturbed signals are processed by a conventional PLL, while strong scintillation signals are tracked using feedbacks from VTL outputs. A signal integrity-monitoring module generates indicators of scintillation level or “health” status of each channel. A VTL computes the position, velocity, and timing (PVT) solutions based on outputs from healthy PLL channels to construct the code phase and carrier Doppler frequency model as feedback for the stressed channels. Xu et al. [2014] expanded this algorithm to dual constellation tracking and successfully demonstrated its feasibility to track GPS L1 and BeiDou B1 signals under strong scintillation conditions. Xu and Morton [2015] further applied the approach to ground-based receivers with known surveyed positions. This so-called Fixed-Position-Feedback (FPF) algorithm applies extended integration time and accurate receiver and satellite position information to reveal carrier phase structures during deep signal fading. Figure 5 shows example results obtained by applying the FPF algorithms to Ascension Island IF data. Carrier phases on GPS PRN 24 L1 and L5 signals both showed half-cycle changes (upper panel) during their deep amplitude fading (lower panel). Our investigation showed that phase reversal during deep fading is not uncommon in equatorial scintillation [Xu and Morton, 2015]. Does this phenomenon occur with RO measurements in the ionosphere and in the lower troposphere? What are the underlying ionosphere and atmosphere properties that lead to such phenomena? Accurate carrier phase estimations hold the key to reliable retrievals of atmospheric and ionospheric profiles from RO measurements. Being able to uncover
phase structures during deep fading is critical for sensing ionospheric irregularities and troposphere water vapor. The algorithms discussed above exploit spatial diversity of ionospheric irregularities, with the expectation that some GNSS satellite signals will arrive at the receiver without penetrating irregularities. These healthy signals are used to derive receiver PVT solutions to generate feedback parameters for the scintillating channel. As the number of multi-GNSS signals increases, this strategy will continue to improve its performance for ground-based receivers. On LEO satellites such as COSMIC, a frequency model is used as the reference to enable open loop (OL) tracking for low altitude occultation, while closed loop (CL) is used to track high altitude occultation signals for ionosphere profiling. The OL frequency model is based on Figure 5. GPS L1 and L5 carrier phase reversals during deep amplitude fading. The plots are generated by applying the Fixed-Position-Feedback (FPF) algorithm [Xu and Morton, 2015] to Ascension Island IF data collected on March 8, 2013. I ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1–7 satellite PVT solutions determined by a separate receiver and other onboard navigation sensors [Tseng et al., 2014]. The VTL and FPF described above are in essence adaptive mixed mode tracking techniques as they continuously evaluate the signal conditions and tracking loop stress to decide the mode of operation at each integration period. OL tracking is only evoked when the signal intensity drops below a certain threshold value. CL tracking will take over after the signal power returns to above the threshold. Instead of blanking the entire flight of signals through strong scintillation regions with OL tracking, these algorithms evoke OL tracking only during the short intervals when deep fading occurs. Our studies of ground-based ionospheric scintillation indicate that the average deep fading duration for equatorial scintillations is 60–100 ms with average time between consecutive deep fading being 5–10 seconds [Morton et al., 2015]. Therefore, it is possible for OL tracking to operate for about 100 ms before handing over to CL tracking. Unlike the current RO receiver OL tracking method, the VTL and FPF algorithms have knowledge of the most recent signal parameters, and therefore can generate a more accurate frequency code reference model for the short time period during deep signal fading. By adopting these algorithms for RO receivers, we are effectively exploiting temporal diversity of scintillation signals. More studies are needed to characterize the deep fading durations and consecutive fading time for lower troposphere scintillations to have a better understanding of the benefit of the approach at lower troposphere. Adaptive multi-frequency (AMF) tracking is another approach that can be applied to RO receivers [Yin et al., 2014]. Figure 6 shows an example of GPS L1, L2C, and L5 signal intensity during an intense scintillation event over Ascension Island. The plot shows that deep fading on L1, L2C, and L5 do not always occur simultaneously. Statistical analysis of thousands of triple-frequency GPS signal deep fading based on data collected on Ascension Island, and in Singapore and Hong Kong show that the probability of having simultaneous fading across all three GPS bands is less than 4% [Morton et al., 2015]. Yin et al. [2014] presented the architecture of the AMF algorithm and tested its performance by tracking real triple-frequency GPS data. Figure 7 shows the carrier-to-noise density ratio \( C/N0 \) of GPS PRN 25 L1, L2C, and L5 signals on March 7, 2013 on Ascension Island generated by the AMF algorithm. The dashed green rectangles indicate when deep fading occurred on at least one frequency and adaptive frequency aiding was automatically evoked by the AMF. Conventional tracking algorithms lost lock on signals during this period. Figure 6. Signal intensity for GPS PRN 25 L1, L2C, and L5 signals over Ascension Island on March 5, 2013. The three marked fading events show that fading do not occur simultaneously on the same satellite signals at different carriers. !! ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1–8 Figure 7. \( C/N0 \) from AMF tracking for PRN 25 L1, L2C, and L5 signals during strong scintillation on March 7, 2013, over Ascension Island. The AMF algorithm was able to maintain lock on all three signals throughout this very challenging time period. The dashed green rectangles indicate where deep fading occurred on at least one frequency and adaptive frequency aiding was automatically evoked by the AMF. The AMF method can be directly applied to RO receivers to track ionospheric scintillation signals, as similar dispersive behavior should occur in RO signals. For lower troposphere scintillation, the applicability of this method will be determined by the outcome of investigations of multi-frequency fading properties of water vapor scintillation. Such an investigation requires wideband IF RO data propagating through the lower troposphere with rich water vapor contents. The PI has obtained funds from Air Force Research Laboratory to collect multi-frequency troposphere scintillation data [Morton, 2015a]. The experiment will be conducted on April 15–26, 2015 using wideband RF front ends and a high gain antenna set up on Haleakala, a mountain peak with 3000 m elevation on Maui in the Hawaiian Islands. While the mountain top data is intended for airborne scintillation research, the results will also be used to support the proposed studies. We propose an adaptive open loop (AOL) architecture that exploits both time and frequency diversities by integrating mixed PLL and VTF with AMF to further improve the robustness and accuracy of RO receiver tracking for both ionosphere and lower troposphere. In this proposed new architecture as depicted in Figure 8, 75 80 85 90 95 100 0 5 10 15 20 25 30 35 40 45 Time (s) \( C/N0(dB-Hz) \) L1:AMF L2:AMF L5 AMF L1 aids L2 & L5 & L5 & L5 & L1 aid L2 & L3 & 4 & 5 & 6 & 2 Figure 8. Proposed adaptive open loop (AOL) tracking method based on integrated VTL and AMF tracking algorithms concepts. ! Carrier&&code&&tracking&process

WidebandDigitalInput&Sample&Compute&tracking&loop&error&stress&indicatior(s); & Signal&intensity; & Phase&error & Frequency&error&Stress&indicator(s); & Threshold?&Construct&optimized&carrier&code&models&using;& & Prediction&from&recent&same&channel&parameters;&Temporal&diversity;&Tracking&loop&inputs&from&other&frequency&band(s)on&the&same&occultation&satellite;&frequency&diversity;&Platform&PVT&solultions&and&GNSS&ephemeris&–&traditional&open&loop&approach&Close&Loop&using; same&channel&testing&as&feedback&Open&loop&using&optimized&carrier&code&models&as&feedback&Yes&No&Figure 8. Proposed adaptive open loop (AOL) tracking algorithm based on integrated VTL and AMF algorithms concepts ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1–9 the default operation is the conventional CL PLL for signals at each carrier frequency. The tracking loop outputs are used to compute stress indicators such as signal intensity, carrier phase and Doppler frequency errors. Note that \( C/N0 \) is not in the proposed scheme because our studies have found that it is not suitable as a sensitive indicator for amplitude fading [Jiao et al., 2014]. Predetermined stress threshold values can be established based on prior experiments or simulation studies of RO data. The stress indicators are compared with the thresholds values at each integration period.
Ionospheric Irregularities Localization

The presence of ionospheric F layer irregularities invalidates the spherical asymmetry assumption in the Abel inversion, resulting in inaccurate retrieval of Ne profiles as well as incorrect location of the irregularities. The Ne profile errors will propagate down in altitude to impact lower ionosphere and troposphere profiles retrieval [Hysell, 2007; Nicolls et al., 2009; Yue et al., 2011]. We propose to extend the phase-screen approach presented by Bernhardt et al. [2006], Carrano et al. [2012], and Sokolovskyi et al. [2002] to back-propagate measurements from both ground-based GNSS receivers and LEO RO receivers to localize high altitude irregularities in a common volume intercepted by the signal paths to both kinds of receivers. With the proliferation of multi-GNSS signals and advancement of LEO RO technologies, more RO profiles and ground-based measurements with ionospheric scintillation signatures are becoming available. Figure 9 shows an example of RO and ground-based observations of ionospheric scintillation effects near our GNSS array in Gakona, Alaska. Two COSMIC RO profiles with scintillation structures (as contrasted by a background 2012 IRI model profile) corresponding to 16:49 and 17:04 UTC on March 15, 2012, are shown in the left panel. The large Ne peaks in the D and lower E regions are most likely due to propagation of large F region retrieval errors in the presence of irregularities. The middle panel shows 9 GPS and 7 GLONASS satellite tracks from 15:56 to 17:56 UTC, within a +/-150 longitude and +/-100 latitude window centered over the ground receiver array. The gray trajectories in the middle panel correspond to tangent points of the RO profiles; with darker colors indicate occultation at lower altitudes. The GPS and GLONASS satellite tracks are color-coded according to their carrier phase scintillation index as indicated by the color scheme below the middle panel. Because of the higher phase noise associated with GLONASS signals, two different color scales are used for GPS and GLONASS measurements. The right panel shows the phase scintillation index for all satellites during the two-hour span. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1 ---1 0 Figure 9. Ionospheric irregularities and scintillation effects observed simultaneously from COSMIC RO Ne profiles (left panel) and our ground-based GNSS array at Gakona, Alaska (middle and right panel) on March 15, 2012. Two COSMIC RO profiles with scintillation structures retrieved at 16:49 and 17:04 UTC and a background IRI (2012) model profile at 16:56 UTC are shown in the left panel. The RO profile tangent point tracks are shown as the gray trajectories in the middle panel with the darker colors corresponding to occultation at lower altitudes. The tracks in the middle panel are color-coded with GPS and GLONASS signal carrier phase scintillation index values. Each satellite track is identified by its constellation (G: GPS; R: GLONASS), followed by the satellite PRN (GPS) or slot number (GLONASS). The right panel shows the phase scintillation index for the satellites during the two-hour span. Although the two occultation profiles shown in Figure 9 intercept multiple GPS and GLONASS satellite signal paths tainted with strong phase fluctuations, the irregularity structures shown in the COSMIC profiles do not necessarily correspond to ionospheric irregularities at the tangent point. Figure 10 illustrates the geometrical relationship among a GNSS-LEO signal path, the tangent point of a retrieved Ne profile from the LEO satellite, potential location of a plasma bubble, and a ground-based receiver reception of a different GNSS satellite signal through the same plasma bubble. We propose an algorithm that uses joint LEO and ground-based multi-GNSS receivers measurements to localize ionospheric irregularities and validate the results. LEO receivers will include the ones on COSMIC, COSMIC-2, and the Canadian CASISIPE satellite which generates up to 100Hz high rate data [Kim and Langley, 2010; Shume et al., 2015]. Figure 11 is the block diagram of this proposed method. The algorithm starts with identification of a geographic- and time window based on ionospheric scintillations observed from ground-based multi-GNSS network. Within this geographic and time window, we search for potential COSMIC, CASSIOPE, and in future, COSMIC-2 RO occultation events. Ne profiles will be obtained using the Abel inversion algorithm for identified occultation events. If scintillation structures exist on a profile, complex EM fields will be constructed using high rate RO receiver tracking loop amplitude and carrier phase outputs and back-propagated along the projected LEO signal path. The location at which minimum phase fluctuation occurs corresponds to the equivalent phase screen location of the irregularities. The altitude and horizontal location of the irregularities can be mapped from the phase screen location along the occultation signal path. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1 ---1 1 Figure 10. Illustration of geometrical relationship among a GNSS-LEO satellite signal path, the tangent point of retrieved ionospheric profile from the LEO satellite, potential location of a plasma bubble, and a ground-based receiver reception of a different GNSS satellite signal through the same plasma bubble. Figure 11. Block diagram of the proposed ionospheric irregularity localization algorithm using joint LEO and ground-based multi-GNSS receiver measurements. The identified altitude and horizontal location of the irregularities will be validated using local ground-based GNSS receiver measurements. With the known coordinates of the groundbased GNSS receivers and GNSS ephemeris, we can determine which receiver-satellite signal paths traverse the identified irregularities. Scintillation indices can be computed during the time window near the occultation event to qualitatively validate the existence of the irregularities. To quantitatively evaluate the irregularities’ locations, the same LEO signal backpropagation procedure can be applied to ground-based receivers to locate equivalent phase screens along their signal paths, leading to new estimations of the irregularity altitude and horizontal locations. These new estimations can be used to evaluate the accuracy of the estimation obtained from LEO measurements. As the number of GNSS satellites increases and ROSES
2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1 — 12 GNSS receiver tracking algorithms improve, the number of LEO and ground observations within a defined geographic area will also increase. It is therefore possible for the same irregularities to be intercepted by multiple signals received by LEO and ground GNSS receivers. Scintillations observed on the LEO platform and by the ground-based network corresponding to these different signal paths will reveal characteristics of the same irregularities along different dimensions. There are a number of potential error sources that impact the algorithm performance and accuracy. The phase screen equivalence assumption for ionization irregularity is affected by the level of amplitude modulation inside the irregularity volume. The proposed studies will explore means to improve the physics-based approach by investigating back-propagations through multiple phase screens. The projected signal propagation path is determined by the background ionosphere. Geographical locations, tangent point altitude, and background geomagnetic field vector estimates will all contribute to the error budget of the localization results. Detailed analysis of these potential error impact factors and observations along different dimensions of the same irregularities will be conducted in this study. The reverse process of back-propagation is the forward propagation of incident GNSS EM waves through phase screens. Forward propagation will allow us to validate the backpropagation results and simulate scintillation RO signals at a receiver [Sokolovskiy et al., 2002; Carrano et al., 2011]. Task 2 will implement forward propagation of multi-frequency GNSS signals through phase screens identified by the back-propagation algorithm to simulate RO signals at LEO satellite for testing and evaluations of the AOL algorithm proposed in Task 1. 1.3.3 Task 3 - Joint RO and Ground-Based Network Ionosphere Interferometry We propose to utilize the network of space- and ground-based GNSS receivers, which continuously track all GNSS satellites in view, for interferometric imaging of the spatial and temporal evolution of the polar ionosphere. The availability of such a large network of GNSS receivers creates the opportunity for multiple baseline interferometry to form ionospheric images. Figure 12 shows a GNSS receiver array, which is convenient to form manifold baselines in Greenland, and a closely-spaced small array in Poker Flat, AK. An additional closely-spaced array will be established in Resolute Bay by the summer of 2016 [Morton, 2015b]. These networks, along with the Canadian High Arctic Ionospheric Network (CHAIN) [Jayachandran et al., 2009], will be used to support this proposed study. In this proposal, the GNSS array is utilized as an interferometer device to measure the spatial coherence function by coherently integrating the product of GNSS carrier phase measurements from a pair of GNSS receivers in the array. The integration should be performed over very small angular separations where the signals are received from same direction and have coherence in the ionosphere. Similarly, we will estimate the spatial coherence function for several baseline ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1 — 13 combinations in the GNSS array. Ionospheric images are synthesized by performing the Fourier transform on the spatial coherence function for all baselines in the interferometry. The GNSS array in Greenland provides ~1700 interferometric baselines, making it possible to achieve high resolution images. These synthesized images will reveal high spatial and temporal characteristics of the ionospheric irregularities with unprecedented details. In addition, 3D ionospheric image will be constructed by augmenting the ground-based GNSS observations with RO profiles obtained using e.g., COSMIC-1, CASSIOPE, and the prospective COSMIC-2 constellations. The number of daily RO measurements over Greenland and Alaska will be greatly enhanced with the impending launch of the COSMIC-2 constellation, which, along with CASSIOPE, will provide us with polar coverage to investigate the 3D evolution of high-latitude plasma irregularity processes—a telltale indicator of solar-terrestrial relations. These details can be further compared and analyzed with results generated by the irregularities localization method proposed in Task 2 and by nearby incoherent scatter radars, RF sounding instruments, and optical imagers. 1.4 Perceived Impact on the State of Knowledge The proposed research will have a major impact on advancing multi-GNSS RO receiver technologies for ionosphere and troposphere remote sensing and on improving our understanding of GNSS signal propagation effects through ionospheric irregularities and the lower troposphere on RO platforms. The proposed AOL tracking algorithm and the data-driven physics-based irregularities localization technique will lead to more accurate, efficient, and robust GNSS RO systems in high latitude and equatorial areas and at lower troposphere. Our unique event-driven IF data collection capabilities will supply high quality data for characterization of ionospheric and tropospheric scintillation and provide design guidance and a unique test bed for new RO algorithms development. The combined ground- and space-based GNSS for high-resolution images of the ionosphere will advance our understanding of high latitude ionospheric responses to solar/geomagnetic activities. 1.5 NASA Programmatic Relevance The proposed research relates directly to NASA objectives outlined in ROSES 2014/A.26 GNSS Remote Sensing Science Team solicitation, which “seeks innovative approaches to the development of GNSS remote sensing techniques and algorithms to advance Earth system science objectives” and “develop occultation techniques with a focus upon the broader utilization of existing GNSS signals such as GPS (L1 C/A, L2C and L5) and the GLONASS ... signals in preparation for future space borne receiver capabilities such as the TriG Receiver.” The proposed RO receiver algorithms leverage our proven techniques for ground-based multi-GNSS signal processing and our unique event-driven wideband multi-GNSS data collection capabilities. Our proposed strategies based on exploitation of diversities offered by new GNSS signals beyond the current legacy operations are in direct response to NRC’s Decadal Survey recommendations. Finally, our proposed high resolution imaging of the polar ionosphere demonstrates the potential of utilizing multi-scale ground-based multi-GNSS array with augmentation from space-based RO observations. The outcomes will substantiate NASA’s vision that new GNSS signal structures will provide unprecedented opportunities for remote sensing of the Earth system with new ground-based systems and relatively simple and robust space borne GNSS receivers. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH14ZDA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1 — 1 Plan of Work 1.6.1 Key Milestones We request four years of support for efforts towards GNSS RO receiver tracking and ionospheric irregularities localization algorithms development at CSU and high resolution polar ionospheric imaging and analysis at JPL. The proposed efforts will be completed jointly by the participating senior personnel, a graduate student, and a postdoctoral researcher. The outcomes of the proposed research will be a combination of methodologies, algorithms, and scientific results. We will report these outcomes throughout the period of performance at appropriate conferences (e.g., AGU Fall Meetings and Institute of Navigation meetings, and submit publications to relevant peer-
reviewed journals (i.e., Radio Science, IEEE Transactions on Aerospace & Electronics Systems, IEEE Transactions on Remote Sensing & Geosciences). Year 1 (2015-16): Algorithm development, RO scintillation simulation. CSU Task Emphasis: Task 1 - design architecture and component development/testing of AOL tracking algorithms for multi-frequency GPS signals; establishing stress indicators, selecting threshold level settings, and optimization of code and carrier models; processing mountaintop IF data using existing custom algorithms and analyze troposphere scintillation signal temporal and spectral characteristics. Task 2 - Identify geographic and time windows based on ground-based and RO scintillation data to support ionosphere irregularity localization algorithm development; implement RO forward-propagation algorithm to generate simulated wideband IF data at LEO RO and ground receivers. JPL Task Emphasis: Task 3 - Develop algorithms to process GNSS carrier phase observations made by the GNSS arrays for forming multi-baseline interferometry; generate high-resolution images and animations, which will reveal the spatial and temporal evolutions of the high-latitude ionosphere. The algorithm development will include a new software, which (1) performs calculation of the spatial coherence function for each baseline (as many as ~1700) using interferometry, and (2) performs inverse Fourier transform operations on the spatial coherence function for all baselines. Year 2 (2016-17): Algorithm development, GNSS scintillation signal characterization. CSU Task Emphasis: Task 1 - Expand component development/testing of AOL tracking algorithm to Galileo multi-carrier and GLONASS frequency-division-multiple-access signal processing, with special attention to mitigate GLONASS signal phase noise to improve its carrier phase measurement quality; threshold settings, and code/carrier model optimization for Galileo and GLONASS. Task 2 - Apply Abel inversion to obtain ionosphere Ne profiles within identified geographic and time window; identify and archive RO scintillation profiles; implement 2D RO back-propagation algorithm to locate equivalent phase screens for identified profiles; test the back-propagation algorithm using simulated RO data during Year 1 effort. JPL Task Emphasis: Task 3 - Test and validate computer codes extensively both on simulated and actual observations using JPL’s supercomputing facilities; develop computer codes for processing and augmenting the ground-based GNSS observations with RO observations for 3D image construction; identify key events and start processing ground-based and space borne data using algorithms developed in Year 1 and part of Year 2. Year 3 (2017-18): Algorithm integration and validation. CSU Task Emphasis: Task 1 - AOL tracking algorithm component integration of Year 1 and 2 results; testing and evaluation of integrated algorithms using ground-based scintillation data, mountaintop RO IF data, and simulated RO scintillation data; provide close-spaced receiver ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH142DA001N-GNSS Multi-GNSS Radio Occultation Algorithms 1—5 array scintillation tracking results to JPL team. Task 2 - Implement back-propagation algorithm for ground receiver measurements; apply the algorithm to test/validate/refine locations of ionospheric irregularities derived from back-propagation of RO signals during Year 2. JPL Task Emphasis: Task 3 - Utilize scientific software developed in Years 1 and 2 for processing the vast amount of ground-based and space-based GNSS observations; perform indepth analysis of processed events. Year 4 (2018-19): Algorithm performance enhancement and error analysis. CSU Task Emphasis: Task 1 - Refine, optimize, and speed up integrated AOL tracking algorithm developed in Year 1-3 for real-time applications on LEO platforms. Task 2: Error analysis of back propagation algorithm derived irregularity locations; comparison with nearby vertical sounding instruments, incoherent scatter radar, and optical imager measurements. JPL Task Emphasis: Task 3 - Interpret our results, prepare manuscripts for publication, present results at national and international scientific conferences; catalog and prepare processed data for archiving and release products to the scientific community for further scrutiny and analysis. 1.6.2 Management Structure The PI, Dr. Jade Morton, will be responsible for managing all technical and administrative aspects of the proposed efforts. She will lead the algorithm development, implementation, testing and validation, and error analysis as described in Task 1 and 2 at CSU. She will coordinate collaboration and information/data exchange between the CSU graduate student and postdoctoral researcher, the NASA JPL PI Dr. Attila Komjathy and Co-I Dr. Esayas Shume, University of New Brunswick (UNB) Co-I Dr. Richard Langley, and Technical University of Denmark (TUD) collaborator Mr. Tibor Dugonics. 1.6.3 Contributions of PI and Key Personnel CSU PI Dr. Jade Morton has extensive experience in GNSS receiver algorithm development, ionospheric irregularity modeling and remote sensing, and radio wave propagation effects studies. She will develop the architecture for algorithms in Task 1 and 2, and advise a graduate student on Task 1 and a postdoctoral researcher on Task 2 implementations. JPL Institutional PI Dr. Attila Komjathy and Co-I Dr. Esayas Shume will be responsible for Task 3 effort. Dr. Komjathy has led development of a number of innovative techniques in ground-based and space-based GNSS remote sensing. Dr. Shume is an expert in solar-terrestrial relations and space weather effects on GNSS, UNB Co-I Dr. Richard Langley is the PI of the GPS instrument on CASSIOPE and a science team member of CHAIN, and a world-leading expert in GNSS and ionosphere monitoring. He will provide support for CASSIOPE and CHAIN data access and support scientific analysis of the proposed studies. TUD collaborator Mr. Tibor Dugonics has experience in GPS remote sensing and oversees the Greenland GNSS array for which he will provide data access and support scientific analysis. ROSES 2014/A.26 GNSS Remote Sensing Science Team NRA NNH142DA001N-GNSS Multi-GNSS Radio Occultation Algorithms 2—12 References and Citations Ao, C. O., G. A. Haji, T. K. Meehan, D. Dong, B. A. Ijuma, A. J. Mannucci, and E. R. Kursinski, “Rising and setting GPS occultations by use of open-loop tracking,” J. Geophys. Res. Atmos., 114(D4), doi:10.1029/2008JD010483, 2009. Basu, S., K. Groves, Su. Basu, P. 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National Space Institute

Geodesy

Colorado State University

NASA Jet Propulsion Laboratory

California Institute of Technology

University of New Brunswick

Project: Decay of the geomagnetic dipole

National Space Institute

Period: 01/06/2015 → 06/09/2018

Number of participants: 3

Acronym: ROSES

Project participant:

Durgonics, Tibor (Intern)

Heeg, Per (Intern)

Project
Main Supervisor:
Finlay, Chris (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

enhanced X-ray Timing and Polarimetry mission, eXTP
The enhanced X-ray Timing and Polarimetry mission (eXTP) is a science mission designed to study the state of matter under extreme conditions of density, gravity and magnetism. Primary goals are the determination of the equation of state of matter at supra-nuclear density, the measurement of QED effects in highly magnetized star, and the study of accretion in the strong-field regime of gravity. Primary targets include isolated and binary neutron stars, strong magnetic field systems like magnetars, and stellar-mass and supermassive black holes.

The mission carries a unique and unprecedented suite of state-of-the-art scientific instruments enabling for the first time ever the simultaneous spectral-timing-polarimetry studies of cosmic sources in the energy range from 0.5-30 keV (and beyond).

Key elements of the payload are:

the Spectroscopic Focusing Array (SFA): a set of 11 X-ray optics operating in the 0.5-10 keV energy band with a field-of-view (FoV) of 12 arcmin each and a total effective area of ~0.9 m² and 0.6 m² at 2 keV and 6 keV respectively. The telescopes are equipped with Silicon Drift Detectors offering <180 eV spectral resolution.

the Large Area Detector (LAD): a deployable set of 640 Silicon Drift Detectors, achieving a total effective area of ~3.4 m² between 6 and 10 keV. The operational energy range is 2-30 keV and the achievable spectral resolution better than 250 eV. This is a non-imaging instrument, with the FoV limited to <1° FWHM by the usage of compact capillary plates.

the Polarimetry Focusing Array (PFA): a set of 2 X-ray telescope, achieving a total effective area of 250 cm² at 2 keV, equipped with imaging gas pixel photoelectric polarimeters. The FoV of each telescope is 12 arcmin and the operating energy range is 2-10 keV.

the Wide Field Monitor (WFM): a set of 3 coded mask wide field units, equipped with position-sensitive Silicon Drift Detectors, covering in total a FoV of 3.7 sr and operating in the energy range 2-50 keV.

The eXTP international consortium includes major institutions of the Chinese Academy of Sciences and Universities in China, as well as major institutions in several European countries and other International partners. eXTP is an enhanced mission concept based on the XTP mission, enabled by the collaboration between Chinese and European institutions.

The predecessor of eXTP, the XTP mission concept, has been selected and funded as one of the so-called background missions in the Strategic Priority Space Science Program of the Chinese Academy of Sciences since 2011. The strong European participation has significantly enhanced the scientific capabilities of eXTP.

The planned launch date of the mission is earlier than 2025.

National Space Institute
Astrophysics and Atmospheric Physics
IHEP
CSIC/IEEE
University of Geneva
Tsinghua University
Tongji University
CAS - National Astronomical Observatories
Shanghai Astronomical Observatory Chinese Academy of Sciences
Nanjing University
Purdue University
MPE
Peking University
Fudan University
Guangxi University
Osservatorio Astronomico di Roma
ASTRON
SRON
Leiden University
INAF - Brera Astronomical Observatory
Dr. Karl-Remeis-Sternwarte and Erlangen Center for Astroparticle Physics
Space Research Centre
University of British Columbia
Nicolaus Copernicus Astronomical Center
XiangTan University
Xinjiang University
Beijing Normal University
University of Zielona Gora
INFN - Sezione di Pisa
New York University
University of Rome III
University of Science and Technology of China
CEA Saclay
University of Helsinki
University of Turku
National Institute for Nuclear Physics
Academy of Sciences of the Czech Republic
Silesian University in Opava
Tata Institute of Fundamental Research
University of Oxford
Massachusetts Institute of Technology
University of Urbino "Carlo Bo"
University of Insubria
Nanjing Normal University
Shanghai Institute of Satellite Engineering
Xiamen University
Institute of Spacecraft System Engineering
Cornell University
Università degli Studi di Roma Tor Vergata
Fondazione Bruno Kessler
CAS - Purple Mountain Observatory
University of Alabama in Huntsville
NASA Goddard Space Flight Center
Period: 01/05/2015 → ...
Number of participants: 1
Acronym: eXTP
Project participant:
Brandt, Søren (Intern)

Relations
Parent project:
LOFT, the Large Observatory For X-ray Timing
Activities:
Wide Field Monitor
eXTP Coordination Meeting
eXTP mission design coordination meeting
High-throughput X-ray Astronomy in the eXTP era
eXTP Workshop 2015
LOFT-WFM concept and design considerations
Project

Airborne gravity measurement for geodesy and geophysics
National Space Institute
Period: 15/12/2014 → 31/08/2018
Number of participants: 3
Phd Student:
Jensen, Tim Enzberger (Intern)
Supervisor:
Olesen, Arne Vestergaard (Intern)
Main Supervisor:
Forsberg, René (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Thermo-chemical structure and evolution of the continental lithosphere: the hen-and-egg problem
National Space Institute
Measurement and Instrumentation Systems
Period: 01/11/2014 → 06/02/2015
Number of participants: 1
Project participant:
Herceg, Matija (Intern)

Computer modelling applied for dynamic flood mapping, monitoring and prediction
National Space Institute
Period: 01/09/2014 → 31/12/2014
Number of participants: 2
Phd Student:
de Brito, Mariana Madruga (Intern)
Main Supervisor:
Knudsen, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Science Without Borders, Brasi  
Project: PhD

**GNSS TEC and Scintillation in Arctic - Space Weather**

National Space Institute  
Period: 01/07/2014 → 07/02/2018  
Number of participants: 7  
Phd Student: Durgonics, Tibor (Intern)  
Supervisor: Vennerstrøm, Susanne (Intern)  
von Benzon, Hans-Henrik (Intern)  
Main Supervisor: Heeg, Per (Intern)  
Examiner: Olsen, Nils (Intern)  
Coster, Anthea J. (Ekstern)  
Wintoft, Peter (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet

**Relations**  
Publications:  
Multi-Instrument Observations of Physical Processes in the Arctic Ionosphere and Derived Applications

**Navigation with UAV's**

National Space Institute  
Period: 01/06/2014 → 05/04/2018  
Number of participants: 6  
Phd Student: Olesen, Daniel Haugård (Intern)  
Supervisor: Jakobsen, Jakob (Intern)  
Main Supervisor: Knudsen, Per (Intern)  
Examiner: Andersen, Jens Christian (Intern)  
Jensen, Anna B. O. (Intern)  
Ruotsalainen, Laura Maria (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**PhD in Environmental Monitoring with Unmanned Airborne Vehicles**

The PhD project is based on remote sensing from Unmanned Airborne Vehicles (UAVs), environmental modeling and data assimilation. Data are acquired using a water laser ranger, a multi-spectral camera and a thermal camera mounted on lightweight unmanned airborne vehicles. Implementation of the payload on the UAVs, processing of the data and informing of hydrological models are the the main study areas. The main objective is to study water and energy fluxes from land and water surfaces, including evapotranspiration, with a spatial accuracy that has no parallel in other remote sensing technologies.

Water Resources Engineering

National Space Institute
Sky Watch
Period: 01/05/2014 → 30/04/2017
Number of participants: 1
UAVs drones remote sensing hydrology water
Project participant:
Bandini, Filippo (Intern)

INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
A collaborative effort among the Laser Interferometer Gravitational-Wave Observatory (LIGO) and LIGO Scientific Collaboration (LSC), the European Gravitational Observatory and Virgo Collaboration (EGO/Virgo), and INTEGRAL Science Data Centre (ISDC) in order to participate in a program to perform follow-up observations of gravitational wave (GW) candidate events with the sharing of proprietary information.

National Space Institute
Astrophysics and Atmospheric Physics
University of Geneva
European Space Astronomy Centre and European Space Agency
Istituto di Astrofisica e Planetologia Spaziali Via Fosso del Cavaliere
University Paris Diderot - Paris 7
University College Dublin
National Institute for Astrophysics
Period: 05/04/2014 → ...
Number of participants: 1
Project participant:
Brandt, Søren (Intern)

Relations
Activities:
Tyngdebølger og den nyeste viden om emnet
Gravitationsbølger: Einstein vinder endnu en runde efter 100 år
INTEGRAL 2017
Gravitationsbølger og kilonova
Gravitational Waves
The New Era of Multi-messenger Astrophysics
Gravitationsbølger

Publications:
INTEGRAL Upper Limits on Gamma-Ray Emission Associated with the Gravitational Wave Event GW150914
INTEGRAL IBIS, SPI, and JEM-X observations of LVT151012
INTEGRAL Observations of GW170104
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Localization and Broadband Follow-Up of the Gravitational-Wave Transient GW150914
INTEGRAL Upper Limits on Gamma-Ray Emission Associated with the Gravitational Wave Event GW150914

Press / Media items:
FAKTA: Tyngdebølger er krusninger i rumtiden: De kaldes århundredets opdagelse. Men hvad er de såkaldte gravitationsbølger egentlig for noget?
Jagten på bølgerne fra universet
Opdagelse af tyngdebølger
Forskere: Disse fund kan vi forvente af tyngdebølger
Fysikerne jubler: Vi har fundet tyngdebølger!
Videnskabelig sensation: Forskere bekræfter Einstein-teori: Den største videnskabelige opdagelse i det nye årtusinde er netop blevet afsløret

Sensationel tyngdebølgemåling åbner nyt kapitel i udforskningen af rummet

Ugens podcast: Dansk rumudstyr bidrog til årets astronyheder

'Menneskeheden har aldrig set noget lignende': Forskere afslører banebrydende observationer

Dansk røntgendetektor på rumfartøj står bag historisk fund

Rygter: LIGO har målt flere tyngdebølger

Rygtebørsen koger over: Forskere har fundet bevis for tyngdebølger

Einstein havde ret

Ugens profil: "Vi fejrer en milepæl i astronomien"

Astronomer jubler over den første observation af sammenstød mellem to neutronstjener

Danske forskere: Tyngdebølger den største opdagelse i 100 år

Science: Neutronstjerners sammenstød er årets videnskabelige gennembrud

Kosmisk kollision var årets største videnskabelige gennembrud

Årets 10 største videnskabelige opdagelser

DTU researchers involved in historic discovery in outer space

Sensationelt fund: 59 kvadrillioner kg guld

Det kan vi bruge tyngdebølger til

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**Engineering Qualification Model (EQM) of a High-Performance Computer for Space Applications for the Atmosphere-Space Interactions Monitor (ASIM) Mission**

Development of a qualification computer board for the ASIM MMIA instruments.

**National Space Institute**

**Astrophysics and Atmospheric Physics**

**Measurement and Instrumentation Systems**

**Period:** 01/04/2014 → 01/06/2017

**Number of participants:** 3

**Acronym:** ASIM EQM

**Project participant:**

**Plauborg, Kim (Ekstern)**

**Project Manager, academic:**

**Brauer, Peter (Intern)**

**Project Coordinator:**

**Neubert, Torsten (Intern)**

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**The Wide Field Imager for the Athena X-ray Observatory**

The WFI is one of the two scientific instruments proposed for Athena, the mission selected to address the "Hot and Energetic Universe" science theme identified by ESA (Athena@ESA) for its L2 large satellite mission with launch in 2028.

The WFI will provide imaging in the 0.2-15 keV energy band over a wide field, simultaneously with spectrally and time-resolved photon counting. The instrument is designed to make optimal use of the grasp (product of collecting area and solid angle) provided by the optical design of the ATHENA mirror system, by combining a sensitive approx. 40°x40° field of view DEPFET detector with a pixel size properly sampling the angular resolution of 5'' on-axis (half energy width).

**National Space Institute**

**Astrophysics and Atmospheric Physics**

**MPE**

**Dr. Karl Remeis-Observatory and Erlangen Centre for Astroparticle Physics**

**IAA-Tuebingen**

**University of Vienna**

**CEA Saclay**
5th Athena/WFI Proto-Consortium Meeting
6th WFI Proto-Consortium Meeting
WFI Proto-Consortium Meeting

**Coastal flooding hazards due to storm surges and subsidence**

National Space Institute
Period: 01/03/2014 → 07/02/2018
Number of participants: 8
Phd Student:
Sørensen, Carlo Sass (Intern)
Supervisor:
Andersen, Ole Baltazar (Intern)
Drews, Martin (Intern)
Drews, Martin (Intern)
Main Supervisor:
Knudsen, Per (Intern)
Examiner:
Drews, Martin (Intern)
Hansen, Anja Skjoldborg (Ekstern)
Sannino, Gianmaria (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Industrial PhD
Mitigation of Space Weather Threats to GNSS Services

MISW (Mitigation of space weather threats to GNSS services) will tackle the research challenges associated with GNSS (Global Navigation Satellite System) and Space Weather to bring practical solutions right into the forefront of European Industry.

Space Weather can affect many modern technologies that we take for granted. One of the most common technologies found across many systems today is navigation and timing provided by the Global Navigation Satellite System (GNSS). The main users of GNSS positioning are reliant on the inherent accuracy that the system can provide but this is not adequate for all applications. Aviation has its own augmentation solution called a Satellite Based Augmentation System (SBAS) and the European version is called EGNOS (European Geostationary Navigation Overlay Service).

These systems gather additional information that allows some mitigation of Space Weather Events. However, they are not yet able to work in the most challenging regions and as a consequence Space Weather disturbances to the ionized upper atmosphere (ionosphere) will cause navigation errors that remain uncompensated.

MISW will research, develop and apply new solutions to compensate for ionospheric effects on GNSS. Measurements of actual extreme events will allow realistic estimates of the ionospheric delays and errors caused by scintillation. MISW will include the development of new mapping techniques to compensate for ionospheric delay and both system-level and receiver-level solutions to scintillation events.

The MISW consortium of leading industry, academia and research organisations will deliver the foundations for the next generation SBAS systems that can be extended across Europe and into Africa, ensuring reliable GNSS services over many decades ahead.

National Space Institute
Geodesy
Period: 01/02/2014 → 31/08/2016
Number of participants: 2
Acronym: MISW
Project ID: 607081
Project participant:
Høeg, Per (Intern)
von Benzon, Hans-Henrik (Intern)

GPS Precise Orbits - Calculations and Forecasts
National Space Institute
Geodesy
Period: 02/12/2013 → 31/10/2014
Number of participants: 4
Acronym: Leikr-Orbits
Project participant:
Durgonics, Tibor (Intern)
Møller, Lars (Ekstern)
Due Østerbye, Nikolaj (Ekstern)
Project Manager, academic:
Høeg, Per (Intern)
Effective high-resolution Geological Modeling

National Space Institute
Period: 01/12/2013 → 01/05/2014
Number of participants: 3
Phd Student:
Lundh Gulbrandsen, Mats (Intern)
Supervisor:
Hansen, Thomas Mejer (Intern)
Main Supervisor:
Mosegaard, Klaus (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

CITS - Copenhagen ITS
Vision: A Green and Smart City
Objective: Demonstrate urban wifi-localization potentials

Problems:
Traffic congestion and safety
Traffic information flow to user entities and humans
Environmental challenges caused by transportation
Lack of cooperative connection and information systems between: people, vehicles, goods, assets, infrastructure, businesses, and public sector entities
Lack of integrated smart city traffic and transport management systems, including information flows and user-platforms

Potentials:
Ubiquitous data collection in Smart City platform architecture based on a background technological infrastructure
Real-time ITS services and approaches for providing seamless connectivity, interoperability, and secure flow of information across all stakeholders
General Crowd Management - Methods, Technology (Management and flow description of humans, cars, trucks, goods, assets, etc., through smart-id tagging)
Digital infrastructure of a localization system consisting of transmitters and sensors in streetlight platforms
Performance of experimental demonstrations of techniques and systems, consisting of advanced crowd-management systems and next-generation localization technology in Smart City applications
Large-scale demonstrations connected to the street lamp project of Copenhagen and through visualization of use scenarios

National Space Institute
Geodesy
Office for Innovation & Sector Services
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Transport

Transport policy and behaviour
Period: 01/10/2013 → 31/05/2014
Number of participants: 5
Acronym: CITS
Project participant:
Starke, Jens (Intern)
Bacher, Peder (Intern)
Nielsen, Thomas Alexander Sick (Intern)
Project Manager, organisational:
Overton Chabre Holm, David (Intern)
Project Manager, academic:
Heeg, Per (Intern)
GOCE USER TOOLBOX, Maintenance, Evolution, Scientific Studies and Product Validation (GUT3)

National Space Institute

Measurement and Instrumentation Systems
Period: 12/09/2013 → 31/12/2015
Number of participants: 1
Acronym: GUT 3
Project participant:
Herceg, Matija (Intern)

Effective high-resolution Geological Modeling
It is the vision of this project to build an user friendly expert system, which is able to combine very large amounts of hard geological, geochemical and geophysical data with geological expert knowledge and information about an area. This approach in building geological models (Smart Interpretation) will facilitate fast, consistent, accurate and reliable modelling of very large areas. It will also facilitate construction of models with very high resolution, (High Definition Models) as the system will “learn” the geology of an area directly from a geological interpretation made by a geological expert. The system can then be used in another similar area by an untrained geologist to build a geological model, guided by the experienced geologists way of interpolation, as quantified by the expert system.

Center for Energy Resources Engineering

National Space Institute

Mathematical and Computational Geoscience
Period: 01/09/2013 → 01/09/2016
Number of participants: 2
Acronym: ERGO
Project ID: 113-2013-1
Project Manager, organisational:
Mosegaard, Klaus (Intern)
Project Manager, academic:
Hansen, Thomas Mejer (Intern)

Modeling in magnetic field of the polar electrojet
National Space Institute
Period: 01/07/2013 → 13/09/2017
Number of participants: 7
Phd Student:
Aakjaer, Cecilie Drost (Intern)
Supervisor:
Finlay, Chris (Intern)
Matzka, Jürgen (Intern)
Main Supervisor:
Olsen, Nils (Intern)
Examiner:
Vennerstrøm, Susanne (Intern)
Laundal, Karl Magnus (Ekstern)
Stolle, Claudia (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

GreenT- Greenland Magneto Tellurics
National Space Institute
Period: 01/06/2013 → 07/12/2016
Number of participants: 7
Phd Student:
Lauritsen, Nynne Louise Berthou (Intern)
Supervisor:
Finlay, Chris (Intern)
Matzka, Jürgen (Intern)
Main Supervisor:
Olsen, Nils (Intern)
Examiner:
Knudsen, Per (Intern)
Brasse, Heinrich (Ekstern)
Whaler, Kathryn Anne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Magnetotelluric investigation in West Greenland - considering the polar electrojet, ocean and fjords
Project: PhD

Mass Change of the Greenland Ice Sheet and its Contribution to Sea Level Rise over the Past Millennium
National Space Institute
Period: 01/05/2013 → 07/09/2016
Number of participants: 6
Phd Student:
Muresan, Ioana Stefania (Intern)
Supervisor:
Kjær, Kurt H. (Ekstern)
Main Supervisor:
Khan, Shfaqat Abbas (Intern)
Examiner:
Olsen, Nils (Intern)
Aðalgeirsdóttir, Guðfinna (Ekstern)
Hvidberg, Christine Schøtt (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Modelling dynamics of Jakobshavn Isbræ and its contribution to sea level rise over the past and future century
Project: PhD

Regional modeling of earth’s magnetic field
National Space Institute
Period: 01/02/2013 → 22/09/2017
Number of participants: 7
Phd Student:
Kother, Livia Kathleen (Intern)
Supervisor:
Finlay, Chris (Intern)
Matzka, Jürgen (Intern)
Main Supervisor:
Olsen, Nils (Intern)
Examiner:
Knudsen, Per (Intern)
Beggan, Ciaran (Ekstern)
Thébault, Erwan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

High accuracy techniques for space borne non cooperative target tracking
National Space Institute
Period: 15/12/2012 → 17/02/2016
Number of participants: 5
Phd Student:
Pedersen, David Arge Klevang (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Merayo, José M.G. (Intern)
Cropp, Alexander (Ekstern)
Wade, Lawrence A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
High Accuracy Tracking of Space-Borne Non-Cooperative Targets
Project: PhD

Satellite altimetry for land hydrology
National Space Institute
Period: 15/12/2012 → 20/04/2016
Number of participants: 7
Phd Student:
Ranndal, Heidi (Intern)
Supervisor:
Deng, Xiaoli (Ekstern)
Stenseng, Lars (Intern)
Main Supervisor:
Andersen, Ole Baltazar (Intern)
Examiner:
Heeg, Per (Intern)
Sandholt, Inge (Intern)
Thibaut, Pierre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Space borne infrared imaging system
National Space Institute
Period: 15/12/2012 → 17/02/2016
Number of participants: 6
Phd Student:
Jørgensen, Andreas Härstedt (Intern)
Supervisor:
Brauer, Peter (Intern)
Main Supervisor:
Merayo, José M.G. (Intern)
Examiner:
Skriver, Henning (Intern)
Park, Ryan (Ekstern)
Sodnik, Zoran (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Project Qualification of a High-Performance Computer for Scientific Instrumentation (ASIM) Phase C/D
Qualification of processes and procedures for the Virtex5 FPGA on a computer board for the MMIA instruments of ASIM

National Space Institute
Astrophysics and Atmospheric Physics
Period: 04/09/2012 → …
Number of participants: 1
Acronym: ASIM Vitex5
Project Coordinator:
Neubert, Torsten (Intern)

GALILEO Advanced RAIM Concepts
Use of GALILEO to support advanced RAIM concepts

Advanced Receiver Autonomous Integrity Monitoring (ARAIM) techniques, possibly aided by ground Integrity Support Messages (ISM), are currently receiving significant attention due to the prospects of good performance and lower infrastructure complexity when applied to the case of many satellites with dual-frequency signals, as it will be the case for GNSSs like GPS and Galileo. The concept of ISM shall cover the overall architecture to support integrity for ARAIM, thus be including the relevant ground infrastructure, the processing and the dissemination of the data information.

Today, aviation integrity services over regional areas rely to a considerable extent on satellite based information (SBAS), based on the single-frequency GPS open services, and require the broadcasting of satellite and ionospheric corrections. Apart from SBAS, RAIM integrity can also be used however limited to en-route phases of flight without vertical guidance and NPA procedures.

The SBAS services are internationally adopted by ICAO, and are regionally implemented by different systems including WAAS and EGNOS. The SBAS infrastructure is responsible of protecting the user from the possible GNSS system and satellite failures, and of informing the user within few seconds.

SBAS systems functions are considerably complex. These functions include, the collection of measurements from a dense continental network of complex sensor stations, the computation and GEO broadcasting in quasi real-time of orbit+clock corrections, the computation and GEO broadcasting in quasi real-time of ionospheric corrections, integrity error bounds for the orbit+clock and ionospheric corrections, and the computation and GEO broadcasting in real-time of integrity flags.

Actual SBAS physical architecture, implementing the above SBAS system functions, is subject to very demanding accuracy, integrity, continuity and availability requirements, implying numerous redundancies, as well as numerous architecture components with very demanding design assurance levels. The project addresses also these aspects.

National Space Institute
Geodesy
Period: 01/06/2012 → 30/06/2014
Number of participants: 3
Acronym: ARAIM
Project participant:
von Benzon, Hans-Henrik (Intern)
Stenseng, Lars (Intern)
Project Manager, academic:
Heeg, Per (Intern)

GALILEO Arctic TestBed Development and Operations
High latitude countries have significant and rapidly growing interests in having GALILEO EGNOS like services, mainly because of the rapidly growing traffic in the region (maritime as well as aviation). However EGNOS GEO signals are not received above 70 degree latitude. The objective of this project is to develop and deploy an Arctic TestBed to support the demonstration of GNSS services over ARCTIC regions on the basis of EGNOS subsystems and other existing infrastructure as deployed and operated on this region. In particular, the use of specific (non GEO) broadcast means. This activity will also support the EGNOS v3 definition phase in relation to the extension of the EGNOS coverage to North.

National Space Institute
Geodesy
Solar System Physics
Period: 01/05/2012 → 30/09/2014
Number of participants: 6
Acronym: Arctic TestBed
Project participant:
Stenseng, Lars (Intern)
von Benzon, Hans-Henrik (Intern)
Christiansen, Freddy (Intern)
Madsen, Finn Bo (Intern)
Hansen, Ole Bjerregaard (Intern)
Project Manager, academic:
Heeg, Per (Intern)
Project

Are xenoliths representative of the cratonic mantle
National Space Institute
Measurement and Instrumentation Systems
Period: 16/04/2012 → 31/12/2013
Number of participants: 1
Project participant:
Herceg, Matija (Intern)
Project

Essential Climate Variables for the Ice Sheets from Space and Airborne measurements
National Space Institute
Period: 01/03/2012 → 07/05/2015
Number of participants: 7
Phd Student:
Fredenslund Levinsen, Joanna (Intern)
Supervisor:
Khan, Shfaqat Abbas (Intern)
Sørensen, Louise Sandberg (Intern)
Main Supervisor:
Forsberg, René (Intern)
Examiner:
Knudsen, Per (Intern)
Ahlstrøm, Andreas P. (Intern)
Gourmelen, Noel (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Cryosphere monitoring from satellites and aircraft
National Space Institute
Period: 15/12/2011 → 18/03/2015
Number of participants: 6
Phd Student: Nilsson, Johan (Intern)
Supervisor: Serensen, Louise Sandberg (Intern)
Main Supervisor: Forsberg, René (Intern)
Examiner: Skriver, Henning (Intern)
Mottram, Ruth H. (Ekstern)
Schrama, Ernst J. O. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Improved sea level determination in the Artic regions through development of tolerant altimetry retracking
National Space Institute
Period: 01/12/2011 → 09/12/2015
Number of participants: 6
Phd Student: Jain, Maulik (Intern)
Supervisor: Dall, Jørgen (Intern)
Main Supervisor: Andersen, Ole Baltazar (Intern)
Examiner: Forsberg, René (Intern)
Egido, Alejandro (Ekstern)
Fenoglio-Marc, Luciana (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Global and Artic Sea Level Change from Satellite Altimetry
National Space Institute
Period: 01/11/2011 → 18/09/2015
Number of participants: 6
Phd Student: Svendsen, Peter Limkilde (Intern)
Supervisor: Nielsen, Allan Aasbjerg (Intern)
Main Supervisor: Andersen, Ole Baltazar (Intern)
Examiner: Høeg, Per (Intern)
Kokkendorff, Simon Lyngby (Intern)
Woodworth, Philip Leslie (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Developing hard X-ray and Gamma-ray multilayer coatings for novel substrates

National Space Institute
Period: 01/09/2011 → 09/11/2015
Number of participants: 5
Phd Student:
Jakobsen, Anders Clemen (Intern)
Main Supervisor:
Christensen, Finn Erland (Intern)
Examiner:
Hornstrup, Allan (Intern)
Lefmann, Kim (Intern)
Romaine, Suzanne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Thunderstorm Effects on the Atmosphere-Ionosphere System (TEA-IS)
European Science Foundation Network of 10 countries for studies of thunderstorms

National Space Institute
Astrophysics and Atmospheric Physics
Period: 09/05/2011 → 09/05/2016
Number of participants: 1
Acronym: TEA-IS
Project Coordinator:
Neubert, Torsten (Intern)

Undertrykkelse af overfladesignaler i isradar systemer

National Space Institute
Period: 01/05/2011 → 18/06/2015
Number of participants: 5
Phd Student:
Nielsen, Ulrik (Intern)
Main Supervisor:
Dall, Jørgen (Intern)
Examiner:
Mohr, Johan Jacob (Intern)
Hélière, Florence (Ekstern)
Ulander, Lars M. H. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

LOFT, the Large Observatory For X-ray Timing
LOFT, the Large Observatory For X-ray Timing, is a proposed space mission intended to answer fundamental questions about the motion of matter orbiting close to the event horizon of a black hole, and the state of matter in neutron stars. LOFT was in 2011 selected by ESA as one of the four space missions concepts of the Cosmic Vision programme that will compete for a launch opportunity at the start of the 2020s.
The LOFT payload module will host two instruments: the Large Area Detector (LAD) and the Wide Field Monitor (WFM).

The LAD will improve upon the effective area of the largest area X-ray instrument ever flown (the Rossi X-ray Timing Explorer’s Proportional Counter Array) by a factor of about 20. The improved energy resolution (better than 260 eV) of the LAD will allow the exploitation of spectral diagnostics of relativistically-broadened 6-7 keV (Fe-K) lines, in particular. It will be deployed through a mechanism based on that used for Synthetic Aperture Radar missions, such as the Soil Moisture and Ocean Salinity (SMOS) mission, where very large panels are deployed in space with high accuracy.

The Wide Field Monitor (WFM) will discover and localise X-ray transients and impulsive events and monitor spectral state changes with unprecedented sensitivity. Targeted follow-up observations will make this resource important in its own right.

DTU Space is heading the European team planning to provide the Wide Field Monitor instrument.

National Space Institute

Astrophysics

Electronic Engineering

Period: 15/02/2011 → ...
Number of participants: 6
Acronym: LOFT
Project participant:
Budtz-Jørgensen, Carl (Intern)
Lund, Niels (Intern)
Kuvvetli, Irfan (Intern)
Hansen, Flemming (Intern)
Project Manager, organisational:
Pedersen, Søren Møller (Intern)
Project Manager, academic:
Brandt, Søren (Intern)

Relations

Activities:
LOFT mission concept Science Study Team (External organisation)
Observing GRBs with the LOFT Wide Field Monitor

Publications:
Accelerator experiments with soft protons and hyper-velocity dust particles: application to ongoing projects of future X-ray missions
Simulations of the x-ray imaging capabilities of the silicon drift detectors (SDD) for the LOFT wide-field monitor
LOFT - The large observatory for x-ray timing
The Large Observatory for X-ray Timing (LOFT)
The LOFT (Large Observatory for X-ray Timing) background simulations
The LOFT wide field monitor
The Science Payload of the LOFT Mission
LOFT - The Large Observatory for X-ray Timing
Observing GRBs with the LOFT Wide Field Monitor
Background simulations for the Large Area Detector onboard LOFT
The Large Observatory For X-ray Timing
The LOFT Ground Segment
The design of the wide field monitor for LOFT
Probing the emission physics and weak/soft population of Gamma-Ray Bursts with LOFT. White Paper in Support of the Mission Concept of the Large Observatory for X-ray Timing
The LOFT wide field monitor simulator
The LOFT Burst Alert System and its Burst On-board Trigger
High-energy radiation from thunderstorms and lightning with LOFT. White Paper in Support of the Mission Concept of the Large Observatory for X-ray Timing.

Press / Media items:
Danskere med i stort rumprojekt: Satellitten LOFT sendes i 2022 ud i rummet med et danskbygget røntgenkamera om bord
Project
Mapping Neutron Stars with Type I X-ray Bursts

Thermonuclear flashes on accreting neutron stars, observed as Type I X-ray bursts, offer a powerful probe of the conditions inside the dense interior of the neutron star. We propose a combined observational and theoretical effort to understand the lightcurves, energetics and ignition conditions of long duration X-ray bursts, using them to measure the temperature of the neutron star interior, and to constrain the mass and radius of neutron stars from the spectrum of Type I X-ray bursts. These approaches give complementary information about the neutron star interior, constraining the uncertain physics of dense matter.

Astrophysics

National Space Institute
McGill University
International Space Science Institute

Period: 01/01/2011 → 12/07/2014
Number of participants: 3
Contact person:
Falanga, Maurizio (Ekstern)
Cumming, Andrew (Ekstern)
Chenevez, Jérôme (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Project

Sea-Level Changes in the Arctic from Satellite Altimetry

National Space Institute

Period: 01/12/2010 → 31/08/2011
Number of participants: 3
Phd Student: Hvid, Tina (Intern)
Supervisor: Knudsen, Per (Intern)
Main Supervisor: Andersen, Ole Baltazar (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Relativistic electronics in electric discharges

National Space Institute

Period: 01/11/2010 → 16/04/2014
Number of participants: 6
Phd Student: Cinar, Deniz (Intern)
Supervisor: Chanrion, Olivier (Intern)
Main Supervisor: Neubert, Torsten (Intern)
Examiner: Budtz-Jørgensen, Carl (Intern)
Marisaldi, Martino (Ekstern)
Østgaard, Nikolai (Ekstern)

Financing sources
Integrated Modeling of Oil Reservoirs - history matching and geostatistical analysis

National Space Institute
Period: 15/06/2010 → 14/05/2014
Number of participants: 7
PhD Student:
Melnikova, Yulia (Intern)
Supervisor:
Shapiro, Alexander (Intern)
Stenby, Erling Halfdan (Intern)
Main Supervisor:
Mosegaard, Klaus (Intern)
Examiner:
Finlay, Chris (Intern)
Demyanov, Vasily V. (Ekstern)
Khan, Amir (Ekstern)

The Atmosphere Space Interactions Monitor (ASIM)

ASIM is a suite of instruments for an external platform of ESA's Columbus module on the International Space Station. ASIM will study x- and gamma-radiation from thunderstorms, electric discharges in the atmosphere between thundercloud tops and the lower ionosphere, and lightning processes within thunderstorms.

National Space Institute
Astrophysics and Atmospheric Physics
Period: 01/04/2010 → 01/04/2020
Acronym: ASIM
Project participant:
Østgaard, Nikolai (Ekstern)
Reglero, Victor (Ekstern)
Jørgensen, Carsten (Ekstern)
Project Coordinator:
Neubert, Torsten (Intern)

Risk assessment and Multiple scenario Generation from Seismic and Geological Data

National Space Institute
Period: 01/03/2010 → 15/01/2014
Number of participants: 6
PhD Student:
Cordua, Knud Skou (Intern)
Supervisor:
Fabricius, Ida Lykke (Intern)
Main Supervisor:
Mosegaard, Klaus (Intern)
Examiner:
Heeg, Per (Intern)
Barnes, Christophe (Ekstern)
Collon-Drouaillet, Pauline (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Micropropulsion Systems for Precision Controlled Space Flight
National Space Institute
Period: 01/02/2010 → 23/09/2013
Number of participants: 5
Phd Student:
Larsen, Jack (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Brauer, Peter (Intern)
Hansen, Flemming (Intern)
Prieur, Pascal (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Synthesis and validation of vision based spacecraft navigation
National Space Institute
Period: 01/02/2010 → 23/09/2013
Number of participants: 5
Phd Student:
Massaro, Alessandro Salvatore (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Merayo, José M.G. (Intern)
Birger, Niss (Ekstern)
Sodnik, Zoran (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Ultra-Fast Flash Observatory, UFFO
The Ultra-Fast Flash Observatory pathfinder (UFFO-p) is a new space mission dedicated to detect Gamma-Ray Bursts (GRBs) and rapidly follow their afterglows in order to provide early optical/ultraviolet measurements.

National Space Institute
Astrophysics and Atmospheric Physics
Sungkyunkwan University
Moscow Lomonosov State University
Instituto de Astrofísica de Andalucía
University of Valencia
National Taiwan University
National Space Organization
Korea Advanced Institute of Science & Technology
Period: 01/01/2010 → ...
Number of participants: 3
Acronym: UFFO
Project participant:
Brandt, Søren (Intern)
Budtz-Jørgensen, Carl (Intern)
Lund, Niels (Intern)

Relations
Activities:
Workshop on GRB with Lomonosov & the UFFO meeting

University Satellites: Lomonosov, RELEC, Tatiana

Publications:
Status report of the UFFO-pathfinder
Design and implementation of the UFFO burst alert and trigger telescope
A next generation Ultra-Fast Flash Observatory (UFFO-100) for IR/optical observations of the rise phase of gamma-ray bursts
The slewing mirror telescope of the Ultra Fast Flash Observatory Pathfinder
Update on The Ultra-Fast Flash Observatory (UFFO) Pathfinder
Ultra-fast flash observatory for detecting the early photons from gamma-ray bursts
The Ultra-Fast Flash Observatory’s space GRB mission and science
Ultra-Fast Flash Observatory for observation of early photons from gamma ray bursts
Design and Fabrication of Detector Module for UFFO Burst Alert & Trigger Telescope
The UFFO slewing mirror telescope for early optical observation from gamma ray bursts
Slewling Mirror Telescope optics for the early observation of UV/optical photons from Gamma-Ray Bursts
The UFFO (Ultra Fast Flash Observatory) Pathfinder: Science and Mission
The readout system and the trigger algorithm implementation for the UFFO Pathfinder
The Uffo Slewing Mirror Telescope for Early Optical Observation from Gamma Ray Bursts
Slewling Mirror Telescope and the Data-Acquisition System for the UFFO-Pathfinder
Calibration and Simulation of the GRB trigger detector of the Ultra Fast Flash Observatory
Development of Motorized Slewing Mirror Stage for the UFFO Project
In-Flight Calibrations of UFFO-Pathfinder
Ultra-Fast Flash Observatory (uffo) for Observation of Early Photons from Gamma Ray Bursts
Readout of the UFFO Slewing Mirror Telescope to detect UV/optical photons from Gamma-Ray Bursts
Ultra-Fast Flash Observatory: Fast Response Space Missions for Early Time Phase of Gamma Ray Bursts
Development of Slewing Mirror Telescope Optical System for the UFFO-pathfinder
Design and implementation of electronics and data acquisition system for Ultra-Fast Flash Observatory
Ultra-Fast Flash Observatory for the observation of early photons from gamma-ray bursts
Testing and Performance of UFFO Burst Alert & Trigger Telescope
The Status of the Ultra Fast Flash Observatory - Pathfinder
Observation of early photons from gamma-ray bursts with the Lomonosov / UFFO-pathfinder
Inverted-conical light guide for crosstalk reduction in tightly-packed scintillator matrix and MAPMT assembly

Absolute Gravimetry - for monitoring Climate Change and Geodynamics in Greenland

National Space Institute
Period: 01/01/2010 → 15/08/2013
Number of participants: 6
Phd Student:
Nielsen, Jens Emil (Intern)
Supervisor:
Strykowski, Gabriel (Intern)
Main Supervisor:
Forsberg, René (Intern)
Examiner:
Knudsen, Per (Intern)
Francis, Olivier (Ekstern)
Omang, Ove Christian Dahl (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Measurement of sea-ice and ice sheets by satellite and airborne radar altimetry
National Space Institute
Period: 01/01/2010 → 11/12/2013
Number of participants: 5
Phd Student:
Kildegaard Rose, Stine (Intern)
Supervisor:
Pedersen, Leif Toudal (Intern)
Main Supervisor:
Forsberg, René (Intern)
Examiner:
Elosegui, Pedro (Ekstern)
Spreen, Gunnar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Determination of Earth's magnetic field from satellite constellation magnetic field observations
National Space Institute
Period: 01/09/2009 → 18/12/2012
Number of participants: 5
Phd Student:
Kotsiaros, Stavros (Intern)
Main Supervisor:
Olsen, Nils (Intern)
Examiner:
Knudsen, Per (Intern)
Hulot, Gauthier (Ekstern)
Rummel, Reiner (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Estimating the future contribution of continental ice to sea-level rise
Ice2sea brings together the EU’s scientific and operational expertise from 24 leading institutions across Europe and beyond. Improved projections of the contribution of ice to sea-level rise produced by this major European-funded programme will inform the fifth IPCC report (due in 2013). In 2007, the fourth Intergovernmental Panel on Climate Change (IPCC) report highlighted ice-sheets as the most significant remaining uncertainty in projections of sea-level rise. Understanding about the crucial ice-sheet effects was “too limited to assess their likelihood or provide a best estimate of an upper bound for sea-level rise”.

National Space Institute
Geodynamics
Period: 01/03/2009 → 31/05/2013
Number of participants: 1
Acronym: ICE2SEA
Relations

Publications:
- Timing and origin of recent regional ice-mass loss in Greenland
- Squeezing more information out of time variable gravity data with a temporal decomposition approach
- A benchmark study for glacial isostatic adjustment codes
- Aerial photographs reveal late-20th-century dynamic ice loss in northwestern greenland.
- Greenland uplift and regional sea level changes from ICESat observations and GIA modelling
- Mass loss of Greenland's glaciers and ice caps 2003-2008 revealed from ICESat laser altimetry data
- Scatter of mass changes estimates at basin scale for Greenland and Antarctica
- The future sea-level rise contribution of Greenland's glaciers and ice caps
- Recurring dynamically induced thinning during 1985 to 2010 on Upernavik Isstrøm, West Greenland
- Spatiotemporal interpolation of elevation changes derived from satellite altimetry for Jakobshavn Isbær, Greenland

Multi INstrument Burst ARchive
Collaboration to the Multi-INstrument Burst ARchive (MINBAR) with responsibility for the INTEGRAL/JEM-X part. MINBAR is a database containing analyses of almost 5000 thermonuclear (type-I) X-ray bursts on the surface of accreting neutron stars. These include the events observed by the Rossi X-ray Timing Explorer, BeppoSAX and INTEGRAL. The database is currently in the process of being assembled by a collaborative team in Australia, Netherlands, Denmark (DTU Space) and the USA.

Astrophysics
National Space Institute
Monash University

Period: 01/01/2009 → 12/07/2013
Number of participants: 2
Acronym: MINBAR
Project participant:
Chenevez, Jérôme (Intern)
Project Manager, organisational:
Galloway, Dr. Duncan (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Project

GOCE in Ocean Modelling for the Internationale Space Station
National Space Institute

Period: 01/11/2008 → 23/05/2012
Number of participants: 6
Phd Student:
Herceg, Matija (Intern)
Supervisor:
Tscherning, Carl Christian (Ekstern)
Main Supervisor:
Knudsen, Per (Intern)
Examiner:
Heeg, Per (Intern)
Jacobsen, Bo Holm (Ekstern)
Rummel, Reinhard (Ekstern)

Financing sources
Source: Internal funding (public)
**Upper Troposphere Lower Stratosphere structure during convective systems using GPS radio occultations**

National Space Institute  
Period: 01/11/2008 → 16/01/2012  
Number of participants: 6  
Phd Student:  
Biondi, Riccardo (Intern)  
Supervisor:  
Larsen, Georg B. (Ekstern)  
Main Supervisor:  
Neubert, Torsten (Intern)  
Examiner:  
Høeg, Per (Intern)  
Bækgaard Lauritsen, Kent (Ekstern)  
Pommereau, Jean-Pierre (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Long X-ray burst monitoring with INTEGRAL: INTEGRAL AO-6 Key Programmes**

In the frame of the INTEGRAL Key Programmes, more than the half of the known X-ray bursters will be observed, among which some may exhibit unusual burst events lasting between a few tens of minutes and several hours. We propose to continue our survey of such long X-ray bursts in order to investigate what conditions, depending on the composition and rate of the accretion, lead to the unstable burning of either a large pile of mixed hydrogen and helium, or the ignition of a thick pure helium layer. A link with the superbursts, that are thought to arise from deeper carbon shell flashes, will also be investigated in the eventuality of the observation of such exceptional events by INTEGRAL. Thanks to the 6 Ms total exposure time and the large field covered by the Key Programmes we may expect to observe a few of these events for which the recurrence time is estimated to be of the order of years. We want to exploit the advanced sensitivity of the INTEGRAL instruments to study the physics of such events up to high energies and compare their observational properties with theoretical predictions. We apply for Key Programme data for any bursts whose light curves show that the flux in JEM-X (3 - 20 keV) or in IBIS/ISGRI (18 – 40 keV) stays above its pre-burst level for more than 10 minutes. In order to investigate the burst properties in relation with the accretion rate history, we also ask for the subset of data concerning the persistent emission of the involved burster.

National Space Institute  
Period: 15/08/2008 → 16/10/2010  
Number of participants: 1  
Project Manager, organisational:  
Chenevez, Jérôme (Intern)

**Financing sources**  
Source: Udenfor rammen  
Name of research programme: 50  
Amount: 0.00 Danish Kroner  
Project

**Viscoelastic crustal deformation due to ice load changes**

National Space Institute  
Period: 01/08/2008 → 18/12/2012  
Number of participants: 7  
Phd Student:  
Nielsen, Karina (Intern)  
Supervisor:  
Forsberg, René (Intern)  
Knudsen, Per (Intern)  
Main Supervisor:
Khan, Shfaqat Abbas (Intern)
Examiner:
Høeg, Per (Intern)
Funder, Svend (Ekstern)
Scherneck, Hans-Georg (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

NuSTAR calibration facility and multilayer reference database: Optic response model comparison to NuSTAR on-ground calibration data
National Space Institute
Period: 01/06/2008 → 19/04/2012
Number of participants: 5
Phd Student:
Brejnholt, Nicolai (Intern)
Main Supervisor:
Christensen, Finn Erland (Intern)
Examiner:
Hornstrup, Allan (Intern)
Pedersen, Kristian (Intern)
Willingale, Richard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Influence of Solar activity on planetary environments - Future Mars explorations
National Space Institute
Period: 01/05/2008 → 22/06/2011
Number of participants: 6
Phd Student:
Falkenberg, Thea Vilstrup (Intern)
Supervisor:
Madsen, Morten Bo (Ekstern)
Main Supervisor:
Vennerstrøm, Susanne (Intern)
Examiner:
Fris-Christensen, Eigil (Intern)
Jørgensen, Therese Moretto (Ekstern)
Veronig, Astrid (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Low Power attitude determination for magnetometry planetary missions
National Space Institute
Period: 01/05/2008 → 16/01/2012
Number of participants: 6
Phd Student:
Christensen, Thorbjørn Helvig (Intern)
Supervisor:
Jørgensen, John Leif (Intern)
Soil Moisture Measured by Microwave Remote Sensing

National Space Institute
Period: 01/05/2008 → 21/02/2012
Number of participants: 7
Phd Student:
Bircher, Simone (Intern)
Supervisor:
Sandholt, Inge (Intern)
Main Supervisor:
Skou, Niels (Intern)
Examiner:
Bauer-Gottwein, Peter (Intern)
Refsøgaard, Jens Christian (Ekstern)
Wigneron, Jean-Pierre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Vision based navigation sensors for spacecrafts rendezvous and docking

National Space Institute
Period: 01/11/2007 → 23/03/2011
Number of participants: 5
Phd Student:
Benn, Mathias (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Brauer, Peter (Intern)
Niss, Birger (Ekstern)
Sodnik, Zoran (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Polar remote sensing by CryoSat-type radar altimetry

National Space Institute
Number of participants: 7
Phd Student:
Stenseng, Lars (Intern)
Cosmic radiation influence on aerosol and cloud formation over short time periods

National Space Institute
Period: 01/07/2007 → 03/03/2010
Number of participants: 5
Phd Student: Bondo, Torsten (Intern)
Supervisor: Dall, Jørgen (Intern)
Main Supervisor: Forsberg, René (Intern)
Examiner: Skou, Niels (Intern)
Burgess, David (Ekstern)
Tonboe, Rasmus Tage (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret
Project: PhD

High resolution time-lapse gravity field from GRACE for hydrological modelling

National Space Institute
Period: 01/07/2007 → 22/06/2011
Number of participants: 6
Phd Student: Krogh, Pernille Engelbredt (Intern)
Supervisor: Bauer-Gottwein, Peter (Intern)
Main Supervisor: Andersen, Ole Baltazar (Intern)
Examiner: Knudsen, Per (Intern)
Lemoine, Frank G. (Ekstern)
Tscherning, Carl Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Attitude Fusion Techniques for Spacecraft

National Space Institute
Period: 01/03/2007 → 23/02/2011
Number of participants: 5
Phd Student:
INTEGRAL Galactic Bulge Monitoring Program

The Galactic Bulge is a region rich in bright variable high-energy X-ray and gamma-ray sources. Since 2005, we have observed this region regularly during all the visibility periods with ESA’s high energy astrophysics observatory INTEGRAL. Complete hexagonal dither patterns (7 pointings of 1800 sec each) are performed during each INTEGRAL revolution (i.e. every 3 days). As a service to the scientific community, the IBIS/ISGRI and JEM-X light curves and sky images in two energy bands are made publicly available as soon as the observations are performed.

The project is ongoing

National Space Institute

Astrophysics

European Space Astronomy Centre and European Space Agency

Period: 01/02/2005 → …

Number of participants: 3

X-ray sources, neutron stars, black holes, Galactic Center

Project participant:
Brandt, Søren (Intern)
Chenevez, Jérôme (Intern)

Project Coordinator:
Kuulkers, Erik (Ekstern)

Nanoprobe for Magnetic Space Cluster Missions

National Space Institute

Period: 15/08/2004 → 29/08/2008

Number of participants: 7

Phd Student:
Thomsen, Michael (Intern)

Supervisor:
Brauer, Peter (Intern)
Jørgensen, John Leif (Intern)

Main Supervisor:
Merayo, José M.G. (Intern)

Examiner:
Hansen, Flemming (Intern)
Connerney, John E. P. (Ekstern)
Madsen, Morten Bo (Ekstern)

Financing sources

Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

The JEM-X X-ray monitor on INTEGRAL

Integral is the first space observatory that can simultaneously observe objects in gamma rays, X-rays and visible light. Its principal targets are violent explosions known as gamma-ray bursts, powerful phenomena such as supernova explosions,
and regions in the Universe thought to contain black holes.

DTU Space has provided 2 X-ray monitor instruments, JEM-X to INTEGRAL.

INTEGRAL was launched on Oct 17, 2002. The mission is currently approved by ESA until the end of 2014.

The INTEGRAL mission was approved by ESA in 1994, and launched in 2002. The mission is currently approved by ESA until the end of 2014. ESA will by June 2013 decide if the mission will further be extended until the end of 2016.

National Space Institute

Astrophysics
Period: 17/10/2002 → …
Number of participants: 6
Project participant:
Chenevez, Jérôme (Intern)
Westergaard, Niels Jørgen Stenfeldt (Intern)
Oxborrow, Carol Anne (Intern)
Budtz-Jørgensen, Carl (Intern)
Lund, Niels (Intern)
Project Manager, academic:
Brandt, Søren (Intern)

Relations
Activities:
The 7th INTEGRAL Workshop (External organisation)
The Extreme and Variable High Energy Sky (External organisation)
8th INTEGRAL Workshop
11th INTEGRAL Conference
INTEGRAL 2017
9th INTEGRAL Workshop
INTEGRAL’s journey through the high energy sky
Gamma and X-ray astronomy - a personal perspective
Press / Media items:
Interview på DR P1 Videnskabens verden
Astronomer jubler over den første observation af sammenstød mellem to neutronstjerner
Project

Coupling of Atmospheric Layers (CAL)
FP5 Marie Curie network of 12 participants and 8 young scientists

National Space Institute

Astrophysics and Atmospheric Physics
Period: 01/06/2001 → 01/06/2005
Number of participants: 1
Acronym: CAL
Project Coordinator:
Neubert, Torsten (Intern)

Advanced Stellar Compass For the SAC-C satellite
The international Geophysics potential decade, has been declared beginning with the launch of the Ørsted satellite. To support the effort of precise mapping of the Geomagnetic field, NASA, the Argentine and the Danish government decided to include a simplified version of the Ørsted instrumentation platform in the Argentine SAC-C satellite. The Space Instrumentation Group was contracted to develop an improved version of the Ørsted Star Imager for this mission.

Department of Automation
National Space Institute
Institute for Product Development
Financing sources
Source: Unknown
Name of research programme: Uckendt
Amount: 1,500,000.00 Danish Kroner
Project:

Activities:

Gravitationsbølger og kilonova
Period: 1 Mar 2018
Søren Brandt (Guest lecturer)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: Regional

Related external organisation
Københavns Astronomiske Forening
Rundetårn, København, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

The Instrument Center for Danish Astrophysics (External organisation)
Period: 1 Mar 2018 → …
Søren Brandt (Chairman)
National Space Institute
Astrophysics and Atmospheric Physics

Description
Degree of recognition: National

Related external organisation
The Instrument Center for Danish Astrophysics
Ny Munkegade 120, 8000, Aarhus, Denmark
Activity: Membership › Membership of research networks or expert groups

The New Era of Multi-messenger Astrophysics
Period: 23 Nov 2017
Søren Brandt (Guest lecturer)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: Local

Related external organisation
Virum Gymnasium
Fuglsangvej 66, 2830, Virum, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Italian Space Agency (External organisation)
Period: 16 Nov 2017
Søren Brandt (Member)
Carl Budtz-Jørgensen (Member)
National Space Institute
Astrophysics and Atmospheric Physics

Description
Projects on future scientific space missions, ASI, Italian Space Agency. Peer review of project proposals
Degree of recognition: International

Related external organisation
Italian Space Agency
Italy
Activity: Membership › Membership in review committee

INTEGRAL 2017
Period: 15 Oct 2017 → 20 Oct 2017
Søren Brandt (Organizer)
National Space Institute
Astrophysics and Atmospheric Physics

Description
The goal of this Symposium is to present and discuss the main results obtained during last decade in the field of high-energy astrophysics, with an emphasis on Time Domain Astrophysics.
Degree of recognition: International

Related event
INTEGRAL 2017: Energetic Time Domain Astrophysics
15/10/2017 → 20/10/2017
Venice, Italy
Activity: Attending an event › Participating in or organising a conference

6th WFI Proto-­Consortium Meeting
Period: 10 Oct 2017 → 12 Oct 2017
Søren Brandt (Participant)
Irfan Kuvvetli (Participant)
Denis Tcherniak (Participant)
6th WFI Proto-Consortium Meeting Agenda

Related event

6th WFI Proto-Consortium Meeting
10/10/2017 → 12/10/2017
Warszaw, Poland
Activity: Attending an event › Participating in or organising a conference

THESEUS Workshop
Period: 5 Oct 2017 → 6 Oct 2017
Søren Brandt (Participant)

National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: International
Links:
http://www.isdc.unige.ch/theseus/workshop2017-venue.html (THESEUS Workshop)
http://www.isdc.unige.ch/theseus/ (THESEUS mission overview)

Related event

THESEUS Workshop
05/10/2017 → 06/10/2017
Napoli, Italy
Activity: Attending an event › Participating in or organising a conference

STROBE-X Science Definition Workshop
Period: 18 Sep 2017 → 20 Sep 2017
Søren Brandt (Participant)

National Space Institute
Astrophysics and Atmospheric Physics

Description
The STROBE-X Science Definition Workshop

Related event

STROBE-X Science Definition Workshop
18/09/2017 → 20/09/2017
Lubbock, Texas, United States
Activity: Attending an event › Participating in or organising a conference

STROBE-X Steering Committee (External organisation)
Period: 1 Jul 2017 → …
Søren Brandt (Member)

National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: International
Links:
https://gammaray.nsstc.nasa.gov/Strobe-X/Team.html (The STROBE-X Team)

Related external organisation
STROBE-X Steering Committee  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Global opvarmning for 56 millioner år siden – og i dag  
Period: 19 Jun 2017  
Jens Olaf Pedpe Pedersen (Speaker)  
National Space Institute  
Innovation and Research-based consultancy  
Degree of recognition: Regional  
Links:  
https://www.facebook.com/events/1688366071459512/?acontext=%7B%22ref%22%3A%22%22%2C%22ref_newsfeed_story_type%22%3A%22regular%22%2C%22action_history%22%3A%22null%22%7D

Related event

Møde i Selskabet for Naturlærens Udbredelse  
13/05/2002 → …  
København, Denmark  
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

SAR for Wind Energy  
Period: 16 Jun 2017  
Merete Badger (Lecturer)  
Charlotte Bay Hasager (Other)  
Ioanna Karagali (Other)  
Tobias Torben Ahsbahs (Guest lecturer)  
Xiaoli Guo Larsén (Other)  
Alfredo Peña (Other)  
Andrea N. Hahmann (Other)  
Patrick Volker (Other)  
Alessandro Di Bella (Other)  
Department of Wind Energy  
Meteorology & Remote Sensing  
Resource Assessment Modelling  
National Space Institute  
Geodynamics  
Links:  
http://www.vindenergi.dtu.dk/english/education/phd/phd-summer-school/charlotte-bay-hasager/phd-summer-school-2017

Related event

PhD Summer School: Remote Sensing for Wind Energy  
12/06/2017 → 16/06/2017  
Roskilde, Denmark  
Activity: Talks and presentations › Conference presentations

Review of proposal for Czech Science Foundation. (External organisation)  
Period: 15 Jun 2017 → 30 Sep 2017  
Søren Brandt (Member)  
National Space Institute  
Astrophysics and Atmospheric Physics  
Description  
Reviewer for Czech Science Foundation space related instrument proposals  
Degree of recognition: International
Related external organisation

Review of proposal for Czech Science Foundation.
Activity: Membership › Membership in review committee

Exploring the potential for improved satellite coverage in the High North
Period: 1 Jun 2017
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Innovation and Research-based consultancy
Degree of recognition: International

Related event

Arctic Patrol and Reconnaissance 2017
31/05/2017 → 01/06/2017
Copenhagen, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Ionospheric magnetic signals during conjunctions between ground based and Swarm satellite observations
Period: 27 Apr 2017
Diana Saturnino (Speaker)
National Space Institute
Geomagnetism

Description
High-precision magnetic measurements collected by satellites such as Swarm or CHAMP, flying at altitudes between 300 and 800km, allow for improved geomagnetic field modelling. An accurate description of the internal (core and crust) field must account for contributions from other sources, such as the ionosphere and magnetosphere. However, the description of the rapidly changing external field contributions, particularly during the quiet times from which the data are selected, constitutes a major challenge of the construction of such models. Our study attempts to obtain improved knowledge on ionospheric field contributions during quiet times conditions, in particular during night local times. We use two different datasets: ground magnetic observatories time series (obtained below the ionospheric E-layer currents), and Swarm satellites measurements acquired above these currents. First, we remove from the data estimates of the core, lithospheric and large-scale magnetospheric magnetic contributions as given by the CHAOS-6 model, to obtain corrected time series. Then, we focus on the differences of the corrected time series: for a pair of ground magnetic observatories, we determine the time series of the difference, and similarly we determine time series differences at satellite altitude, given by the difference between the Swarm Alpha and Charlie satellites taken in the vicinity of the ground observatory locations. The obtained differences time series are analysed regarding their temporal and spatial scales variations, with emphasis on measurements during night local times.
Degree of recognition: International
Links:

Related event

EGU General Assembly 2017: European GEosciences Union 2017
24/04/2017 → 28/04/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations

VO-ESD: a virtual observatory approach to describe the geomagnetic field temporal variations with application to Swarm data
Period: 27 Apr 2017
Diana Saturnino (Speaker)
National Space Institute
Geomagnetism
Description
A complete description of the main geomagnetic field temporal variation is crucial to understand dynamics in the core. This variation, termed secular variation (SV), is known with high accuracy at ground magnetic observatory locations. However, the description of its spatial variability is hampered by the globally uneven distribution of the observatories. For the past two decades, a global coverage of the field changes has been allowed by satellites. Their surveys of the geomagnetic field have been used to derive and improve global spherical harmonic (SH) models through some strict data selection schemes to minimise external field contributions. But discrepancies remain between ground measurements and field predictions by these models. Indeed, the global models do not reproduce small spatial scales of the field temporal variations. To overcome this problem, we propose a modified Virtual Observatory (VO) approach by defining a globally homogeneous mesh of VOIs at satellite altitude. With this approach, we directly extract time series of the field and its temporal variation from satellite measurements as it is done at observatory locations. As satellite measurements are acquired at different altitudes, a correction for the altitude is needed. Therefore, we apply an Equivalent Source Dipole (ESD) technique for each VO and each given time interval to reduce all measurements to a unique location, leading to time series similar to those available at ground magnetic observatories. Synthetic data is first used to validate the new VO-ESD approach. Then, we apply our scheme to measurements from the Swarm mission. For the first time, a 2.5 degrees resolution global mesh of VO time series is built. The VO-ESD derived time series are locally compared to ground observations as well as to satellite-based model predictions. The approach is able to describe detailed temporal variations of the field at local scales. The VO-ESD time series are also used to derive global SH models. Without regularization, these models describe well the secular trend of the magnetic field. The derivation of longer VO-ESD time series, as more data will be made available, will allow the study of field temporal variations features such as geomagnetic jerks.

Degree of recognition: International
Links:

Related event
EGU General Assembly 2017: European GEosciences Union 2017
24/04/2017 → 28/04/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Gravitationsbølger
Period: 3 Apr 2017
Søren Brandt (Speaker)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: Regional

Related external organisation
Folkeuniversitetet i Aarhus
Ny Munkegade 118, 8000, Aarhus, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Kick off Coast to Coast Climate Challenge
Period: 30 Mar 2017
Carlo Sass Sørensen (Participant)
National Space Institute
Geodesy

Description
Contribution to event, e.g. in the preparation of exhibition stand about subprojects C9, C17, and C21 of c2c cc.
Degree of recognition: Regional
Documents:
17117.118 LemvigKommune_roll-up_ren_screen
c2c-300317-1
Links:
http://www.c2ccc.eu

Related event
Kick off Coast to Coast Climate Challenge
30/03/2017 → 30/03/2017
Herning, Denmark
Activity: Attending an event › Participating in or organising a conference

Ruminfrastruktur - Arktis
Period: 23 Mar 2017
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Innovation and Research-based consultancy
Description

Rumindustrien bliver præsenteret bredt og forretningsmulighederne synliggjort. Det gælder både for up-stream og down-stream forretning og ikke mindst de mange afledte muligheder, som datastrømme giver for produkt- og serviceudvikling på stadig flere teknisk- og samfundsmodne områder.
Degree of recognition: National
Links:
http://censec.dk/Files/Billeder/CenSec/rumindustri/Pepke-Pedersen-Arktis.ppt

Related event
Forretningsmuligheder i rumindustrien
23/03/2017 → …
Copenhagen, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

eXTP mission design coordination meeting
Period: 21 Mar 2017 → 23 Mar 2017
Søren Brandt (Speaker)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: International

Related event
eXTP mission design coordination meeting
21/03/2017 → 23/03/2017
Beijing, China
Activity: Talks and presentations › Conference presentations

A space infrastructure for the Arctic
Period: 20 Mar 2017
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Innovation and Research-based consultancy
Description
Ships and other methods for surveillance of the Arctic regions.
Degree of recognition: National

Related event
Skibsteknisk Selskab: Ships and other methods for surveillance of the Arctic regions
20/03/2017 → 20/03/2017
Copenhagen, Denmark
**Mod det uendelige Univers / Kosmisk stråling**  
Period: 15 Mar 2017  
Jens Olaf Pepke Pedersen (Speaker)  
National Space Institute  
Innovation and Research-based consultancy  

**Description**  
Foredrag på Folkeuniversitetet  
Degree of recognition: Regional  
Documents:  
Kosmiske stråler FU 2017  

**Related event**  
**Mod det uendelige Univers: Kosmist Stråling**  
15/03/2017 → 15/03/2017  
Copenhagen, Denmark  
Activity: Talks and presentations › Conference presentations  

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**Gravitationsbølger**  
Period: 13 Mar 2017  
Søren Brandt (Speaker)  
National Space Institute  
Astrophysics and Atmospheric Physics  
Degree of recognition: Regional  

**Related external organisation**  
Folkeuniversitetet i København  
Læderstræde 34, 2, 1201 , København, Denmark  
Activity: Talks and presentations › Conference presentations  

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**Climate Adaptations**  
Period: 9 Mar 2017  
Carlo Sass Sørensen (Speaker)  
National Space Institute  
Geodesy  

**Description**  
Invited speaker  
Degree of recognition: National  
Documents:  
6_climate_adaptation_carlo_sass  
Links:  
http://workshop.copernicus.eu/denmark-infosession (Workshop homepage)  
https://www.youtube.com/watch?v=VumSug7Yrws&feature=youtu.be (Talk)  

**Related event**  
**Copernicus Training and Information Session in Denmark, Aarhus, 9 Mar 2017**  
09/03/2017 → 09/03/2017  
Activity: Talks and presentations › Conference presentations
Climate proofing our cities
Period: 7 Mar 2017
Carlo Sass Sørensen (Speaker)
National Space Institute
Geodesy
Degree of recognition: Local
Links:
http://holstebrofolkeuniversitet.dk/

Related external organisation
Holstebro, Danmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Geopolitik i Arktis – konflikt eller samarbejde?
Period: 1 Mar 2017 → 8 Mar 2017
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Innovation and Research-based consultancy
Description
Forelæsningsrække i Folkeuniversitetet Emdrup
Degree of recognition: Regional
Links:

Related external organisation
Folkeuniversitetet i Emdrup
Aarhus Universitet, Campus Emdrup, Tuborgvej 164, 2400, København NV, Denmark
Activity: Talks and presentations › Conference presentations

High-throughput X-ray Astronomy in the eXTP era
Period: 6 Feb 2017 → 8 Feb 2017
Søren Brandt (Organizer)
National Space Institute
Astrophysics and Atmospheric Physics
Description
Member of the Scientific Organizing Committee
First Science Meeting dedicated to the high-throughput X-ray Astronomy and the eXTP mission.
Degree of recognition: International

Related event
High-throughput X-ray Astronomy in the eXTP era
06/02/2017 → 08/02/2017
Rome, Italy
Activity: Attending an event › Participating in or organising a conference

5th Athena/WFI Proto-Consortium Meeting
Period: 25 Jan 2017 → 26 Jan 2017
Søren Brandt (Participant)
Irfan Kuvvetli (Participant)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: **International**

**Documents:**

5th WFI Proto-Consortium Meeting Agenda

**Links:**

http://cerere.astropa.unipa.it/5WFIConsortiumMeeting/5WFIConsortiumMeeting.html (5th Athena/WFI Proto-Consortium Meeting)

**Related event**

**5th Athena/WFI Proto-Consortium Meeting**

25/01/2017 → 26/01/2017

Palermo, Italy

Activity: Attending an event › Participating in or organising a conference

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**Kampen om Arktis: Foredrag sammen med Kate Pepke Pedersen**

Period: 18 Jan 2017

Jens Olaf Pepke Pedersen (Lecturer)

National Space Institute

Innovation and Research-based consultancy

**Description**

Arktis er kommet i fokus både internationalt og i Danmark. Vi vil se nærmere på de klimaændringer, der er sket og hvilke ressourcer, der er i Arktis. Derudover vil vi se på de centrale aktører og hvad kampen om Arktis drejer sig om. Hvordan er mulighederne for konflikt eller samarbejde og hvad er Danmarks rolle heri?

Foredrag i Selskabet for Arktisk Forskning og Teknologi

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**Contribution to Trap Danmark**

Period: 2016 → 2017

Carlo Sass Sørensen (Lecturer)

National Space Institute

Geodesy

**Description**

Written contribution to Trap Danmark on coasts as expert in the subject in volumes 3, 4, 5 & 6.

Degree of recognition: **National**

**Links:**

https://trap.dk/ (Homepage for 6th edition of Trap Danmark)

**Related external organisation**

Trap Danmark

Agern Allé 13, 2970, Hørsholm, Denmark

Activity: Other

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**Tro og Videnskab: Sogneaften i Christianskirken, Lyngby**

Period: 2 Dec 2016

Jens Olaf Pepke Pedersen (Lecturer)

National Space Institute

Innovation and Research-based consultancy

**Related external organisation**

Unknown external organisation
**DTU Sustain Conference**

**Period:** 30 Nov 2016

Jens Olaf Pepke Pedersen (Organizer)

National Space Institute

Innovation and Research-based consultancy

**Description**

Member og organizing committee, DTU Sustain Conference 2016

**Related event**

DTU Sustain Conference
30/11/2016 → 30/11/2016
Lyngby, Denmark

Activity: Attending an event › Participating in or organising a conference


**Period:** 17 Nov 2016

Jens Olaf Pepke Pedersen (Lecturer)

National Space Institute

Innovation and Research-based consultancy

**Description**

Forsvarsministeren og Forsvarsministeriet vil præsentere analysen under høringen, hvor Forsvarsudvalget også har inviteret en række fagkyndige oplægsholdere, som vil bidrage med spændende indlæg til en efterfølgende paneldebat. Høringen modereres af ordstyrer Martin Breum.

Satellitter og droner i Arktis – perspektiverne ved opgaveløsning i Arktis, v/ Jens Olaf Pepke Pedersen, Ph. D. og seniorforsker ved DTU Space

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

**Universet - et hav af fortid**

**Period:** 17 Nov 2016

Carol Anne Oxborrow (Invited speaker)

National Space Institute

Astrophysics and Atmospheric Physics

**Description**

Foredrag for skoleelever i forbindelse med den nationale matematiske temadag om Universet

A lecture for school children from ages 6 to 15 about the universe and Ole Rømer's discovery of the finite speed of light and how it affects everything we see in the universe

**Related event**

Matematiske temadag på Endrupskolen om universet
17/11/2016 → 17/11/2016
Fredensborg, Denmark

Activity: Talks and presentations › Conference presentations
Satellitovervågning i Arktis: Søværnets Officersskole

Period: 16 Nov 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Innovation and Research-based consultancy

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Gravitationsbølger

Period: 15 Nov 2016
Søren Brandt (Lecturer)
National Space Institute
Astrophysics and Atmospheric Physics

Description

Related event
Gravitationsbølger
15/11/2016 → 15/11/2016
Helsingør, Denmark
Activity: Talks and presentations › Conference presentations

Workshop on Soft γ-ray Astronomical Telescopes

Period: 7 Nov 2016 → 8 Nov 2016
Søren Brandt (Participant)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: International
Links:

Related event
Workshop on Soft γ-ray Astronomical Telescopes
07/11/2016 → 08/11/2016
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Deformation monitoring in Denmark – Danish initiatives

Period: 2 Nov 2016
Joanna Fredenslund Levinsen (Speaker)
Carlo Sass Sørensen (Other)
National Space Institute
Geodesy

Description
This European User Workshop will address discussions about cross-border cooperation in Europe to establish a Supra-National Ground Motion Service
within the Copernicus Program. DK contribution.

Degree of recognition: International
Documents:
SNGMS_021116_jfl_

Related external organisation
Federal Institute for Geosciences and Natural Resources (BGR)
Germany
Activity: Talks and presentations › Conference presentations

Er vi alene?: Jagten på liv i rummet
Period: 27 Oct 2016
Jens Olaf Pøpke Pedersen (Lecturer)
National Space Institute
Innovation and Research-based consultancy
Description
Foredrag i Have Marks Foredragsforening, Dalmose

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Wide Field Monitor
Søren Brandt (Speaker)
Margarita Hernanz (Other)
National Space Institute
Astrophysics and Atmospheric Physics
Description
An overview of the Wide Field Monitor proposed for the eXTP mission
Degree of recognition: International

Related event
eXTP Coordination Meeting
24/10/2016 → 26/10/2016
Beijing, China
Activity: Talks and presentations › Conference presentations

eXTP Coordination Meeting
Søren Brandt (Participant)
National Space Institute
Astrophysics and Atmospheric Physics
Description
eXTP Consortium meeting at the Institute for High Energy Physics (IHEP), Chinese Academy of Sciences (CAS), Beijing
Degree of recognition: International

Related event
**eXTP Coordination Meeting**
24/10/2016 → 26/10/2016
Beijing, China
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**11th INTEGRAL Conference**
Søren Brandt (Organizer)
National Space Institute
Astrophysics and Atmospheric Physics
Degree of recognition: International
Links:

**Related event**

**11th INTEGRAL Conference: Gamma-Ray Astrophysics in Multi-Wavelength Perspective**
10/10/2016 → 14/10/2016
Amsterdam, Netherlands
Activity: Attending an event › Participating in or organising a conference

**44th ISCWSA meeting**
Period: 22 Sep 2016
Livia Kathleen Kother (Participant)
National Space Institute
Geomagnetism

**Description**
Poster presentation
directional drilling conference

**Related event**

**44th ISCWSA meeting: Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA)**
22/09/2016 → 22/09/2016
Glasgow
Activity: Attending an event › Participating in or organising a conference

**Physics of Climate**
Period: 12 Sep 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Innovation and Research-based consultancy

**Related event**

**Nanophotonics Section Workshop**
12/09/2016 → …
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

**Tyngdebølger**
Period: 12 Sep 2016
Søren Brandt (Lecturer)
National Space Institute
Hvad styrer klimaet?: Er det mennesket eller naturen, der har størst indflydelse på klimaet? Det kan man finde ud af ved at studere fortidens klima, fra før mennesket blev til.

Period: 7 Sep 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Innovation and Research-based consultancy

Description
Jens Olaf Pepke Pedersen undersøger betydningen af naturlige klimavariable ved at modellere overgangen mellem forskellige geologiske perioder, fordi det er her, man finder de største skift i klimaet.

Flere af disse skift kan forklares ved massive vulkanudbrud der udspyer store askeskyer og gasser, som danner skyer og skygger for solen over lange perioder, hvilket forårsager masseuddøden af livsformer. Den største katastrofe var overgangen mellem perm og trias for 250 mio. år siden, hvor 95% af alle livsformer forsvandt.

En af de mindre dramatiske overgange skete for 55 mio. år siden mellem paleocæn og eocæn, som man fx. kan se i moleret på Fur. Den adskiller sig ved at man finder en kraftig, men kortvarig, opvarmning, som minder om vor tids klimaændringer.

Jens Olaf, som også har bidraget med modelberegninger til den seneste IPCC rapport, vil i sit foredrag redegøre for, hvordan hans modelforsøg bidrager til at redegøre for Jordens klimahistorie og øger vores forståelse af de naturlige klimavariables betydning i vores dage.

Arrangeret af Miljøteknisk Gruppe, IDA Nord, Aalborg
Links:
https://universe.ida.dk/arrangement/hvad-styrer-klimaet-317699/

Related event
Hvad styrer klimaet?
07/09/2016 → …
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

Gravitational Waves
Period: 22 Aug 2016
Søren Brandt (Lecturer)
National Space Institute
Astrophysics and Atmospheric Physics

Description
After-dinner talk presented at workshop of SPOC, DTU at Sørup Herregård, Ringsted, Denmark

Related external organisation
INNOVATIVE SEA SURFACE MONITORING WITH GNSS-REFLECTOMETRY ABOARD ISS: OVERVIEW AND RECENT RESULTS FROM GEROS-ISS

Period: 10 Jul 2016 → 15 Jul 2016
Per Høeg (Lecturer)
National Space Institute
Geodesy

Description
Paper #3271, titled 'INNOVATIVE SEA SURFACE MONITORING WITH GNSS-REFLECTOMETRY ABOARD ISS: OVERVIEW AND RECENT RESULTS FROM GEROS-ISS', has been ACCEPTED for inclusion as a oral presentation in the IGARSS 2016 program.

Peer-reviewed paper
Documents:
IGARSS2016_ShortPaper

Related event
IGARSS 2016
10/07/2016 → 15/07/2016
Activity: Talks and presentations › Conference presentations

Er Kristendom og naturvidenskab modsætninger?: Faglig forkælelse med Weekendavisen

Period: 27 Jun 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Kursus på Krogerup Højskole
Links:
https://krogerup.dk/faglig-forkaelse-med-weekendavisen/

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

UTILISING SPACE ASSETS FOR RECONNAISSANCE AND INFORMATION TRANSFER IN ORDER TO BUILD GREATER DOMAIN AWARENESS IN THE HIGH NORTH

Period: 8 Jun 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Description
DTU's research in polar satellite capability Using satellites as integrators to collate and transfer information from other platforms and assets What are the benefits of nano-satellites when used for Arctic patrol functions? How can satellite assets deliver tangible benefits in Arctic operations such as search & rescue, and maritime management?
Documents:
Arctic Patrol 2016

Related event
Arctic Patrol and Reconnaissance 2016
07/06/2016 → 08/06/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations
Tyngdebølger og den nyeste viden om emnet  
Period: 20 May 2016  
Søren Brandt (Lecturer)  
National Space Institute  
Astrophysics and Atmospheric Physics  

Description  
DTU Bibliotek, Temadag nr. 2: "Vi kigger ud i verdensrummet"  
DTU Bibliotek, Temadag nr. 2: "Vi kigger ud i verdensrummet"  
Degree of recognition: Local  
Links:  
https://www.youtube.com/watch?v=tgEtExUmpbg  

Related external organisation  
DTU Bibliotek  
Activity: Talks and presentations › Conference presentations  

EU COST Action CA15211 (Atmospheric Electricity Network: coupling with the Earth System, climate and biological systems) (External organisation)  
Period: 15 May 2016 → …  
Jens Olaf Pæpe Pedersen (Participant)  
National Space Institute  
Sunclimate  

Description  
Danish representative, Management Committee  
Degree of recognition: International  

Related external organisation  
EU COST Action CA15211 (Atmospheric Electricity Network: coupling with the Earth System, climate and biological systems)  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar  

Jordens Store Kredsløb  
Period: 10 May 2016 → 7 Jun 2016  
Jens Olaf Pæpe Pedersen (Lecturer)  
National Space Institute  

Description  
Forelæsningsrække på Folkeuniversitetet i Emdrup (5 gange)  

Related event  
Folkeuniversitetet i Emdrup: Jordens Store Kredsløb  
10/05/2016 → 07/06/2016  
Emdrup, Denmark  
Activity: Talks and presentations › Conference presentations  

Selskabet for Naturlærens Udbredelsen (SNU) (External organisation)  
Period: 18 Apr 2016 → …  
Jens Olaf Pæpe Pedersen (Participant)  
National Space Institute  

Description
Formidling af naturvidenskab

Member of board
Links:
http://www.naturvidenskab.net/

Related external organisation

Selskabet for Naturlærens Udbredelsen (SNU)
Activity: Membership » Board duties in companies, associations, or public organisations

Gravitationsbølger: Einstein vinder endnu en runde efter 100 år
Period: 12 Apr 2016
Søren Brandt (Lecturer)
National Space Institute
Astrophysics and Atmospheric Physics

Description
Foredrag i Ingeniørforeningen, IDA, Kalvebod Brygge, 1780, København V
Foredrag i Ingeniørforeningen, IDA
Links:
(Gravitationsbølger)

Related external organisation

Unknown external organisation
Activity: Talks and presentations » Conference presentations

Hvad sker der i Arktis?: Udforskning, klimaændringer og grænsedragning i Arktis
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Suncclimate

Description
2 lectures (29/2 and 3/3)

Related event

Senioruniversitetet i Værløse
29/02/2016 → 03/03/2016
Vejrø, Denmark
Activity: Talks and presentations » Conference presentations

Universets gåder: Kosmisk Stråling
Period: 27 Jan 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Suncclimate

Related event

Folkeuniversitetet Emdrup: Universets gåder
27/01/2016 → 24/02/2016
København, Denmark
Activity: Talks and presentations » Conference presentations
**Er vi alene?**
Period: 26 Jan 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

**Description**
Foredrag i Fensmark, Rislev, Toksværd og Holme Olstrup sogn

**Related event**
Foredragssaften
26/01/2016 → 26/01/2016
Fensmark, Denmark
Activity: Talks and presentations › Conference presentations

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**Satellite Derived Dynamic Ocean Currents in the Arctic**
Period: 25 Jan 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

**Related event**
The Arctic area – new possibilities and new challenges: Skibsteknisk Selskab & IDA Maritim
25/01/2016 → 25/01/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

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**Drones & Space**
Period: 20 Jan 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate
Documents:
DTUSpace_DronesAndSpace Pepke Pedersen

**Related event**
Drones & Space Conference 2016: International Innovation on UAS Capabilities
20/01/2016 → 20/01/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

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**Satellitmålinger af havstrømme i Det nordlige Atlanterhav og deres anvendelser**
Period: 18 Jan 2016
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

**Related event**
Polar DTU Årsmøde
18/01/2016 → 18/01/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations
**DTU Sustain Conference 2015**  
Period: 17 Dec 2015  
Jens Olaf Pepke Pedersen (Organizer)  
National Space Institute  
Sunclimate

**Description**  
Member of organizing committee

**Related event**

**DTU Sustain Conference 2015**  
17/12/2015 → 17/12/2015  
Lyngby, Denmark  
Activity: Attending an event › Participating in or organising a conference

**Modelling the Antarctic Ice Sheet**  
Period: 17 Dec 2015  
Jens Olaf Pepke Pedersen (Lecturer)  
National Space Institute  
Sunclimate

**Documents:**  
DTU Sustain konference

**Related event**

**DTU Sustain Conference 2015**  
17/12/2015 → 17/12/2015  
Lyngby, Denmark  
Activity: Talks and presentations › Conference presentations

**En rejse i rummet - Afstande i Universet: Distance dans l'Univers - Vie et mort des étoiles**  
Period: 14 Dec 2015  
Jérôme Chenevez (Invited speaker)  
National Space Institute  
Astrophysics

**Description**  
Formidlingsbesøg ved det franske Gymnaium (Lycée Prince Henry).  
Foredrag til 3. og 2. G elever

**Related external organisation**

**Unknown external organisation**  
Activity: Talks and presentations › Conference presentations

**Røntgenastronomi, Neutronstjærner og Sorte huller**  
Period: 12 Dec 2015  
Jérôme Chenevez (Invited speaker)  
National Space Institute  
Astrophysics

**Description**  
Foredrag på Brorfeide Observatorium

Foredragsholder
ISSI-team meeting
Period: 7 Dec 2015 → 11 Dec 2015
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics

Description
Member of ISSI international team

Participation to ISSI-team meeting on "Nuclear Reactions in Superdense Matte - From the Laboratory to the Stars" at the International Space Science Institute, Bern, Switzerland

Related event
ISSI-team meeting: Nuclear Reactions in Superdense Matter - From the Laboratory to the Stars
07/12/2015 → 11/12/2015
Bern, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Arktis i Forandring: Forelæsningsrække over 3 aftener
Period: 30 Nov 2015 → 14 Dec 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Udforskningen af Arktis i fortid og nutid
Klimaændringer i Arktis
Udvikling og grænsedragning i Arktis

Related event
Folkeuniversitetet Emdrup: Arktis – klimaændringer, udvikling og grænsedragning
30/11/2015 → 14/12/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Presentation of the µASC Star Tracker: during Andreas Mogensens visit to DTU
Period: 27 Nov 2015
Mathias Benn (Invited speaker)
National Space Institute
Measurement and Instrumentation Systems

Links:
http://www.dtu.dk/Service/Kalender/2015/11/Andreas-Mogensen-besoeger-DTU?id=94a1b9af-8541-46b3-a08b-79807c38e19e (Andreas Mogensen Visits DTU)
Røntgenobservationer af en pulsar: SRP opgave
Period: 17 Nov 2015
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Undervisning til 10 Studieretningsprojekter
Documents:
Røntgenobservation af en pulsar_2015
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Security and Governance in the Globalised Arctic
Period: 13 Nov 2015
Jens Olaf Pepke Pedersen (Organizer)
National Space Institute
Center for Polar Activities

Description
Organizer and speaker: Workshop on New Technologies for the Arctic
Workshop on New Technologies for the Arctic
Links:
http://matchpoints.au.dk/

Related event
Security and Governance in the Globalised Arctic: Nordic and International Perspectives
12/11/2015 → 13/11/2015
Aarhus, Denmark
Activity: Attending an event › Participating in or organising a conference

Synergies in military and civilian use of satellites for communication, navigation and surveillance
Period: 13 Nov 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Suncclimate
Links:
http://matchpoints.au.dk/fileadmin/matchpoints/Powepoint_from_Jens_Olaf_Pepke.pdf

Related event
Security and Governance in the Globalised Arctic: Nordic and International Perspectives
12/11/2015 → 13/11/2015
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

Hvorfor ændrer klimaet sig?
Period: 10 Nov 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related event

Intoduktion til nye medarbejdere
10/11/2015 → ...
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Center for Polar Activities, DTU
Period: 3 Nov 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Description
Folkeuniversitetskursus
Links:
http://pepke.dk/FUHerning.pdf

Related event

NTNU visit to DTU
02/11/2015 → 03/11/2015
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

LOFT-WFM concept and design considerations
Period: 27 Oct 2015
Søren Brandt (Speaker)
National Space Institute
Astrophysics and Atmospheric Physics

Description
Overview of the Wide Field Monitor proposed for the LOFT mission and its application for the eXTP mission
Degree of recognition: International

Related event

eXTP Workshop 2015
26/10/2015 → 27/10/2015
Beijing, China
Activity: Talks and presentations › Conference presentations

eXTP Workshop 2015
Søren Brandt (Participant)
National Space Institute
Astrophysics and Atmospheric Physics

Description
eXTP Science Workshop
Degree of recognition: International

Related event
Beijing, China
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Universets Gåder: Kosmiske Stråler**
Period: 26 Oct 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

**Related event**

**Folkeuniversitetet: Universets gåder**
26/10/2015 → 26/10/2015
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

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**Juno Earth Flyby: presented during 'Kulturnatten' at the Ministry of Science, Innovation and Higher Education**
Period: 9 Oct 2015
Mathias Benn (Invited speaker)
National Space Institute
Measurement and Instrumentation Systems

Links:

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**NICER (Neutron star Interior Composition ExploreR)**
Period: 9 Oct 2015
Jérôme Chenevez (Invited speaker)
National Space Institute
Astrophysics

**Description**
Talk on the NICER mission

On behalf of Z. Arzoumanian

Links:

**Related event**

**INTEGRAL 2015**
05/10/2015 → 09/10/2015
Rome, Italy
Activity: Talks and presentations › Conference presentations

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**The "Clocked Burster" acting out of character**
Period: 7 Oct 2015
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics
Description
Talk given at INTEGRAL Italian workshop, Rome, 2015
Links:
(Talk slides)

Related event

INTEGRAL 2015
05/10/2015 → 09/10/2015
Rome, Italy
Activity: Talks and presentations › Conference presentations

INTEGRAL 2015
Søren Brandt (Organizer)
National Space Institute
Astrophysics and Atmospheric Physics

Description
Participant and member of Science Organizing Committee

INTEGRAL 2015
The New High Energy Sky after a Decade of Discoveries
Links:

Related event

INTEGRAL 2015
05/10/2015 → 09/10/2015
Rome, Italy
Activity: Attending an event › Participating in or organising a conference

Maritime Route Optimization
Period: 5 Oct 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Description
From: Presentation of the Arctic Maritime Platform
Documents:
Blue SIROS Arctic Maritime Platform

Related event

Maritime Days 2015
05/10/2015 → 09/10/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

En rejse i rummet: Afstande i universet og døde stjerner
Period: 23 Sep 2015 → 2 Dec 2015
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
6 foredrag i forbindelse med DTU Explore til gymnasieklasser på besøg på DTU Space
Foredragholder

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Naturvidenskab og kristendom
Period: 23 Sep 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Description
Foredrag i Lundtofte Sogn

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Introduction to Blue SIROS
Period: 15 Sep 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event

Fra Blå Drømme til Blå Virksomhed: Ruteoptimering - 7. møde i netværksgruppen
15/09/2015 → …
Hvidovre, Denmark
Activity: Talks and presentations › Conference presentations

Workshop om space infrastruktur i Arktis
Period: 8 Sep 2015
Jens Olaf Pepke Pedersen (Organizer)
National Space Institute
Center for Polar Activities

Description
Multiuse of satellites and drones in the Arctic (for Industry)
Workshop on Space Infrastructure in the Arctic

Related event

Workshop om space infrastruktur i Arktis
08/09/2015 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Workshop om space infrastruktur i Arktis
Period: 2 Sep 2015
Jens Olaf Pepke Pedersen (Organizer)
National Space Institute
Center for Polar Activities

Description
Workshop on multiuse of satellites and drones in the Arctic (for researchers)
Workshop on Space infrastructure in the Arctic
Related event

Workshop om space infrastruktur i Arktis: Multiuse
02/09/2015 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Métodos de análisis intervalar y funcional de modelado matemático multi-dimensional para cartografía y bathimetría
Francesc/François Antón Castro (Invited speaker)
National Space Institute
Geodesy

Description
Invited conference (English title: Multi-dimensional mathematical modeling functional and interval analysis methods for cartography and bathymetry.

Related event

Semana Geomática Internacional
10/08/2015 → 14/08/2015
Bogotá, Colombia
Activity: Talks and presentations › Conference presentations

Application review (External organisation)
Jérôme Chenevez (Member)
Astrophysics
National Space Institute

Description
Review of three funding applications to the Swedish National Space Board

External reviewer

Body type: Public Sector Consultancy
Degree of recognition: International

Related external organisation

Application review
Activity: Membership › Membership in review committee

EWASS 2015
Period: 22 Jun 2015 → 26 Jun 2015
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics

Description
Presentation of a poster

Poster: "The Clocked Burster GS 1826-24 acting out of character"
Documents:
poster EWASS2015

Related event

EWASS 2015
22/06/2015 → 26/06/2015
Tenerife, Spain
Activity: Attending an event › Participating in or organising a conference

Censortaktivitet på KU
Period: 19 Jun 2015
Jérôme Chenevez (External examiner)
Astrophysics
National Space Institute
Description
Censor for to bachelorprojekter ved henholdsvis Johan Fynbo og Sune Toft
Activity: Examinations and supervision › External examination

NewCOMPSTAR (External organisation)
Period: 17 Jun 2015
Jérôme Chenevez (Participant)
Astrophysics
National Space Institute
Description
Participation at the annual NewCompStar COST Steering Committee meeting in Budapest
Representative suppleant
Body type: COST
Degree of recognition: International
Links:
https://compstar.uni-frankfurt.de/ (Network website)
Related external organisation
NewCOMPSTAR
Activity: Membership › Membership of research networks or expert groups

Rigsfællesskabet som en Arktisk nation
Period: 11 Jun 2015
Jens Olaf Pepke Pedersen (Invited speaker)
National Space Institute
Sunclimate
Description
Paneldebatt med Martin Breum (journalit), Johannes Riber Nordby (Forsvarsakademiet) og Jens Olaf Pepke Pedersen (DTU Space)
Links:
https://www.youtube.com/watch?v=Osj0fHMoxBs
Related event
Folkemøde
11/06/2015 → 14/06/2015
Allinge, Denmark
Activity: Talks and presentations › Conference presentations

En rejse i Rummet: Rumforskning på DTU Space
Period: 9 Jun 2015
Jérôme Chenevez (Speaker)
A future Arctic space infrastructure, including unmanned systems: A Kingdom of Denmark perspective
Period: 28 May 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event
Arctic Patrol and Reconnaissance
26/05/2015 → 28/05/2015
Oslo, Norway
Activity: Talks and presentations › Conference presentations

Annual Danish Astronomy Meeting 2015
Period: 13 May 2015
Jérôme Chenevez (Speaker)
National Space Institute

Description
Talk: The "Clocked Burster" acting out of character
Documents:
Chenevez_DNAM-2015
Links:
http://ida.au.dk/currently/annual-danish-national-astronomy-meeting-2015/ (Conference website)

Related event
Annual Danish Astronomy Meeting 2015
12/05/2015 → 13/05/2015
Helsingør, Denmark
Activity: Talks and presentations › Conference presentations

Marine Route Optimization
Period: 6 May 2015
Jens Olaf Pepke Pedersen (Lecturer)
Satellitkommunikation til hjælp med at agere i Arktis
Period: 4 May 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Foredrag for VL gruppe 26, Skandinavisk Data Center A/S, Ballerup

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

"Mass Change of the Greenland Ice Sheet, Sea Level Rise and Climate Change"
Period: 24 Apr 2015
Carlo Sass Sørensen (Lecturer)
National Space Institute
Geodesy

Description
Oral presentation in workshop for high school students facilitated by DTU Space.
Documents:
Thyborøn_April_2015

Related event

Spacecentret Thyborøn: Space research and technology -Space Day
23/04/2015 → 25/04/2015
Thyborøn, Denmark
Activity: Talks and presentations › Conference presentations
En rejse i Rummet - Afstande i universet: Forskningsdøgn
Period: 23 Apr 2015
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics
Description
2 foredrag til Forskningsdøgn på DTU

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Spacecentret Thyborøn
Period: 23 Apr 2015 → 25 Apr 2015
Carlo Sass Sørensen (Organizer)
National Space Institute
Geodesy
Description
Event development, funding, organisation/planning, marketing, execution of and participation in 3 day event under "Research Days" (Forskningens Døgn) 2015
A 3 day Danish "Research Days" event with oral presentations and workshops for high school students and the public. Co-organized by DTU Space, Danish Coastal Authority, kystcentret.dk, and Lemvig Municipality
Documents:
Press-massmedia
De_Bergske_240415
De_Bergske_250415
ForskningStorAnnonce
Miljøministeriet -Pressemeldelse 24042015
Moderne rumteknologi kan hjælpe os mod fremtidens oversvømmelser - DR P4 Midt & Vest - 12.30 - Nyhedsclip 24.04
Satellitter skal redder din kælder fra oversvømmelse _ Midt og Vest _ DR
SPACECENTRET THYBORØN - Rummet, rumforskning og rumteknologi — Forskningens Døgn
Links:
http://www.space.dtu.dk/english/News/2015/05/Thyboroen-gets-its-own-Space-Centre-for-Research-Days?id=1e225cd4-bd54-4c7e-9f35-5789ae6b1d8a (Thyborøn gets its own Space Centre for Research Days (DTU Space, News, 11 May 2015))
http://www.space.dtu.dk/Nyheder/2015/05/Kystcentret-i-thyboroen-blevet-til-Spacecentret?id=215016f7-75bd-40a7-88c2-254af844c74
Related event
Spacecentret Thyborøn: Space research and technology -Space Day
23/04/2015 → 25/04/2015
Thyborøn, Denmark
Activity: Attending an event › Participating in or organising a conference

Multiuse of satellites and drones in the Arctic
Period: 22 Apr 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate
Description
Presentation of multiuse report
US Office of Naval Research: Workshop at DTU
22/04/2015 → …
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

US Office of Naval Research
Period: 22 Apr 2015
Jens Olaf Pepke Pedersen (Organizer)
National Space Institute
Sunclimate

*Forvaltningen af Danmarks kyster*
Period: 21 Apr 2015
Carlo Sass Sørensen (Invited speaker)
National Space Institute
Geodesy

Description
Oral presentation and panel discussion

Konference om kritiske klimapåvirkninger, tilpasning og sårbarhed i Danmark: Centre For Regional Change in the Earth System
20/04/2012 → 21/04/2015
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Censoraktivitet
Period: 10 Apr 2015
Jérôme Chenevez (External examiner)
Astrophysics
National Space Institute

Description
Censor for de mundtlige eksamener til kurset om "Jorden og de Terrestriske Planeter" ved Klaus Mosegaard (KU).
Activity: Examinations and supervision › External examination

Naturvidenskab og kristendom
Period: 11 Mar 2015
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Nørre Lyndelse Kirke
Documents:
Pages from kirkeblad_december
Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Science for the Environment Conference, Aarhus, Denmark, 1-2 October 2015 (External organisation)
Period: 1 Feb 2015 → 3 Oct 2015
Jens Olaf Pepke Pedersen (Participant)
National Space Institute
Sunclimate

Description
Member of scientific committee

Related external organisation

Science for the Environment Conference, Aarhus, Denmark, 1-2 October 2015
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Spanish National Congress of Geographic Information Technologies (External organisation)
Period: 2014 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy

Description
TIG 2014 - Congreso Nacional de Tecnologías de la Información Geográfica.

Body type: International Program Committee

Related external organisation

Spanish National Congress of Geographic Information Technologies
Activity: Membership › Membership in review committee

XVIth IAGA Workshop on Geomagnetic Observatory Instruments Data Acquisition and Processing
Period: 2014
Lars William Pedersen (Participant)
National Space Institute
Geomagnetism

Related event

XVIth IAGA Workshop on Geomagnetic Observatory Instruments Data Acquisition and Processing
07/10/2014 → 16/10/2014
Hyderabad, India
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Swarm Initial Field Model – a Model of the Earth's Magnetic Field for 2014 Determined From One Year of Swarm Satellite Constellation Data
Period: 19 Dec 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2014
Links:
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/22655

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Updating the CHAOS series of field models using Swarm data and resulting candidate models for IGRF-12**
Period: 19 Dec 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2014
Links:
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/15467

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**A 2015 IGRF Candidate Model Based on Swarm's Experimental ASM Vector Mode Data**
Period: 17 Dec 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2014
Links:
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/10124

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**An Equivalent Source Method for Modelling the Lithospheric Magnetic Field Using Satellite and Airborne Magnetic Data**
Period: 17 Dec 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2014
Links:
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/6463

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**An Equivalent Source Method for Modelling the Lithospheric Magnetic Field Using Satellite and Airborne Magnetic Data**
Period: 17 Dec 2014
Livia Kathleen Kother (Lecturer)
National Space Institute
Geomagnetism

**Description**
We present a technique for modelling the lithospheric magnetic field based on estimation of equivalent potential field sources. As a first demonstration we present an application to magnetic field measurements made by the CHAMP satellite during the period 2009-2010. Three component vector field data are utilized at all latitudes. Estimates of core and large-scale magnetospheric sources are removed from the satellite measurements using the CHAOS-4 model. Quiet-time and night-side data selection criteria are also employed to minimize the influence of the ionospheric field. The model for the remaining lithospheric magnetic field consists of magnetic point sources (monopoles) arranged in an icosahedron grid with an increasing grid resolution towards the airborne survey area. The corresponding source values are estimated using an iteratively reweighted least squares algorithm that includes model regularization (either quadratic or maximum entropy) and Huber weighting. Data error covariance matrices are implemented, accounting for the dependence of data error variances on quasidipole latitudes. Results show good consistency with the CM5 and MF7 models for spherical harmonic degrees up to n = 95. Advantages of the equivalent source method include its local nature and the ease of transforming to spherical harmonics when needed. The method can also be applied in local, high resolution, investigations of the lithospheric magnetic field, for example where suitable aeromagnetic data is available. To illustrate this possibility, we present preliminary results from a case study combining satellite measurements and local airborne scalar magnetic measurements of the Norwegian coastline.

**Related event**
2014 AGU Fall Meeting
15/12/2014 → 19/12/2014
San Francisco, CA, United States
Activity: Talks and presentations › Conference presentations

**Documents:**
AGU_LK_2014_final

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Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2014

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

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Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2014

**Links:**
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/8924
Swarms Absolute Magnetometer (ASM) Experimental Vector Mode, a Unique Capability With Considerable Potential

Period: 17 Dec 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2014
Links:
https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/12371

En rejse i rummet - Afstande i universet og døde stjerner
Period: 13 Dec 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Foredrag for Brorfeldes Vennekreds
Inviteret på Brorfelde Observatorium

En rejse i rummet - Afstande i universet
Period: 12 Dec 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
DTU Explore foredrag til 18 gymnasieelever fra Lyngby stx

Luftskibe i rumfartens tjeneste
Period: 11 Dec 2014
René Fléron (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

**Description**
Foredrag om udvikling af en luftskibsbaseret platform til test og eksperimenter udført i stratosfæren afholdt i Teatret ved Sorte Hest.

**Links:**
http://www.sortehest.com/portfolio-item/hjernekassen/

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Minedrift i rummet**

**Period:** 4 Dec 2014

Allan Hornstrup (Lecturer)

National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag i UNF Århus

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**En rejse i rummet - Afstande i universet**

**Period:** 3 Dec 2014

Jérôme Chenevez (Lecturer)

National Space Institute
Astrophysics

**Description**
DTU Explore foredrag til 22 gymnasielever fra Lyngby stx

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Polar DTU – Center for polare aktiviteter**

**Period:** 1 Dec 2014

Jens Olaf Pepke Pedersen (Lecturer)

National Space Institute

**Documents:**

Polar DTU – Center for polare aktiviteter

**Related event**

**Rektoriedet delegasjon fra DTU til NTNU**

01/12/2014 → …
Trondheim, Norway
Activity: Talks and presentations › Conference presentations

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**SRP-øvelse: Røntgen observation af en pulsar**

**Period:** 27 Nov 2014
Jérôme Chenevez (Participant)
Astrophysics
National Space Institute

Description
Besøg af tre 3.g gymnasielaver til at udføre en øvelse på DTU Space.
Links:
Activity: Other

FRA PLAN TIL HANDLING, KONFERENCE – KLIMATILPASNING
Period: 24 Nov 2014
Carlo Sass Sørensen (Participant)
National Space Institute
Geodesy

Description
Participant in Discussion Panel at Conference
From Plan to Action - Conference arranged by Danish Architecture Centre in collaboration with Realdania and Nature Agency, Danish Ministry of the Environment
Documents:
klimatilpasning_a4trykfil
Links:

Related event
FRA PLAN TIL HANDLING, KONFERENCE – KLIMATILPASNING: TEMADEBAT 2 – OM MULIGHEDER OG UDFORDRINGER: KYSTSIKRING
24/11/2014 → 24/11/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Naturvidenskab og Kristendom
Period: 24 Nov 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event
Rotary Allerød
24/11/2014 → …
Allerød, Denmark
Activity: Talks and presentations › Conference presentations

Har klimaet brug for talenter?
Period: 19 Nov 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related event
Borupgaard Gymnasium: TalentSummit ’14
19/11/2014 → …
Ballerup, Denmark
Activity: Talks and presentations › Conference presentations
**En rejse i rummet - Afstande i universet**
*Period: 18 Nov 2014*
Jérôme Chenevez (Lecturer)
National Space Institute

**Description**
DTU Explore foredrag. 3.g klasse fra TEC Lyngby

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Thule Tuvalu**
*Period: 17 Nov 2014*
Jens Olaf Pepke Pedersen (Panel member)
National Space Institute

**Description**
Filmforevisning Thule Tuvalu og debatmøde
Debatmødte med meteorolog Jesper Theilgaard
Links:
http://cphdox.dk/node/7910

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Naturvidenskab og Kristendom**
*Period: 13 Nov 2014*
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

**Related event**

**Allinge Kirke**
13/11/2014 → …
Allinge, Denmark
Activity: Talks and presentations › Conference presentations

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**Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU**
*Period: 11 Nov 2014*
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Planeterne, Universet og sorte huller**
*Period: 11 Nov 2014*
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
2 foredrag på folkeskole i Farum

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Minedrift i rummet**
Period: 7 Nov 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Oplæg ved DTU Business Techno Trends

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Danmark i rummet 2014**
Period: 4 Nov 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag for Force institutets pensionistforening

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Solsystemet**
Period: 1 Nov 2014
Kristoffer Leer (Participant)
National Space Institute
Astrophysics

**Description**
Bog til børn om solsystemet
Links:
http://forlagetepsilon.dk/?page=110
Activity: Other
En rejse i rummet - Afstande i universet
Period: 7 Oct 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

**Description**
DTU Explore foredrag. 3.g fra Ribe Katedralsgymnasium

**Related external organisation**
**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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Den danske nationalkomite for lysets år (External organisation)
Period: 1 Oct 2014 → …
Jens Olaf Pepke Pedersen (Participant)
National Space Institute
Sunclimate

**Links:**
http://www.dfs-lysets-aar.fotonik.dtu.dk/Forside/Den-Danske-Nationalkomite

**Related external organisation**
**Den danske nationalkomite for lysets år**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

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Supernovaer og sorte huller
Period: 1 Oct 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag for 9. klasse på Engholmskolen

**Related external organisation**
**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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Censoraktivitet
Period: 30 Sep 2014
Jérôme Chenevez (External examiner)
Astrophysics
National Space Institute

**Description**
Censor for Sarah Massalkhis MSc forsvar på KU 30. september 2014
Activity: Examinations and supervision › External examination

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WFI Proto-Consortium Meeting
Period: 29 Sep 2014 → 1 Oct 2017
Søren Brandt (Participant)
National Space Institute
Astrophysics and Atmospheric Physics

Description
WFI Proto-Consortium Meeting
Degree of recognition: International
Documents:
WFI Proto-Consortium Meeting Agenda

Related event
WFI Proto-Consortium Meeting: Ringberg Castle Sep 29 - Oct 1 2014
29/09/2014 → 01/10/2014
Kreuth, Bavaria, Germany
Activity: Attending an event › Participating in or organising a conference

ESA-CAS Workshop at DTU Space
Period: 24 Sep 2014
Alessandro Salvatore Massaro (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Description
Presentation on rendezvous, landing, docking and formation flight sensors

Related event
ESA-CAS Workshop at DTU Space
24/09/2014 → …
Kongens Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Hard X-ray Astronomy: Astrosat and beyond
Period: 24 Sep 2014 → 26 Sep 2014
Søren Brandt (Invited speaker)
National Space Institute
Astrophysics
Links:
http://www.tifr.res.in/~astrogoa2014/home.html (Hard X-ray Astronomy: Astrosat and Beyond, A topical conference International Center, Goa, India, September 24-26, 2014 )

Related event
Hard X-ray Astronomy: Astrosat and beyond: A topical conference
24/09/2014 → 26/09/2014
Goa, India
Activity: Talks and presentations › Conference presentations

10th INTEGRAL Workshop
Period: 15 Sep 2014 → 19 Sep 2014
Søren Brandt (Participant)
National Space Institute
Astrophysics
Degree of recognition: International
Links:
http://www.clemson.edu/ces/physics-astro/conferences/INTEGRAL/ (Conference homepage.)
Related event

10th INTEGRAL Workshop: A Synergistic View of the High Energy Sky
15/09/2014 → 19/09/2014
Annapolis, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Thyborøn Channel and life on the Limfjord Barriers: The past and the future challenges
Period: 1 Sep 2014
Carlo Sass Sørensen (Other)
National Space Institute
Geodesy

Description
Dissemination and conversation about the history and current and future challenges, e.g., in relation to climate change

Conversation with HM the Queen
Documents:
Planche_1_gamle_kystlinier
Planche_2a
Planche_3a
Planche_4

Links:
http://m.dagbladet-holstebro-struer.dk/lemvig/dronningen-fortalte-om-barndommen (e-newspaper article)

Related event

The Royal couple's "summer expedition", 2014: HM Queen Margrethe and His Royal Highness Prince Henrik's visit in Thyborøn
01/09/2014 → 01/09/2014
Thyborøn, Denmark
Activity: Talks and presentations › Conference presentations

Kvant 25 år
Period: 19 Aug 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related event

Selskabet til Naturlærens Udbredelse: 190 års jubilæumsarrangement
19/08/2014 → …
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Environment Committee, Danish Parliament
Period: 18 Aug 2014
Carlo Sass Sørensen (Organizer)
National Space Institute
Geodesy

Description
Organiser and guide on Field trip on the Jutland west coast for the Environment Committee of the Danish Parliament

The Environment Committee of the Danish Parliament - on tour!

Related event
Environment Committee, Danish Parliament: Visit to the Jutland west coast
18/08/2014 → 18/08/2014
Lemvig, Denmark
Activity: Attending an event › Participating in or organising a conference

Ministry of the Environment - Summer Tour of 2014
Period: 14 Aug 2014
Carlo Sass Sørensen (Organizer)
National Space Institute
Geodesy

**Description**
Organisation, co-ordination and participation in 4 hours of action and dissemination in and around Thyborøn

Danish Ministry of the Environment "Summer Tour 2014". 4 hour visit in Thyborøn for the Minister of the Environment, Ms. Kirsten Brosbøl and app. 25 guests visiting local businesses etc. and learning about coastal challenges.

**Related event**
Ministry of the Environment - Summer Tour of 2014: Visit to Thyborøn
14/08/2014 → 14/08/2014
Thyborøn, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Coastal Engineering Journal (Journal)
Period: 15 Jul 2014 → 30 Sep 2014
Carlo Sass Sørensen (Reviewer)
National Space Institute
Geodesy

**Description**
Paper review
Degree of recognition: International

**Related journal**
Coastal Engineering Journal
0578-5634
Central database
Activity: Research › Peer review of manuscripts

SPIE 2014
Period: 22 Jun 2014 → 27 Jun 2014
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Related event**
SPIE 2014: Astronomical Telescopes + Instrumentation
22/06/2014 → 27/06/2014
Montreal, Canada
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Nordic Physics Days, 2015 June 9-12 in Trondheim, Norway (External organisation)
Period: 1 Jun 2014 → 30 Jun 2015
Jens Olaf Pepke Pedersen (Participant)
National Space Institute
Sunclimate

Description
Committee on Space, atmosphere and Environmental Physics

Related external organisation
Nordic Physics Days, 2015 June 9-12 in Trondheim, Norway
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Exploring the Earth’s Magnetic Field Using Satellites – From Ørsted to Swarm
Period: 14 May 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Seminar talk, University of Lancaster, UK

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Måne Fup eller fakta
Period: 8 May 2014
Kristoffer Leer (Lecturer)
National Space Institute
Astrophysics

Description
Om Apollo programmet og konspirationsteorier på Planetariet
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet - Afstande i universet
Period: 28 Apr 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
DTU Explore foredrag. 2.g + 3g. fra Allerød Gymnasium

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
The use of vertical and horizontal surface displacements at EPOS GNSS stations in Greenland to study ice sheet mass balance
Period: 28 Apr 2014
Shfaqat Abbas Khan (Lecturer)
National Space Institute
Geodesy

Documents:
EGU2014-11132_Abbas

Related event
European Geosciences Union General Assembly 2014
27/04/2014 → 02/05/2014
Vienna, Austria
Activity: Talks and presentations › Conference presentations

En rejse i rummet: Afstande i Universet og døde stjerner
Period: 25 Apr 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Offentlig foredrag om astrofysik ved Bolsjefabrikken, Ragnhildgade 1 på Nørrebro.

Related event
Bestil en Forsker - Forskningens Døgn
24/04/2014 → 26/04/2014
Denmark
Activity: Talks and presentations › Conference presentations

Minedrift i rummet
Period: 22 Apr 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

Description
Foredrag UNF Ålborg

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Naturvidenskab og Kristendom
Period: 22 Apr 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event

Lillerød Kirke
22/04/2014 → …
Allerød, Denmark
Activity: Talks and presentations › Conference presentations

The SKY Experiments
Period: 9 Apr 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event

COST Workshop
09/04/2014 → 11/04/2014
Reading, United Kingdom
Activity: Talks and presentations › Conference presentations

Hvorfor ændrer klimaet sig?
Period: 2 Apr 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute

Related event

Krogerup Højskole: Fordybelse med Weekendavisen
30/03/2014 → 05/04/2014
Krogerup, Denmark
Activity: Talks and presentations › Conference presentations

NICER (External organisation)
Period: 1 Apr 2014 → …
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics

Description
Neutron Star Interior Composition Explorer
Member of NICER Science Team
Body type: NASA
Degree of recognition: International

Related external organisation

NICER
Activity: Membership › Membership of research networks or expert groups

Danmarks videnskabelige bidrag til astrofysisk forskning fra rummet
Period: 25 Mar 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag for Astronomisk Forening for Vestsjælland

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Lys over mørk energi med Euclid**
Period: 24 Mar 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag i FU og Astronomisk Selskab, Århus

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Lys over mørk energi med Euclid**
Period: 17 Mar 2014
Allan Hornstrup (Lecturer)
National Space Institute
Astrophysics
IT-Department

**Description**
Foredrag i FU og Astronomisk Selskab, København

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**SROpgave**
Period: 17 Mar 2014
Jérôme Chenevez (Lecturer)

**Description**
Besøg af tre 2.g elever fra Frederikssund Gymnasium til at udføre en opgave på DTU Space.

Lære

**Related external organisation**

**Frederikssund gymnasium**
Denmark
Activity: Other
Exploring the Earth’s Magnetic Field Using Satellites – From Ørsted to Swarm
Period: 14 Mar 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Invited talk, Royal Astronomical Society London

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet - Afstande i universet
Period: 12 Mar 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
DTU Explore foredrag. Klasse fra Bornholm

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Universets Gåder - Kosmisk Stråling
Period: 18 Feb 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Forelæsning på Folkeuniversitetet. Documents:
Kosmiske stråler JOPP 2014

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Overbefolkning - et overset problem
Period: 16 Feb 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Description
Hjortespring Søndagsskole.

Related external organisation

Unknown external organisation
IEEE Student Branch Space Talk: Vision Augmented Spacecraft Navigation
Period: 13 Feb 2014
Alessandro Salvatore Massaro (Invited speaker)
National Space Institute
Measurement and Instrumentation Systems

30120 Astrofysik
Period: 6 Feb 2014 → 22 May 2014
Jérôme Chenevez (Participant)
Astrophysics
National Space Institute

The Magnetic Field – a Tool for Exploring the Earth's Interior
Period: 31 Jan 2014
Nils Olsen (Speaker)
National Space Institute
Geomagnetism

Kosmisk Stråling: Universets Gåder
Period: 22 Jan 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Related event

Related external organisation
University of Leeds
United Kingdom
Activity: Talks and presentations › Conference presentations

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Related event

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Related event

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Related event
Kosmiske stråler FU 2014

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

CO2-effekten er overvurderet
Period: 14 Jan 2014
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Indlæg på Plantekongres 2014.
Documents:
35_2_CO2-effekten_er_overvurderet
Links:
https://www.landbrugsinfo.dk/Planteavl/Plantekongres/Sider/pl_plk_2014_prog_tema_inspiration.aspx#35

Related event

Plantekongres 2014
14/01/2014 → 15/01/2014
Herning, Denmark
Activity: Talks and presentations › Conference presentations

The spatio-temporal distribution of magnetic satellite data errors
Period: 10 Jan 2014
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Talk at RAS Specialist Discussion Meeting on Geomagnetic field dynamics and structure on timescales from minutes to Decades, London/UK

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet - Afstande i universet
Period: 6 Jan 2014
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
DTU Explore foredrag. 1.g fra Falkonergårdens gymnasium.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
Member of the Editorial Committee of JGIS (External organisation)
Period: 2013 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy
Degree of recognition: International

Related external organisation
Member of the Editorial Committee of JGIS
Activity: Membership › Membership in review committee

Deriving enhanced geomagnetic field models by means of satellite magnetic gradiometry
Period: 9 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Invited Presentation at AGU Fall Meeting 2013
Links:
http://abstractsearch.agu.org/meetings/2013/FM/sections/GP/sessions/GP52A/abstracts/GP52A-06

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Heat flux and crustal thickness in Greenland adjacent to and under the ice sheet
Period: 9 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2013
Links:
http://abstractsearch.agu.org/meetings/2013/FM/sections/C/sessions/C51A/abstracts/C51A-0493

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Marine induction studies based on sea surface scalar magnetic field measurements. A concept and its verification
Period: 9 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2013
Links:
http://abstractsearch.agu.org/meetings/2013/FM/sections/GP/sessions/GP22A/abstracts/GP22A-06

Related external organisation
Rapid core field variations during the satellite era: Investigations using stochastic process based field models
Period: 9 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2013
Links:
http://abstractsearch.agu.org/meetings/2013/FM/sections/GP/sessions/GP53C/abstracts/GP53C-1150

The CHAOS-4 Geomagnetic Field Model
Period: 9 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2013
Links:
http://abstractsearch.agu.org/meetings/2013/FM/sections/GP/sessions/GP53C/abstracts/GP53C-1154

Magnetic fields of the solar system: A comparative planetology toolkit
Period: 5 Dec 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2011
Links:

En rejse i rummet
Period: 29 Nov 2013
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics
Description

Related external organisation

Unknown external organisation
Activity: Talks and presentations » Conference presentations

Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU
Period: 12 Nov 2013
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related external organisation

Unknown external organisation
Activity: Talks and presentations » Conference presentations

On Geomagnetic Field Modelling
Period: 6 Nov 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Lecture, Geomagnetism seminar, British Geological Survey, Edinburgh/UK

Related external organisation

Unknown external organisation
Activity: Talks and presentations » Conference presentations

NewCOMPSTAR (External organisation)
Period: 1 Nov 2013 → 31 Dec 2017
Jérôme Chenevez (Participant)
Astrophysics
National Space Institute

Description
COST Action MP 1304: "Exploring fundamental physics with compact stars (NewCompStar)".

Body type: EU
Degree of recognition: International

Related external organisation

NewCOMPSTAR
Activity: Membership » Membership of research networks or expert groups

A Danish Earth System Model of Intermediate Complexity
Period: 29 Oct 2013
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate
Related event

**Workshop to develop and explore new approaches to analysing past, present and future climate dynamics**

28/10/2013 → 31/10/2013  
Longyearbyen, Norway  
Activity: Talks and presentations › Conference presentations

**INTEGRAL's journey through the high energy sky**  
Period: 15 Oct 2013 → 18 Oct 2013  
Søren Brandt (Organizer)  
National Space Institute  
Astrophysics  
Links:  
http://www.iaps.inaf.it(sz/integral2013/index.htm (INTEGRAL's journey through the high energy sky)

Related event

**INTEGRAL's journey through the high energy sky**  
15/10/2013 → 18/10/2013  
Rome, Italy  
Activity: Attending an event › Participating in or organising a conference

**INTEGRAL's journey through the high energy sky (External organisation)**  
Period: 15 Oct 2013 → 18 Oct 2013  
Søren Brandt (Participant)  
National Space Institute  
Astrophysics

**Description**  
INTEGRAL Workshop  
15-18 October 2013  
Rome, Italy  
Scientific Organizing Committee  
Body type: Scientific Organizing Committee  
Degree of recognition: International  
Links:  
http://www.iaps.inaf.it(sz/integral2013/ ("INTEGRAL's journey through the high energy sky")

Related external organisation

**INTEGRAL's journey through the high energy sky**  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**The Magnetic Field – a Tool for Exploring the Earth's Interior**  
Period: 10 Oct 2013  
Nils Olsen (Lecturer)  
National Space Institute  
Geomagnetism

**Description**  
Talk in Earth and Planetary Science Seminar, School of GeoSciences, University of Edinburgh

Related external organisation

**Unknown external organisation**  
Activity: Talks and presentations › Conference presentations
En rejse i rummet: Videnskaben på besøg v. Dansk Naturvidenskabsfestival
Period: 24 Sep 2013 → 27 Sep 2013
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Foredrag om astronomi til skole og gymnasier.
Holdt fire foredrag i forbindelse med Dansk NaturvidenskabsFestival 2013 (uge 39) på hhv. Vanløse Kulturstation, Sankt Annæ Skole, og Allerslev Skole i Lejre.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

ESA's Swarm Satellite Constellation Mission
Period: 24 Sep 2013
Nils Olsen (Speaker)
National Space Institute
Geomagnetism

Description
Talk at Birkeland Space Science Center, Bergen, Norway

Related external organisation
Birkeland centre for Space Science
Bergen, Norway
Activity: Talks and presentations › Conference presentations

SCARF – the Swarm Satellite Constellation Application and Research Facility
Period: 13 Sep 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Poster at ESA’s “Living Earth” Symposium, Edinburgh/UK
Degree of recognition: International

Related event
ESA Living Planet Symposium — 2013
09/09/2013 → 13/09/2013
Edinburgh, United Kingdom
Activity: Talks and presentations › Conference presentations

15th Annual Conference of the International Association for Mathematical Geosciences
Period: 2 Sep 2013
Thomas Mejer Hansen (Organizer)
Center for Energy Resources Engineering
National Space Institute
Mathematical and Computational Geoscience
Description
Session 20: Geostatistical priors in inversion of geophysical and engineering data
Conveners: Klaus Mosegaard (Technical University of Denmark, DENMARK), Thomas Mejer Hansen (Technical University of Denmark, DENMARK)
This session will explore current research in integration of geostatistical information with geophysical or engineering data. Special focus will be on new ideas and methods for incorporating geological realism into the solution of inverse problems such as history matching and seismic inversion.

Related event
15th Annual Conference of the International Association for Mathematical Geosciences: Frontiers of Mathematical Geosciences: New approaches to understand the natural World
02/09/2013 → 06/09/2013
Madrid, Spain
Activity: Attending an event › Participating in or organising a conference

Bridging the gap between CHAMP and Swarm using Ørsted and ground observatory data
Period: 26 Aug 2013
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at IAGA General Assembly 2013, Mexico

Related event
IAGA 2013 The 12th Scientific Assembly
26/08/2013 → 31/08/2013
Merida, Yucatan, Mexico
Activity: Talks and presentations › Conference presentations

Topside ionospheric midlatitude electric current density inferred from multiple magnetic satellites
Period: 26 Aug 2013
Nils Olsen (Other)
National Space Institute
Geomagnetism

Related event
IAGA 2013 The 12th Scientific Assembly
26/08/2013 → 31/08/2013
Merida, Yucatan, Mexico
Activity: Talks and presentations › Conference presentations

Topological / geometrical methods and data structures for real-world data analysis
Period: 22 Aug 2013
Francesc/François Antón Castro (Lecturer)
National Space Institute
Geodesy

Description
Invited lecture at the Department of Mathematics, Nanyang Technological University, Singapore.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Why I care about continuous functions?
Period: 22 Aug 2013
Francesc/François Antón Castro (Lecturer)
National Space Institute
Geodesy

Description
Seminar at the Department of Mathematics, Nanyang Technological University, Singapore.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Censoraktivitet
Period: 21 Jun 2013
Jérôme Chenevez (External examiner)
Astrophysics
National Space Institute

Description
Censor til Simone F. Juul Jakobsens kandidatafhandling "Supernova remnants and pulsar wind nebulae in the Norma region" ved Niels Bohr Institut, KU.
Activity: Examinations and supervision › External examination

5th International Conference on Spacecraft Formation Flying Missions and Technologies
Period: 31 May 2013
Mathias Benn (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Description
Presentation of paper: Autonomous Vision Based Detection of Non-stellar Objects Flying in Formation with Camera Point of View.

Related event

5th International Conference on Spacecraft Formation Flying Missions and Technologies
29/05/2013 → 31/05/2013
Münich, Germany
Activity: Talks and presentations › Conference presentations

Universiti Teknologi Malaysia
Period: 30 May 2013 → 29 Aug 2013
Francesc/François Antón Castro (Visiting researcher)
Department of Informatics and Mathematical Modeling
National Space Institute
Geodesy

Description
Visiting Full Professor
3D GIS Research Group at the Faculty of Geoinformation and Real Estate, UTM.
Activity: Visiting an external institution › Visiting another research institution
Luftskibe - en ideel platform for eksperimenter
Period: 2 May 2013
René Fléron (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Description
Foredrag i forbindelse med forskningens døgn 2013

Related event
Bestil en forsker: Forskningens døgn
02/05/2013 → 04/05/2013
Denmark
Activity: Talks and presentations › Conference presentations

DTU Space - How to measure the Earth from Space: An introduction to DTU Space
Period: 29 Apr 2013
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Lecture to danish school teachers accompanying competitors of the Unge Forskere competition

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet: Afstande i Universet
Period: 15 Apr 2013
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Foredrag til en 3.g klasse på besøg på DTU Space. DTU Explore

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi - rummets betydning for Jorden
Period: 11 Apr 2013
Unknown Person (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Besøg af Egaa Gymnasium, Aalborg

Related external organisation
Experimental studies of the formation of cluster ions formed by corona discharge in an atmosphere containing SO2, NH3, and H2O

Period: 15 Mar 2013
Jens Olaf Pepke Pedersen (Invited speaker)
National Space Institute
Solar System Physics
Sunclimate

Related event

4th NICITA Workshop
12/03/2013 → 15/03/2013
Göteborg, Sweden
Activity: Talks and presentations › Conference presentations

En stjerne som nabo: Solstorme og lys fra himlen
Period: 25 Feb 2013
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Foredrag på Senioruniversitetet, Værlose

Related external organisation

Kosmiske Stråler
Period: 18 Feb 2013
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

**Description**
Folkeuniversitetet, forelæsningsrække om Universets Gåder

**Links:**

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**NASA Ames Research Center**
Period: 4 Feb 2013 → 10 May 2013
Alessandro Salvatore Massaro (Visiting researcher)
National Space Institute
Measurement and Instrumentation Systems

**Description**
External Research Stay at NASA Ames Research Center

Implemented and verified key components of an algorithm for infrastructure-free global rover localization. The algorithm is intended to enhance the autonomous navigation capabilities of surface vehicles stationed on remote planetary bodies for the scope of exploration and human support.

Activity: Visiting an external institution › Visiting another research institution

**Natural Sciences and Engineering Research Council of Canada (External organisation)**
Period: Jan 2013
Francesc/François Antón Castro (Member)
National Space Institute
Geodesy

**Description**
National Research Funding Agency for Natural Sciences and Engineering of Canada

Review of a funding application in interval analysis

Body type: Research Funding Agency
Degree of recognition: International

**Related external organisation**

**Natural Sciences and Engineering Research Council of Canada**
Activity: Membership › Membership in review committee

**IARIA Computation Tools (External organisation)**
Period: 1 Jan 2013 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy

**Description**
International Conference on Computational Logics, Algebras, Programming, Tools, and Benchmarking.

Body type: Technical Program Committee
Degree of recognition: International

**Related external organisation**
IARIA GeoProcessing (External organisation)
Period: 1 Jan 2013 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy

Description
International Conference on Advanced Geographic Information Systems, Applications, and Services

Body type: Technical Program Committee
Degree of recognition: International

Related external organisation

IARIA GeoProcessing
Activity: Membership › Membership in review committee

Working Group II/2 of Commission II of the ISPRS (External organisation)
Period: 2012 → 2016
Francesc/François Antón Castro (Chairman)
National Space Institute
Geodesy

Description

ISPRS Working group II/2 aims to promote the development of new methodologies, algorithms and applications related to the representation of n-dimensional spatial data at multiple scales. Another focus of the group is on the development of topological and geometric data models, data structures and algorithms for automatic n-dimensional data generalization at different levels of detail and for various purposes. To this purpose, the WG organises workshops to exchange the latest developments on representation of n-dimensional spatial data at multiple scales. The WG will be in cooperation with WG II/1 on spatio-temporal data models and structures and on spatio-temporal topology and relationships. The WG will promote research dissemination through books, journal papers, and peer-reviewed conference papers through ISPRS and general math and computer science publications.

Body type: Non-Governmental Organization
Degree of recognition: International
Links:
http://www2.isprs.org/commissions/comm2/wg2.html (Web site)

Related external organisation

Working Group II/2 of Commission II of the ISPRS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

XV IAGA Workshop on Geomagnetic Observatory Instruments Data Acquisition and Processing
Period: 2012
Lars William Pedersen (Participant)
National Space Institute
Geomagnetism

Related event

XV IAGA Workshop on Geomagnetic Observatory Instruments Data Acquisition and Processing
04/06/2012 → 14/06/2012
San Fernando, Cadiz, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**SKY-ZERO @ Boulby: Cosmic rays and climate: What can we learn from the ultra-low radiation environment**
Period: 19 Dec 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Suncclimate

**Description**

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**Underground Synergies with Astro**
Period: 17 Dec 2012 → 19 Dec 2012
Jens Olaf Pepke Pedersen (Invited speaker)
National Space Institute
Solar System Physics
Suncclimate

**Related event**
Underground Synergies with Astro: Multi-Disciplinary Studies in the World's Deep Underground Science Facilities
17/12/2012 → 19/12/2012
Durham, United Kingdom
Activity: Talks and presentations › Conference presentations

**Closed Loop Simulation for a Magnetic Gradiometry Mission**
Period: 13 Dec 2012
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

**Description**
Presentation at AGU Fall Meeting 2010
Links:

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**Magnetic effects of magnetospheric currents at ground and in low orbit**
Period: 3 Dec 2012
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism
Description
Presentation at AGU Fall Meeting 2012
Links:
http://abstractsearch.agu.org/meetings/2012/FM/sections/GP/sessions/GP51B/abstracts/GP51B-01

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

11. november 1572 kl 19.00
Period: 17 Nov 2012
Kristoffer Leer (Lecturer)
National Space Institute
Solar System Physics

Description
Foredrag om forholdet mellem religion og videnskab. Holdt på planetaret for Ateistisk Selskab

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU
Period: 13 Nov 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Cosmic ray induced aerosol formation in Earth's atmosphere
Period: 7 Nov 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related event

9th European Space Weather Week
05/11/2012 → 09/11/2012
Brussels, Belgium
Activity: Talks and presentations › Conference presentations

En rejse i rummet - afstande i rummet
Period: 7 Nov 2012
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Foredrag bestilt til Hedehusene Bibliotek via Nina Vestergaard
Links:
Rumsonden JUNO: - rumsonden JUNO ved Jupiter
Period: 6 Nov 2012
John Leif Jørgensen (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Description
Novastronomi arrangement i Toldkammeret, Havnepladsen, Helsingør
Links:
http://novastronomi.wordpress.com/2012/11/02/novanyt-fredag-d-2-november-2012/

Kosmiske Stråler
Period: 5 Nov 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Del af forelæsningsrække om Universets Gåder på Folkeuniversitetet

The role of atmospheric ions in aerosol nucleation
Period: 2 Nov 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Foredrag på Kemisk Institut, Oslo Universitet
Links:
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

**Related event**

**Klimarealisterne**
01/11/2012 → …
Oslo, Norway
Activity: Talks and presentations › Conference presentations

The FGE magnetometer and the Intermagnet 1 second standard: Tests of FGE magnetometer and Mingeo datalogger
Period: Oct 2012
Lars William Pedersen (Lecturer)
National Space Institute
Geomagnetism
Documents:
DTU FGE Magnetometer oral abstract - rev
DTU_FGE_Magnetometer_oral_abstract_rev.pdf

**Related event**

**XVIIth IAGA Workshop on Geomagnetic Observatory Instruments Data Acquisition and Processing**
07/10/2014 → 16/10/2014
Hyderabad, India
Activity: Talks and presentations › Conference presentations

At leve med en Stjerne
Kristoffer Leer (Lecturer)
National Space Institute
Solar System Physics

Description
Foredrag om Solen i forbindelse med praktik

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**9th INTEGRAL Workshop**
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description
15-19 October 2012, Bibliotheque Nationale de France, Paris, France
Member of Scientific Advisory Committee
Body type: Scientific Advisory Committee
Degree of recognition: International
Links:
http://integralworkshop2012.in2p3.fr/Home.html (9th INTEGRAL Workshop An INTEGRAL view of the high-energy sky (the first 10 years) 15-19 October 2012 Bibliotheque Nationale de France, Paris, France)
9th INTEGRAL Workshop: An INTEGRAL view of the high-energy sky (the first 10 years)
15/10/2012 → 19/10/2012
Paris, France
Activity: Attending an event › Participating in or organising a conference

Observing GRBs with the LOFT Wide Field Monitor
Period: 11 Oct 2012
Søren Brandt (Lecturer)
National Space Institute
Astrophysics

2012 Fall Gamma Ray Burst Symposium
08/10/2012 → 12/10/2012
Marbella, Spain
Activity: Talks and presentations › Conference presentations

The Fall 2012 Gamma-Ray Burst Symposium (External organisation)
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description
The Fall 2012 Gamma-Ray Burst Symposium: "15 years of Gamma-Ray Bursts afterglows: progenitors, environments and host galaxies from the nearby to the early Universe", held in Marbella (Málaga, Spain), 8-12 Oct 2012

Member of Scientific Organizing Committee

Body type: Scientific Organizing Committee
Degree of recognition: International
Links:
http://grb2012.iaa.es/ (Fall 2012 Gamma Ray Burst Symposium home page)

Evidence of nearby supernovae affecting life on Earth
Period: 4 Oct 2012
Henrik Svensmark (Lecturer)
National Space Institute
Solar System Physics
Sunclimate

Description
Links:

Related external organisation

Unknown external organisation
Månefup eller fakta  
Period: 4 Oct 2012  
Kristoffer Leer (Lecturer)  
National Space Institute  
Solar System Physics  

Description  
Foredrag for 3.g fra Herlufsholm Gymnasium  

Related external organisation  

Second Science Meeting Loft  
Period: 24 Sep 2012 → 27 Sep 2012  
Søren Brandt (Participant)  
National Space Institute  
Astrophysics  

Description  
24-27 September, Toulouse, France  

Body type: Scientific Organizing Committee  
Degree of recognition: International  
Links:  
http://www.isdc.unige.ch/loft/public-meetings/second-loft-science-meeting.html

Related event  
Second Science Meeting Loft  
24/09/2012 → 27/09/2012  
Toulouse, France  
Activity: Attending an event › Participating in or organising a conference  

Asparges På Mars  
Period: 7 Sep 2012  
Kristoffer Leer (Lecturer)  
National Space Institute  
Solar System Physics  

Description  
Foredrag og rundvisning for 1. g fra Ballerup  

Related external organisation  

Asparges på Mars  
Period: 2 Sep 2012  
Kristoffer Leer (Lecturer)  
National Space Institute  
Solar System Physics
**Description**
Foredrag for Nova i Helsingør

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Censoraktivitet**
Period: 21 Aug 2012
Jérôme Chenevez (External examiner)
Astrophysics
National Space Institute

**Description**
Censor til Mette Friis' kandidat afhandling "A search for thermal emission in gamma ray bursts" ved Niels Bohr Institut, KU.
Activity: Examinations and supervision › External examination

**Asia Oceania Geosciences Society 9th Annual General Meeting**
Period: 17 Aug 2012
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Solar System Physics
Sunclimate

**Description**
ST07-D5-AM2-Vir1-007 (ST07-A020)

**Related event**
**Asia Oceania Geosciences Society 9th Annual General Meeting**
13/08/2012 → 17/08/2012
Singapore, Singapore
Activity: Talks and presentations › Conference presentations

**Ph.D. Committee at Leibniz Universität Hannover (External organisation)**
Period: 18 Jul 2012
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Description**
Ph. D. thesis "Development of a digital phase measuring system with microradian precision for LISA" by Joachim Kullmann
Body type: Ph.D. committee
Degree of recognition: International

**Related external organisation**

**Ph.D. Committee at Leibniz Universität Hannover**
Activity: Membership › Membership in review committee

**Space Telescopes and Instrumentation 2012: Ultraviolet to Gamma Ray**
Period: 1 Jul 2012 → 6 Jul 2012
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

Space Telescopes and Instrumentation 2012: Ultraviolet to Gamma Ray
01/07/2012 → 06/07/2012
Amsterdam, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

En rejse i Rummet
Period: 25 Jun 2012
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics

Description
Foredrag

Organiser: Christa Tandrum (AUS)

Related organisation

En rejse i Rummet
Chenevez, J. (Speaker)
25 Jun 2012
Activity: Other

Some results from the SKY experiments
Period: 15 Jun 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related event

COST Action ES1005 Workshop: TOSCA - Towards a more complete assessment of the impact of solar variability on the Earth's climate
14/06/2012 → 15/06/2012
Bern, Switzerland
Activity: Talks and presentations › Conference presentations

12th European Vacuum Conference
Period: 5 Jun 2012
Jens Olaf Pepke Pedersen (Participant)
National Space Institute
Solar System Physics
Sunclimate

Description
Poster: "REACTION VACUUM CHAMBER FOR ATMOSPHERIC NUCLEATION STUDIES"
P-20

Related event

12th European Vacuum Conference
03/06/2012 → 08/06/2012
Dubrovnik, Croatia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Visionday
Period: 31 May 2012
Ulla Svensmark (Organizer)
National Space Institute
Technical University of Denmark

Description
DTU Professor John Leif Jørgensen fra DTU Space, National Space Institute opens the conference with a Plenary talk: "Vision in Space". Thursday 31th May 09:00-10:00

Visionday 2012 Programme. DTU Informatics in collaboration with DTU Food invite companies, organizations, and institutions to a one-day conference covering a range of topics including computer graphics, machine vision, multivariate analysis, and image analysis for medical and food applications.

Links:
http://www.visionday.dk/VD12/programme.html

Related event

Visionday: Extra keynote/Ramesh Raskar/MIT Media Lab
31/05/2012 → ...
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Annual Danish Astronomy Meeting
Period: 30 May 2012 → 31 May 2012
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics

Description
Poster: What can NuSTAR do for X-ray burst?


Related event

Annual Danish Astronomy Meeting
30/05/2012 → 31/05/2012
Hven, Sweden
Activity: Attending an event › Participating in or organising a conference

Annual Danish Astronomy Meeting (External organisation)
Period: 30 May 2012 → 31 May 2012
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description

Member of Organizing Committee

Body type: Organizing Committee

Related external organisation

Annual Danish Astronomy Meeting
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
Dekanernes undervisningsseminarer
Period: 14 May 2012
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics

Description
Participation at the workshop on Master studies
Participation at “Dekanernes undervisningsseminarer”

Related event
Dekanernes undervisningsseminarer
14/05/2012 → …
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU
Period: 8 May 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Få syn for “Science & Design”: Forskningens Døgn 2012 - DTU Space byder velkommen til alle
Period: 21 Apr 2012
Jérôme Chenevez (Lecturer)
Astrophysics
National Space Institute

Description
Sted: Landmålerhuset på Landmålervej, 2800 Kgs. Lyngby
Oplev glæden ved at køre med en specialdesignet GPS-miniracerbil på en bane på 27 meter og hør spændende, faglig formidling i loops om Universets gåder og få et par festlige briller (uddeles så længe lager haves).
Hele arrangementet foregår i og omkring Landmålerhuset, der grænser op til Jægersborg Dyrehave.
Deltag i fotokonkurrencen på dagen (brug evt. din mobil) og send dit foto fra dagen til office@space.dtu.dk - inkl. oplysninger om dit navn, adresse + telefonnummer.
Vi glæder os til at møde dig.
Venligst, Ulla Svensmark

Forsker Jakob Jakobsen, DTU Space Fysiker Carol Anne Oxborrow, DTU Space Seniorforsker Jérôme Chenevez, DTU Space

Related event
Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Other
Få syn for "Science & Design": Forskningens Døgn 2012 - DTU Space byder velkommen til alle
Period: 21 Apr 2012
Jakob Jakobsen (Lecturer)
Astrophysics
National Space Institute
Geodesy

Description
Sted: Landmålerhuset på Landmålervej, 2800 Kgs. Lyngby
Oplev glæden ved at køre med en specialdesignet GPS-miniracerbil på en bane på 27 meter og hør spændende, faglig
formidling i loops om Universets gåder og få et par festlige briller (uddeles så længe lager haves).
Hele arrangementet foregår i og omkring Landmålerhuset, der grænser op til Jægersborg Dyrehave.
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ophylsninger om dit navn, adresse + telefonnummer.
Vi glæder os til at møde dig.
Venligst, Ulla Svensmark

Forsker Jakob Jakobsen, DTU Space Fysiker Carol Anne Oxborrow, DTU Space Seniorforsker Jérôme Chenevez, DTU
Space

Related event
Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Other
formidling i loops om Universets gåder og få et par festlige briller (uddeles så længe lager haves).
Hele arrangementet foregår i og omkring Landmålerhuset, der grænser op til Jægersborg Dyrehave.
Deltag i fotokonkurrencen på dagen (brug evt. din mobil) og send dit foto fra dagen til office@space.dtu.dk - inkl. oplysninger om dit navn, adresse + telefonnummer.
Vi glæder os til at møde dig.
Venligst, Ulla Svensmark

Forsker Jakob Jakobsen, DTU Space Fysiker Carol Anne Oxborrow, DTU Space Seniorforsker Jérôme Chenevez, DTU Space

Related event

Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Forskningens Døgn 2012
Period: 20 Apr 2012
Ulla Svensmark (Organizer)
National Space Institute

Description
En rejse i rummet - afstande i Universet og døde stjerner: Bestil en forsker

Forskningens Døgn 2012 - Bestil en forsker
20. april 2012, ved seniorforsker Jérôme Chenevez/ DTU Space
Gefion Gymnasium, Øster Voldgade 10, Kbh.

Bidrag til Forskningens Døgn 2012 via "Bestil en forsker"

Related event

Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

En rejse i rummet - afstande i Universet og døde stjerner: Bestil en forsker
Period: 19 Apr 2012 → 20 Apr 2012
Jérôme Chenevez (Lecturer)
National Space Institute
Astrophysics

Description
Bestil en forsker - bidrag til Forskningens Døgn 2012.
Moto Guzzi Klub Denmark, Rungstedvej 88, 2960 Rungsted Kyst

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Forskningens Døgn 2012
Period: 19 Apr 2012
Ulla Svensmark (Organizer)
National Space Institute

Description
En rejse i rummet - afstande i Universet og døde stjerner: Bidrag til "Bestil en forsker"

Bidrag til Forskningens Døgn 2012 via "Bestil en forsker"
ved seniorforsker, Jérôme Chenevez, DTU Space
Nærørm Gymnasium, Nærørm Hovedgade 30, 2850 Nærøm

Bidrag til "Bestil en forsker" til årets Forskningens Døgn 2012

Related event

Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Forskningens Døgn 2012
Period: 19 Apr 2012
Ulla Svensmark (Organizer)
National Space Institute

Description
"Science & Design": Bidrag til Forskningens Døgn 2012

Bygning 101 A, mødelokale 1, 2800 Kgs. Lyngby

Kl. 14.00-14.10
"Velkommen til FD12’s event Science & Design" v. Informationsspecialist Ulla Svensmark / DTU Space

Kl. 14.10-15.10
"Planck-missionen: Universet, himmelsk design og hemmelige data" v. Fysiker Carol Anne Oxborrow / DTU Space

Kl. 15.10-15.25
"Satellitopbygning, design & tests" v. Ingeniør Niels Christian Jessen / DTU Space

Kl. 15.25-15.35
Video: Launch af Planck-satellitten

Kl. 15.35-16.00
"Røntgenoptik & avanceret design" v. Seniorforsker Finn Erland Christensen / DTU Space

Kl. 16.00-16.30
"Med røntgenblik afslares naturens molekyler" v. Lektor Pernille Harris / DTU Kemi

Kl. 16.30-17.00
"Space – high speed tour gennem science & teknologi" v. Professor John Leif Jørgensen / DTU Space

Kl. 17.00-17.30
"Supernovaer´s betydning for Jorden" v. Professor Henrik Svensmark / DTU Space

Kl. 17.30-18.00
"En direktør gør status over en videnskabelig rejse på sit institut" v. Direktør Eigil Friis-Christensen / DTU Space

Foredragsrække samt udstilling i Vandrehallen i hovedbygningen 101 A bestående af Planck-spejl/-model samt Tågekammeret med kosmisk stråling

Related event

Forskningens Døgn 2012
19/04/2012 → …
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Invited talk at KRISS, Korea 2012: How to run and maintain a geomagnetic observatory
Period: 19 Mar 2012
Lars William Pedersen (Invited speaker)
National Space Institute
Geomagnetism

Description
Foredrag holdt på KRISS, Korea i forbindelse med reparation af magnetometer og træning af personale

Related event

Workshop at CYG Observatory
Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU
Period: 13 Mar 2012
Jens Olaf Pepke Pedersen (Lecturer)
National Space Institute
Sunclimate

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Månefup eller fakta
Period: 8 Mar 2012
Kristoffer Leer (Lecturer)
National Space Institute
Solar System Physics

Description
About Apollo
At Jels Planetarium

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

NOAA
Period: 1 Mar 2012 → 1 Jun 2012
Stine Kildegaard Rose (Visiting researcher)
Geodynamics
National Space Institute

Description
External stay: Laboratory of Satellite Altimetry, NOAA
Activity: Visiting an external institution › Visiting another research institution

Asparges På Mars
Period: 29 Feb 2012
Kristoffer Leer (Lecturer)
National Space Institute
Solar System Physics

Description
About Mars on Senior University in Slagelse

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
**Dimpling Lobe Progress: Planck HFI Core Team Meeting, IAS**

**Period:** 18 Jan 2012 → 20 Jan 2012

Carol Anne Oxborrow (Invited speaker)

National Space Institute

**Astrophysics**

**Description**
En videnskabelig/teknisk præsentation

**Related event**

**Planck HFI Core Team Meeting**

18/01/2012 → 19/01/2012
Paris, France

Activity: Talks and presentations › Conference presentations

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**Forskerfortælling: Introduktionsmøde for nye medarbejdere ved DTU**

**Period:** 10 Jan 2012

Jens Olaf Pepke Pedersen (Lecturer)

National Space Institute

**Sunclimate**

**Related external organisation**

**Unknown external organisation**

Activity: Talks and presentations › Conference presentations

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**UDTU: Teaching & Learning**

**Period:** 10 Jan 2012 → 13 Jan 2012

Jérôme Chenevez (Participant)

National Space Institute

**Astrophysics**

**Description**
Participation at the UDTU course on "Teaching & Learning" module 1

**Related event**

**UDTU Course: Teaching & Learning: Module 1**

10/01/2012 → 13/01/2012
Lyngby, Denmark

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

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**Ledestjørner, stjærekameraer og DTU som rumfartsuniversitet**

**Period:** 8 Dec 2011

John Leif Jørgensen (Speaker)

National Space Institute

**Measurement and Instrumentation Systems**

**Description**
Place: DTU Mødelokale 1, Bygn. 101A

**Related external organisation**

**Unknown external organisation**

Activity: Talks and presentations › Conference presentations
Global induction studies from space. From 1-D to 3-D conductivity models of the Earth’s mantle
Period: 5 Dec 2011
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Invited Presentation at AGU Fall Meeting 2011
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

SCARF - The Swarm Satellite Constellation Application and Research Facility
Period: 5 Dec 2011
Nils Olsen (Lecturer)
National Space Institute
Geomagnetism

Description
Presentation at AGU Fall Meeting 2013
Links:

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Børnenes Universitet 2011
Period: 17 Nov 2011
Allan Hornstrup (Participant)
National Space Institute
IT-Department
Documents:
Invitation - stjernernes børn 2011.pdf

Related event

Børnenes Universitet 2011: Stjernernes børn - mødet mellem nysgerrighed og evne
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Børnenes Universitet 2011
Period: 17 Nov 2011
Carol Anne Oxborrow (Participant)
National Space Institute
Astrophysics
Documents:
Invitation - stjernernes børn 2011.pdf

Related event
Børnenes Universitet 2011: Stjernernes børn - mødet mellem nysgerrighed og evne
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Finn Erland Christensen (Participant)
National Space Institute
Astrophysics
Documents:
Invitation - stjernernes børn 2011.pdf

Related event

Børnenes Universitet 2011: Stjernernes børn - mødet mellem nysgerrighed og evne
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ib Lundgaard Rasmussen (Participant)
National Space Institute
Astrophysics
Documents:
Invitation - stjernernes børn 2011.pdf

Related event

Børnenes Universitet 2011: Stjernernes børn - mødet mellem nysgerrighed og evne
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ulla Svensmark (Organizer)
National Space Institute
Documents:
Invitation - stjernernes børn 2011.pdf

Related event

Børnenes Universitet 2011: Stjernernes børn - mødet mellem nysgerrighed og evne
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Explore Talks
Period: 17 Nov 2011
Hans Ulrik Nørgaard-Nielsen (Participant)
National Space Institute
Astrophysics

Related event
DTU Explore Talks: Planck og Liv i Universet
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Explore Talks
Period: 17 Nov 2011
Ib Lundgaard Rasmussen (Participant)
National Space Institute
Astrophysics

Related event

DTU Explore Talks: Planck og Liv i Universet
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Explore Talks
Period: 17 Nov 2011
Ulla Svensmark (Organizer)
National Space Institute

Related event

Planck: Dimpling Lobes for 857GHz Beam Map: Planck HFI Pre-Core Team Systematics Meeting
Period: 9 Nov 2011 → 10 Nov 2011
Carol Anne Oxborrow (Lecturer)
National Space Institute
Astrophysics

Description
APC, Paris, 9.-10. nov. 2011

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Hybrid scientific computing using Interval Analysis, Homotopy and Algebraic Geometry for Photogrammetry, GPS and GIS
Period: 7 Nov 2011
Francesc/François Antón Castro (Keynote speaker)
National Space Institute
Geodesy

Related event

International Workshop on Geoinformation Advances
07/11/2012 → 08/11/2012
Johor Bahru, Malaysia
Activity: Talks and presentations › Conference presentations
LOFT Science Meeting (External organisation)
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description
LOFT Science Meeting, October 26-28, 2011, Science Park, Amsterdam, the Netherlands

Member of the Scientific Organizing Commitee for the LOFT Science Meeting, October 26-28, 2011, Science Park, Amsterdam, the Netherlands

Body type: Scientific Organizing Commitee
Degree of recognition: International
Links:

Related external organisation
LOFT Science Meeting
Activity: Membership › Membership of commitees, commissions, boards, councils, associations, organisations, or similar

Camera-based Navigation in Space: Lecture at Ny Lyngbygård
Period: 13 Oct 2011
Mathias Benn (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Grib talentet - og lad innovationen blomstre
Period: 6 Oct 2011
John Leif Jørgensen (Speaker)
National Space Institute
Measurement and Instrumentation Systems
Documents:
InnovationÅbentHus6okt.pdf

Related event
Grib talentet - og lad innovationen blomstre
06/10/2011 → 06/10/2011
Experimentarium, Hellerup
Activity: Other

Plack projektet: Evigt som pyramidene
Period: 6 Oct 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Hellerup skole, Hellerup
Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Plack projektet: Evigt som pyramiderne
Period: 30 Sep 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Skolen på Islands Brygge, Kbh. S.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Plack projektet: Evigt som pyramiderne
Period: 30 Sep 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Prins Henriks skole, Frederiksberg

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Plack projektet: Evigt som pyramiderne
Period: 29 Sep 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Virum Skole, Virum

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Plack projektet: Evigt som pyramiderne
Period: 28 Sep 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Langelinieskolen, Kbh. Ø.

Related external organisation
**Plack projektet: Evigt som pyramiderne**
Period: 26 Sep 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

**Description**
Place: Kulturstation Vanløse

**Related external organisation**

**Besat af rumraketter**
Period: 20 Sep 2011
John Leif Jørgensen (Speaker)
National Space Institute
Measurement and Instrumentation Systems

**Description**
Place: Tycho Brahe Planetariet, København
Links:
http://www.vcaf.dk/1351 (EXT-OA)

**Related external organisation**

**The Extreme and Variable High Energy Sky: A SCIENCE WORKSHOP IN SARDINIA**
Period: 19 Sep 2011 → 23 Sep 2011
Jérôme Chenevez (Speaker)
Astrophysics
National Space Institute

**Description**
First superburst observed by INTEGRAL/JEM-X On February 13, 2011, the X-ray monitor JEM-X onboard INTEGRAL observed for the first time a superburst, which occurred from the Galactic bulge low mass X-ray binary SAX J1747.0-2853. This event is also noticeable in light-curves from the MAXI all-sky monitor onboard the International Space Station. Three days earlier, a flare at GeV energy was detected by the Fermi/LAT instrument from a position consistent with SAX J1747.0-2853, marking the beginning of a new outburst from this transient X-ray source. This talk will present the JEM-X data, showing that the superburst is immediately preceded by a 30 minute long burst. This exceptional sequence of events makes this first superburst ever observed from SAX J1747.0-2853 a very peculiar one. In particular, we will discuss the possibility for the intermediate long burst to act as a firestarter for the superburst.
Place: Chia Laguna, Italy
Degree of recognition: International
Links:
http://www.iasf-roma.inaf.it/extremesky_chia2011 (REL-OA)

**Related event**

**A Science Workshop In Sardinia: The Extreme and Variable High Energy Sky**
Sardinia, Italy
Activity: Talks and presentations › Conference presentations
The Extreme and Variable High Energy Sky (External organisation)
Period: 19 Sep 2011 → 23 Sep 2011
Søren Brandt (Participant)
National Space Institute
Astrophysics
Description
A Science Workshop in Sardinia
Chia Laguna (Cagliari) - Italy
19 - 23 September 2011
Member of Scientific Advisory Committee
Body type: Scientific Advisory Committee
Degree of recognition: International
Links:
http://www.iasf-roma.inaf.it/extremesky_chia2011/index.htm (Workshop website.)
Related external organisation
The Extreme and Variable High Energy Sky
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

12th Meeting of the ASS High Energy Astrophysics Division
Period: 7 Sep 2011 → 10 Sep 2011
Jérôme Chenevez (Participant)
National Space Institute
Astrophysics
Description
What can NuSTAR do for X-ray bursts?
Poster
Related event
12th Meeting of the ASS High Energy Astrophysics Division
07/09/2011 → 10/09/2011
Newport, RI, United States
Activity: Attending an event › Participating in or organising a conference

Hybrid scientific computing using Interval Analysis, Homotopy and Algebraic Geometry for Photogrammetry, GPS and GIS
Period: Jul 2011
Francesc/François Antón Castro (Invited speaker)
National Space Institute
Geodesy
Description
Invited lectures at Tsinghua University and Shandong University
Related event
8th International Symposium on Voronoi Diagrams in Science and Engineering
28/06/2011 → 30/06/2011
Qingdao, China
Activity: Talks and presentations › Conference presentations
INTEGRAL observations of long X-ray bursts Type I X-ray bursts are thermonuclear explosions in the surface layers of a neutron star. They are generally characterized by an exponential decay phase, which duration ranges typically between a few seconds and a couple of minutes, and are explained by the unstable nuclear burning of a mixture of helium and hydrogen. However, some bursts have occasionally been observed with decay times of a few tens of minutes. Because of their duration and energy release these rare long bursts appear as intermediate between the above-mentioned short X-ray bursts and exceptional superbursts that last several hours and are thought to arise from carbon shell ashes in the layers below the surface of the neutron star. Thanks to the wide field of view of the JEM-X coded-mask X-ray monitor aboard the INTEGRAL satellite many X-ray sources are simultaneously observed in the 3-35 keV energy range, that makes it possible to monitor several X-ray bursters in one shot and/or the occurrence of rare events. So far, a good number of intermediate long bursts have been detected by INTEGRAL, and the mechanisms up to high energies of these unusual events have been investigated. With this research we aim to inquire the relationship between nuclear ignition processes, burning regimes, and accretion states of the binary system, that lead up to long bursts. In particular, a handful of long bursts have been observed that exhibit dual decay phases with an initial spike similar to a normal short burst; we discuss the possibility for such twofold bursts to be some kind of link between different burning regimes. Depending on the composition of the accreted material, intermediate long bursts may be explained by either the unstable burning of a large pile of mixed hydrogen and helium, or the ignition of a thick pure helium layer. The latter case is particularly expected at very low accretion rates, which seem to be prevalent in ultra-compact binaries; it may also provide an opportunity to study the transition from a hydrogen-rich bursting regime to a pure helium regime. On February 13, 2011, INTEGRAL observed its first superburst, from the transient source SAX J1747.0-2853 (see ATel 3183). At the time of writing, only very preliminary observation results are available, but analysis results from this spectacular event will also be presented at the conference.

Place: St. Petersburg
Degree of recognition: International
Links:

Related event
International Conference Physics of Neutron Stars
11/07/2011 → 15/07/2011
St. Petersburg, Russian Federation
Activity: Talks and presentations › Conference presentations

Sjælkompasset der ændrede rumfarten
Period: 31 May 2011
John Leif Jørgensen (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Description
Danmarks første satellit, "Ørsted", har givet verden de mest nøjagtige magnetfeltsmodeller og -kort over Jorden, der nogensinde er fremstillet.
Foredrag arrangeret af Ingeniørhuset, Kalvebod Brygge 31-33, Kbh. (Med tilmelding til IDA)
Links:
http://rumfart.dk/vis.asp?moedeid=270

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

LOFT mission concept Science Study Team (External organisation)
Period: 25 May 2011 → 31 Dec 2013
Søren Brandt (Participant)
1) Define and document, jointly with the ESA Study Scientist, the scientific requirements for the LOFT mission and for its payload.
2) Define and document the main characteristics of the payload that will satisfy the science requirements.
3) Advise the ESA internal study team on the scientific implication of the proposed designs.
4) Support the ESA internal study team during the industrial study phase.
5) Provide input to the Report at the end of the Assessment Study, especially on the science related sections.

Body type: ESA Science Study Team
Degree of recognition: International
Links:
http://sci.esa.int/science-e/www/area/index.cfm?fareaid=125 (ESA LOFT home page)

Related external organisation

LOFT mission concept Science Study Team
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Ekstern undervisning
Period: 11 May 2011
Jérôme Chenevez (Lecturer)

Astrophysics
National Space Institute

Description
Forelæsning til kandidat kurset om "Kompakte Objekter og Relativistisk Astrofysik" (127511) ved Niels Bohr Institut, KU.

Forelæsning om neutronstjerner og X-ray bursts.
Links:
https://sis.ku.dk/kurser/viskursus.aspx?knr=127511

Related external organisation

University of Copenhagen
Thorvaldensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

En bid af kundskabens frugt på DTU Space
Period: 30 Apr 2011
Ulla Svensmark (Organizer)

National Space Institute

Related event

En bid af kundskabens frugt på DTU Space
30/04/2011 → 30/04/2011
Rockefeller Kompleksset, København Ø.
Activity: Attending an event › Participating in or organising a conference

På tommelfinger rundt i Solsystemet
Period: 29 Apr 2011
John Leif Jørgensen (Speaker)

National Space Institute
Measurement and Instrumentation Systems

Description
Place: Naturvidenskabernes Hus (NVH), Bjerringbro
Links:
http://www.nvhus.dk (EXT-OA)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramidene
Period: 29 Apr 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Frederiksberg Gymnasium

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

6th IACHEC meeting
Period: 11 Apr 2011 → 14 Apr 2011
Carl Budtz-Jørgensen (Participant)
National Space Institute
Astrophysics

Description
Crab intensity from JEM-X and a source of "deadtime"

Place: Villa Grazioli, Grottaferrata, Italy 11-14 April 2011
Links:
http://web.mit.edu/iachec/meetings/2011/Presentations/Westergaard_JEMX.pdf (EXT-OA)

Related event

6th IACHEC meeting
11/04/2011 → 14/04/2011
Grottaferrata, Italy
Activity: Attending an event › Participating in or organising a conference

6th IACHEC meeting
Period: 11 Apr 2011 → 14 Apr 2011
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description
Crab intensity from JEM-X and a source of "deadtime"

Place: Villa Grazioli, Grottaferrata, Italy 11-14 April 2011
Links:
http://web.mit.edu/iachec/meetings/2011/Presentations/Westergaard_JEMX.pdf (EXT-OA)
6th IACHEC meeting
Period: 11 Apr 2011 → 14 Apr 2011
Carol Anne Oxborrow (Participant)
National Space Institute
Astrophysics

Description
Crab intensity from JEM-X and a source of "deadtime"

Place: Villa Grazioli, Grottaferrata, Italy 11-14 April 2011
Links:
http://web.mit.edu/iachec/meetings/2011/Presentations/Westergaard_JEMX.pdf (EXT-OA)

6th IACHEC meeting
Period: 11 Apr 2011 → 14 Apr 2011
Finn Erland Christensen (Participant)
National Space Institute
Astrophysics

Description
NuSTAR optic calibration

Links:

6th IACHEC meeting
Period: 11 Apr 2011 → 14 Apr 2011
Nicolai Brejnholt (Participant)
National Space Institute
Astrophysics

Description
NuSTAR optic calibration

Links:
Crab intensity from JEM-X and a source of "deadtime"

Period: 11 Apr 2011 → 14 Apr 2011
Niels Jørgen Stenfeldt Westergaard (Speaker)
National Space Institute
Astrophysics

Description
Place: Villa Grazioli, Grottaferrata, Italy 11-14 April 2011
Links:
http://web.mit.edu/iachec/meetings/2011/Presentations/Westergaard_JEMX.pdf (EXT-OA)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

NuSTAR optic calibration

Period: 11 Apr 2011 → 14 Apr 2011
Niels Jørgen Stenfeldt Westergaard (Speaker)
National Space Institute
Astrophysics

Links:

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Workshop on GRB with Lomonosov & the UFFO meeting

Period: 9 Apr 2011
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

Workshop on GRB with Lomonosov & the UFFO meeting
08/04/2011 → 12/04/2011
Seoul, Korea, Republic of
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Klima-satellit synger på sidste vers

Period: 8 Apr 2011
Per Knudsen (Speaker)
National Space Institute
Geodesy

Description
Klippefast viden om klimaforandringerne er afgørende, mener et forskerhold, der er på charmefølsiv for opsætning af ny klima-satellit på geovidenskabernes konference i Wien i denne uge.

Links:
Related event

European Geosciences Union General Assembly 2011
03/04/2011 → 08/04/2011
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 28 Mar 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Sct. Joseph Søstrenes skole, Charlottenlund

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 21 Mar 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Sct. Joseph Søstrenes skole, Charlottenlund

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 11 Feb 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Bjørns Internationale Skole, København Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 11 Feb 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: Bjørns Internationale Skole, København Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 26 Jan 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 8.B. på Toftevangsskolen, Birkerød

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 26 Jan 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 8.A. Toftevangsskolen, Birkerød

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck Projektet: Evigt som pyramiderne
Period: 26 Jan 2011
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 7.A. Toftevangskolen, Birkerød

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Geometry and Algebra
Period: 2010
Francesc/François Antón Castro (Lecturer)
National Space Institute
Geodesy

Description
Vie et mort des étoiles: Life and death of the stars  
Period: 15 Dec 2010  
Jérôme Chenevez (Speaker)  
National Space Institute  
Astrophysics  
Description  
Note: Deltagelse til den franske Naturvidenskabelige Festival organiseret af den franske Ambassade i Prins Henrik franske skole.  
Related external organisation  
Lycée français Prins Henrik, Frederiksberg, Denmark  
Activity: Other

CHAOS-4 - A high-resolution geomagnetic field model derived from low-altitude CHAMP data  
Period: 13 Dec 2010  
Nils Olsen (Lecturer)  
National Space Institute  
Geomagnetism  
Description  
Presentation at AGU Fall Meeting 2010  
Links:  
Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations

Mantle conductivity model derived from 9 years of CHAMP, Ørsted, and SAC-C magnetic data  
Period: 13 Dec 2010  
Nils Olsen (Invited speaker)  
National Space Institute  
Geomagnetism  
Description  
Invited Presentation at AGU Fall Meeting 2010  
Degree of recognition: International  
Links:  
http://abstractsearch.agu.org/meetings/2010/FM/sections/DI/sessions/DI31B/abstracts/DI31B-05  
Related event  
2010 AGU Fall Meeting  
13/12/2010 → 17/12/2010  
San Francisco, CA, United States  
Activity: Talks and presentations › Conference presentations
Gamma and X-ray astronomy - a personal perspective
Period: 24 Nov 2010
Søren Brandt (Lecturer)
National Space Institute
Astrophysics

Description
Seminar given at ESOC, Darmstadt.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

DNT i tid & rum samt Planck projektet - evigt som pyramiderne
Period: 17 Nov 2010
Ulla Svensmark (Organizer)
National Space Institute

Description
En spændende dag på DTU: DNT i tid & rum samt Planck projektet - evigt som pyramiderne

Documents:
InvitationNov2010MEver3.JPG

Related event

DNT i tid & rum samt Planck projektet - evigt som pyramiderne
17/11/2010 → 17/11/2010
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

En spændende dag på DTU: DNT i tid & rum samt Planck projektet - evigt som pyramiderne
Period: 17 Nov 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Bioteket. Bygn. nr. 221. lok. 021
Documents:
InvitationNov2010MEver3.JPG

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Liv i solsystemet
Period: 16 Nov 2010
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Syddansk Universitet, Odense

Related external organisation
**Præsentation af udvalgte forskningsområder anno 2010 på DTU Space**
**Period:** 2 Nov 2010
**Martin Andreas Bødker Enghoff (Speaker)**
National Space Institute

**Description**
Place: Rockefeller, Kbh. Ø.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Præsentation af udvalgte forskningsområder anno 2010 på DTU Space**
**Period:** 2 Nov 2010
**Hans Ulrik Nørgaard-Nielsen (Speaker)**
National Space Institute

**Description**
Place: Rockefeller, Kbh. Ø.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Præsentation af udvalgte forskningsområder anno 2010 på DTU Space**
**Period:** 2 Nov 2010
**Ulla Svensmark (Organizer)**
National Space Institute

**Description**
Præsentation af udvalgte forskningsområder anno 2010 på DTU Space

Place: Rockefeller, Kbh. Ø.

**Related event**

**Præsentation af udvalgte forskningsområder anno 2010 på DTU Space**
02/11/2010 → 02/11/2010
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

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**Planck projektet - Evigt som pyramiderne**
**Period:** 6 Oct 2010
**Carol Anne Oxborrow (Speaker)**
National Space Institute

**Astrophysics**

**Description**
Place: 6. klasse, Kildeskolen, Valby

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations
Planck projektet - Evigt som pyramiderne
Period: 6 Oct 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 3. klasse, Kildeskolen, Valby

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Stjernenes liv og død: Thermonuclear explosions on neutron stars observed by JEM-X
Period: 5 Oct 2010
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics

Description
Place: Danmarks Tekniske Universitet, 101, S02
Documents:
DTU_fyraften_JC.pdf
Links:
http://www.explore.dtu.dk/OPLEV/Fyraftensm%c3%b8der/Stjernernes%20liv%20og%20d%c3%b8d.aspx (REL-OA)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck projektet - Evigt som pyramiderne
Period: 4 Oct 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 2.g., Allerød Gymnasium

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck projektet - Evigt som pyramiderne
Period: 4 Oct 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 3.g., Allerød Gymnasium
Planck projektet - Evigt som pyramiderne
Period: 1 Oct 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: 6.a., Toftevangskolen, Birkerød

Planck projektet - Evigt som pyramiderne
Period: 30 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: 4.a., Sct. Joseph Søstrenes Skole, Charlottenlund
**Planck projektet - Evigt som pyramiderne**
Period: 29 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

**Description**
Place: 2.b., Nordregårds-skolen, Kastrup/Tårnby

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Planck projektet - Evigt som pyramiderne**
Period: 29 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

**Description**
Place: 2.a., Nordregårds-skolen, Kastrup/Tårnby

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Planck projektet - Evigt som pyramiderne**
Period: 28 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

**Description**
Place: 7. klasse, Hillerød Lille Skole

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Planck projektet - Evigt som pyramiderne**
Period: 28 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

**Description**
Place: 6. klasse, Hillerød Lille Skole

**Related external organisation**

**Unknown external organisation**
8th INTEGRAL Workshop
Period: 27 Sep 2010 → 29 Sep 2010
Søren Brandt (Participant)
National Space Institute
Astrophysics

Description
Scientific Organizing Committee, 8th INTEGRAL Workshop, “The Restless Gamma-ray Universe”, 27th-30th September 2010, Dublin Castle, Dublin, Ireland

Body type: Scientific Organizing Committee
Degree of recognition: International
Links:

Related event

8th INTEGRAL Workshop : The Restless Gamma-ray Universe
27/09/2010 → 30/09/2010
Dublin, Ireland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Planck projektet - Evigt som pyramiderne
Period: 27 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 0.-3. klasse, Gribskov skole, Helsinge

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Planck projektet - Evigt som pyramiderne
Period: 27 Sep 2010
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: 4.-7. klasse, Gribskov skole, Helsinge

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

38th Scientific Assembly of the Committee on Space Research
Period: 18 Jul 2010 → 25 Jul 2010
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

38th Scientific Assembly of the Committee on Space Research
18/07/2010 → 25/07/2010
Bremen, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

University Satellites: Lomonosov, RELEC, Tatiana
Period: 7 Jun 2010 → 10 Jun 2010
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

University Satellites: Lomonosov, RELEC, Tatiana
07/07/2010 → 10/07/2010
Moscow, Russian Federation
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

 På tomemfinger rundt i solsystemet
Period: 31 May 2010
John Leif Jørgensen (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Description
I filmen om Apollo 13s mislykkede månfærd bliver NASAs ingeniører og astronauter vist som de helt store helte, der med snarrådighed, mod og ingeniørkunst redder besætningens liv, efter at en ilttank på rumfartøjet eksploderede kort efter opsendelsen, og derved redder både nationens ære og besætningens liv.

Foredrag arrangeret af IDA, Ingeniørhuset
Links:
http://rumfart.dk/vis.asp?moedeid=260

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Small Satellite Systems and Services
Period: 31 May 2010 → 4 Jun 2010
Mathias Benn (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Description
Presentation of the papers:
Inflight Calibration of a Vision Based Sensor for Pose and Position Determination Inbetween Satellites.
Star Trackers on Spinning Spacecrafts.

Related event

Small Satellite Systems and Services
31/05/2010 → 04/06/2010
Funchal, Madeira, Portugal
Activity: Talks and presentations › Conference presentations
Space Technology: Lecture at Kolding Gymnasium
Period: 6 May 2010
Mathias Benn (Lecturer)
National Space Institute
Measurement and Instrumentation Systems

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En gigantisk rejse i tid - mellem Universets begyndelse og nu’et
Period: 20 Apr 2010
Shfaqat Abbas Khan (Speaker)
National Space Institute

Description
Place: Rockefeller, Kbh. Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En gigantisk rejse i tid - mellem Universets begyndelse og nu’et
Period: 20 Apr 2010
Henrik Svensmark (Speaker)
National Space Institute

Description
Place: Rockefeller, Kbh. Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En gigantisk rejse i tid - mellem Universets begyndelse og nu’et
Period: 20 Apr 2010
Arne Heilmann-Clausen (Speaker)
National Space Institute

Description
Place: Rockefeller, Kbh. Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

En gigantisk rejse i tid - mellem Universets begyndelse og nu’et
Period: 20 Apr 2010
Allan Hornstrup (Speaker)
National Space Institute

Description
Place: Rockefeller, Kbh. Ø.
**Activity: Talks and presentations › Conference presentations**

**En gigantisk rejse i tid: - mellem Universets begyndelse og nu’et**

**Period:** 20 Apr 2010

**Shfaqat Abbas Khan (Speaker)**

National Space Institute

Geodesy

**Description**

Place: Rockefeller, Kbh. Ø.

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**En gigantisk rejse i tid: - mellem Universets begyndelse og nu’et**

**Period:** 20 Apr 2010

**Henrik Svensmark (Speaker)**

National Space Institute

Sunclimate

**Description**

Place: Rockefeller, Kbh. Ø.

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**En gigantisk rejse i tid: - mellem Universets begyndelse og nu’et**

**Period:** 20 Apr 2010

**Arne Heilmann-Clausen (Speaker)**

National Space Institute

Electronic Engineering

**Description**

Place: Rockefeller, Kbh. Ø.

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**En gigantisk rejse i tid: - mellem Universets begyndelse og nu’et**

**Period:** 20 Apr 2010

**Allan Hornstrup (Speaker)**

National Space Institute

IT-Department

**Description**

Place: Rockefeller, Kbh. Ø.
**En gigantisk rejse i tid: - mellem Universets begyndelse og nu´et**

Period: 20 Apr 2010  
Ulla Svensmark (Organizer)  
National Space Institute

**Description**
En gigantisk rejse i tid: - mellem Universets begyndelse og nu´et

**Related event**

**En gigantisk rejse i tid: - mellem Universets begyndelse og nu´et**  
20/04/2010 → 20/04/2010  
København Ø., Denmark

**Activity:** Attending an event › Participating in or organising workshops, courses, seminars etc.

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**Hvor blev vandet af på Mars?**

Period: 20 Apr 2010  
Susanne Vennerstrøm (Speaker)  
National Space Institute

**Description**

**Links:**  
http://www.dr.dk/DR2/Danskerne+akademi/Natur_Matematik/Hvor_blev_vandet_af_paa_Mars.htm (EXT-OA)

**Related external organisation**

**Danskernes Akademi, DR**

**Activity:** Talks and presentations › Talks and presentations in private or public companies and organisations

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**Multi-temporal images and semi-automatic map updating**

Period: 4 Mar 2010  
Allan Aasbjerg Nielsen (Speaker)  
National Space Institute  
Geodesy

**Description**
Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

DTU Explore på Rockefeller
Period: 28 Jan 2010
Ulla Svensmark (Organizer)
National Space Institute

Related event

DTU Explore på Rockefeller: Videndeling på tværs af DTUs organisationer
28/01/2010 → 28/01/2010
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Explore på Rockefeller: Videndeling på tværs af DTUs organisationer
Period: 28 Jan 2010
Allan Hornstrup (Speaker)
National Space Institute

Description
Place: Rockefeller, Kbh. Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

DTU Explore på Rockefeller: Videndeling på tværs af DTUs organisationer
Period: 28 Jan 2010
Carol Anne Oxborrow (Speaker)
National Space Institute

Astrophysics

Description
Place: Rockefeller, Kbh. Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kernel methods in change detection based on generalised multivariate difference images
Period: 28 Jan 2010
Allan Aasbjerg Nielsen (Speaker)
National Space Institute

Geodesy

Description
Note: Invited contribution
Place: Center for Remote Sensing of Land Surfaces, University of Bonn, Germany

Related external organisation

Unknown external organisation
En anden klimatæori, klimaforandringer og kosmisk stråling  
Period: 25 Jan 2010  
Martin Andreas Bødker Enghoff (Speaker)  
National Space Institute  
Sunclimate  

Description  
Place: Odense Rotaryklub  

Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

Cosmoclimatology: How stars can affect climate  
Period: 13 Jan 2010  
Martin Andreas Bødker Enghoff (Lecturer)  
Sunclimate  
National Space Institute  

Description  
Note: HC Ørsted-instituttet, Københavns Universitet for studerende på kurset "Atmosfærisk Miljøkemi".  

Related external organisation  
University of Copenhagen  
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities  

Solens indflydelse på Jordens klima: Er skyer fra rummet?  
Period: 13 Jan 2010  
Martin Andreas Bødker Enghoff (Speaker)  
National Space Institute  
Sunclimate  

Description  
Place: Vallekilde-hørve Friskole  

Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

Cosmoclimatology: How space can affect climate on Earth  
Period: 1 Jan 2010  
Martin Andreas Bødker Enghoff (Speaker)  
National Space Institute  
Solar System Physics  

Description  
Surprisingly the mechanisms leading to cloud formation are still not well described, making clouds the major source of uncertainty in understanding Earth’s climate. One mechanism that can lead to the formation of cloud condensation nuclei is that of ion induced nucleation – formation of molecular clusters enhanced by ions. Cosmic rays are a major contributor to the ionization of Earth and the amount of these rays reaching the atmosphere is controlled by the activity of the Sun, providing a link between solar activity and climate on Earth. In this talk I will explain the background of the theory of Cosmoclimatology and present some of the evidence for the theory – from paleoclimate, satellite observations, and
experiments - on timescales from minutes to millions of years

**Related external organisation**

**Aarhus University**  
Inge Lehmanns Gade 10, 8000, Aarhus C, Denmark  
*Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities*

**NuSTAR (External organisation)**  
Period: 1 Jan 2010 → …  
Jérôme Chenevez (Participant)  
National Space Institute  
Astrophysics  

**Description**  
NuSTAR: Nuclear Spectroscopic Telescope Array  
Member of NuSTAR Science team  

*Body type: NASA*
*Degree of recognition: International*

**Related external organisation**

**NuSTAR**  
*Activity: Membership › Membership of research networks or expert groups*

**Dansk Metal besøger DTU Space - en palette af projektpåvisningar**  
Period: 9 Nov 2009  
Ulla Svensmark (Organizer)  
National Space Institute  

**Related event**

**Dansk Metal besøger DTU Space - en palette af projektpåvisningar**  
København Ø., Denmark  
*Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.*

**Dansk Metal besøger DTU Space - en palette af projektpåvisningar**  
Period: 9 Nov 2009  
Shfaqat Abbas Khan (Participant)  
National Space Institute  
Geodesy  

**Related event**

**Dansk Metal besøger DTU Space - en palette af projektpåvisningar**  
København Ø., Denmark  
*Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.*

**Dansk Metal besøger DTU Space - en palette af projektpåvisningar**  
Period: 9 Nov 2009  
Arne Heilmann-Clausen (Participant)  
Electronic Engineering  
National Space Institute
Related event

Dansk Metal besøger DTU Space - en palette af projektpræsentationer
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Dansk Metal besøger DTU Space - en palette af projektpræsentationer
Period: 9 Nov 2009
Allan Hornstrup (Participant)
Astrophysics
National Space Institute

Related event

Dansk Metal besøger DTU Space - en palette af projektpræsentationer
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Solens inflydelse på Jordens klima
Period: 3 Nov 2009
Martin Andreas Bødker Enghoff (Speaker)
National Space Institute
Sunclimate
Description
Place: Nykøbing Sjælland Rotaryklub

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

60th International Astronautical Conference 2009
Period: 14 Oct 2009
Mathias Benn (Speaker)
National Space Institute
Measurement and Instrumentation Systems
Description

Related event

60th International Astronautical Conference 2009
12/10/2009 → 16/10/2009
Daejeon, Korea, Republic of
Activity: Talks and presentations › Conference presentations

En rejse i Rummet: Solsystemet eller Stjernernes liv og død
Period: 21 Sep 2009
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics
Description
Den nedre atmosfære
Period: 17 Sep 2009
Martin Andreas Bødker Enghoff (Lecturer)
Sunclimate
National Space Institute

Description
Place: DTU
(Course lecturer)

Related organisation

Klimaforandring: Fra drivhus til supernovaer
Period: 16 Sep 2009
Martin Andreas Bødker Enghoff (Speaker)
National Space Institute
Sunclimate

Description
Place: Frederiksberg Rotaract Klub

Related external organisation

Elastic crustal uplift due to unloading of ice from the main outlet glaciers in southeast Greenland (G3); 2009
Shfaqat Abbas Khan (Speaker)
National Space Institute
Geodesy

Description
Place: Nuuk, Greenland

Related external organisation

Niels Bohr International Academy Summer School on Stellar Collapse, Compact Objects, Supernovae, and Gamma-Ray Bursts (External organisation)
Søren Brandt (Participant)
National Space Institute

Description
Body type: Local Organizing Committee
Degree of recognition: International

Related external organisation

Niels Bohr International Academy Summer School on Stellar Collapse, Compact Objects, Supernovae, and Gamma-Ray Bursts
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Period: 3 Jul 2009
Henrik Svensmark (Lecturer)
National Space Institute
Solar System Physics

Sunclimate

Description
Meget tyder på at processer i rummet har en direkte påvirkning på jordens klima og livet på Jorden. For eksempel solsystemets rejse gennem mælkevejen gennem de sidste 500 millioner år, giver anledning til henholdsvis kraftige istider og meget varme perioder. Gennem 10 års intensiv forskning er vi nu ved at få et sammenhængende billede, hvor alt tyder på at det er jordens skydække der er nøglen til at forstå Jordens klima. Og overraskende ser det ud til rummets fingeraftryk på klimaet kan findes overalt hvor vi leder, også i den globale opvarmning som der tales så meget om.

Henrik Svensmark holdt foredrag på University of The Faroe Islands
Links:

Related external organisation

International Symposium on Voronoi Diagrams in science and engineering (External organisation)
Period: 23 Jun 2009 → …
Francesc/François Antón Castro (Participant)
National Space Institute
Geodesy
Department of Informatics and Mathematical Modeling
Image Analysis and Computer Graphics

Description
Body type: Steering Committee
Degree of recognition: International

Related external organisation

International Symposium on Voronoi Diagrams in science and engineering
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

X- and gamma-ray Astronomy with JEM-X and INTEGRAL
Period: 17 Jun 2009
Søren Brandt (Speaker)
National Space Institute
Astrophysics
Documents:
X- and gamma-ray astronomy with JEM-X and INTEGRAL

Related event
Danish Physical Society - Nordic Meeting
16/06/2009 → 18/06/2009
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

2009 Annual Meeting of the Danish Physical Society
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
2009 Annual Meeting of the Danish Physical Society
16/06/2009 → 18/06/2009
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Det globale miljø: Klimaforandringer
Period: 9 May 2009
Martin Andreas Bødker Enghoff (Speaker)
National Space Institute
Sunclimate

Related external organisation
Søminestation
Holbæk, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Stjernenes liv og død: Fra stjerner til verden
Period: 24 Apr 2009
Jérôme Chenevez (Speaker)
National Space Institute

Description
Place: Virum gymnasium
Documents:
Stjerner.pdf

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Med en stjerne som nabo
Period: 23 Apr 2009
Martin Andreas Bødker Enghoff (Speaker)
National Space Institute
Suncimate

Description
Place: DTU, Forskningens Døgn

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

DU er en rummand
Period: 30 Jan 2009
Martin Andreas Bæcker Enghoff (Speaker)
National Space Institute
Suncimate

Description
Place: Bording Friskole

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 13 Dec 2008
Henrik Svensmark (Speaker)
National Space Institute
Suncimate

Description
Place: Brorfelde

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 6 Dec 2008
Henrik Svensmark (Speaker)
National Space Institute
Suncimate

Description
Place: Oslo, Norge

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 2 Dec 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

**Description**
Place: Fiolstræde, Kbh.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Kosmoklimatologi**
Period: 26 Nov 2008
Henrik Svensmark (Speaker)

National Space Institute
Sunclimate

**Description**

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Kosmoklimatologi**
Period: 25 Nov 2008
Henrik Svensmark (Lecturer)

National Space Institute
Sunclimate

**Description**
Note: Institut for Fysik og Astronomi

**Related external organisation**

**Aarhus University**
Inge Lehmanns Gade 10, 8000, Aarhus C, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

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**Kosmoklimatologi**
Period: 13 Nov 2008
Henrik Svensmark (Speaker)

National Space Institute
Sunclimate

**Description**
Place: Orion Planetariet, Jels

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Klima og Kosmos**
Period: 10 Nov 2008
Henrik Svensmark (Speaker)
National Space Institute
Solar System Physics

**Description**
Place: Museum Sønderjylland, Gram

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Kosmoklimatologi**
Period: 6 Nov 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

**Description**
Place: Rundetårn

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Best practices in phd supervision**
Period: 4 Nov 2008
Martin Andreas Børker Enghoff (Speaker)
National Space Institute
Sunclimate

**Related event**

**Best practices in phd supervision**
04/11/2008 → 04/11/2008
Envirosymp, Roskilde Universitet
Activity: Talks and presentations › Conference presentations

**Kosmoklimatologi**
Period: 1 Nov 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

**Description**
Place: Store Heddinge

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**The Geomagnetic Field: a Tool for Exploring the Earth’s Interior**
Period: 1 Nov 2008 → 1 Dec 2008
Nils Olsen (Speaker)
National Space Institute
Rummets betydning for klimaændringer
Period: 27 Oct 2008
Henrik Svensmark (Lecturer)
Sunclimate
National Space Institute

Description
Note: Folkeuniversitetskursus “Forhistorisk DNA, iskerner og klimaændringer”

Related external organisation
Borgerhuset, Tåstrup
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Cosmoclimatology - the influence of Cosmic Rays on Climate
Period: 14 Oct 2008
Henrik Svensmark (Lecturer)
Solar System Physics
National Space Institute

Description
Note: Norges Tekniske Vitenskapsakademii

Related external organisation
Nansensenteret, Bergen
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Architecture, Development and Implementation Plan of the Swarm SCARF
Period: 1 Oct 2008
Nils Olsen (Participant)
Solar System Physics
National Space Institute

Related external organisation
ESTEC
Netherlands
Activity: Other

Test data preparation and estimation of transfer functions from Swarm constellation data
Period: 1 Oct 2008
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
Test data preparation and estimation of transfer functions from Swarm constellation data
**The Geomagnetic Field: a Tool for Exploring the Earth’s Interior**  
*Period: 1 Oct 2008 → 31 Oct 2008*  
Nils Olsen (Lecturer)  
Solar System Physics  
National Space Institute  

**Related external organisation**  
University of Copenhagen  
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**En rejse i Rummet: Solsystemet eller Stjernernes liv og død**  
*Period: 22 Sep 2008 → 26 Sep 2008*  
Jérôme Chenevez (Lecturer)  
Astrophysics  
National Space Institute  

**Description**  
Place: Skole o/l i Stor København  
(Course lecturer)  
Links:  
http://www.formidling.dk/sw174.asp (REL-OA)

**Related external organisation**  
Unknown external organisation  
Activity: Other

**The 7th INTEGRAL Workshop (External organisation)**  
*Period: 8 Sep 2008 → 11 Sep 2008*  
Søren Brandt (Vice-chairman)  
National Space Institute  
Astrophysics  

**Description**  
*An INTEGRAL view of compact objects*, 8-11 September 2008, Copenhagen, Denmark  
Co-chair of Scientific Organizing Committee and member of Local Organizing Committee  

**Body type:** Scientific Organizing Committee and Local Organizing Committee  
**Degree of recognition:** International  
**Documents:**  
7th INTEGRAL Workshop photo  
7th INTEGRAL Workshop poster  
Links:  
http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=67 (Proceedings of the 7th INTEGRAL Workshop in Proceedings of Science)

**Related external organisation**  
The 7th INTEGRAL Workshop
Internal and External Field Separation
Period: 1 Sep 2008
Nils Olsen (Participant)
Solar System Physics
National Space Institute

Related event
Internal and External Field Separation: Examples and Pitfalls
01/09/2008 → 01/09/2008
Bern/CH
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Earth’s Magnetic Field
Period: 1 Sep 2008
Nils Olsen (Lecturer)
Solar System Physics
National Space Institute

Related event
The Earth’s Magnetic Field
01/09/2008 → 01/09/2008
Bern/CH
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 22 Aug 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

Description
Place: Gurre Slot

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

On the Input provided to the Swarm L2 Preparation Study
Period: 1 Aug 2008
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
On the Input provided to the Swarm L2 Preparation Study
01/08/2008 → 01/08/2008
DTU Space, Copenhagen
Activity: Talks and presentations › Conference presentations
On the Comprehensive Inversion Chain of the Swarm Level 2 Processor
Period: 1 Jun 2008
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
On the Comprehensive Inversion Chain of the Swarm Level 2 Processor
01/06/2008 → 01/06/2008
DTU Space, Copenhagen
Activity: Other

On the Comprehensive Inversion Chain of the Swarm Level 2 Processor
Period: 1 Jun 2008
Lars Tøffner-Clausen (Speaker)
National Space Institute
Solar System Physics

Related event
On the Comprehensive Inversion Chain of the Swarm Level 2 Processor
01/06/2008 → 01/06/2008
DTU Space, Copenhagen
Activity: Other

Solens inflydelse på Jordens Klima
Period: 27 May 2008
Martin Andreas Bødker Enghoff (Speaker)
National Space Institute
Sunclimate

Description
Place: Dansk Energi Brancheforenings Generalforsamling

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 23 May 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

Description
Place: DTU, Lyngby

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Solens indflydelse på Jordens klima
Period: 15 May 2008
Martin Andreas Bødker Enghoff (Speaker)
Thermonuclear explosions on neutron stars observed with JEM-X; 2: Lunch talk
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics

Exploring the Earth’s magnetic field: from Ørsted to Swarm
Period: 1 May 2008
Nils Olsen (Lecturer)
Solar System Physics
National Space Institute

3rd International Symposium on Formation Flying, Missions and Technologies
Period: 25 Apr 2008
Mathias Benn (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Deutsches Geoforschungszentrum
Period: 1 Apr 2008
Nils Olsen (Visiting researcher)
Solar System Physics
On the estimation of C-responses using synthetic Swarm data
Period: 1 Apr 2008
Nils Olsen (Lecturer)
Solar System Physics
National Space Institute

Related external organisation
ESTEC
Netherlands
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Kosmisk stråling og klima
Period: 10 Mar 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

Description
Place: Frederiksborg Byskole, Hillerød

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Kosmoklimatologi
Period: 7 Mar 2008
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

Description
Place: DTU, Lyngby

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

On the development of the xCHAOS Field Model
Period: 1 Mar 2008
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Place: University of Grenoble/F

Related external organisation
**Time Changes of the Recent Geomagnetic Field as Observed by Satellites**
Period: 1 Mar 2008
Nils Olsen (Lecturer)
National Space Institute

**Kosmoklimatologi**
Period: 12 Feb 2008
Henrik Svensmark (Speaker)
National Space Institute
Solar System Physics

**On the Comprehensive Inversion Chain of the Swarm Level 2 Processor**
Period: 1 Feb 2008
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

**Architecture Design Document (ADD) of the Swarm Level 2 Processor**
Period: 1 Jan 2008 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

**INTEGRAL Operations Coordination Group (External organisation)**
Period: 2007 → …
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Description**
The INTEGRAL Operations Coordination Group (IOCG) advises the INTEGRAL Mission Manager on all aspects of the operation and conduct of the Integral mission.

Representative for the JEM-X instrument on INTEGRAL

Body type: ESA advisory group
Degree of recognition: International
Links:
http://www.rssd.esa.int/index.php?project=INTEGRAL&page=About_INTEGRAL_Teams_IOCG (ESA's INTEGRAL Operations Coordination Group)

**Related external organisation**

**INTEGRAL Operations Coordination Group**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Instrumentation in Danish Astronomy**
Period: 13 Nov 2007
Allan Hornstrup (Keynote speaker)

**Description**
The workshop will cover presentations of the current work on instrumentation within the Danish Astronomical community, as well as presentations of new ideas. The workshop will discuss visions for the instrumentations, and if there still is a "raison d'être" for astronomical instrumentation in Denmark. Finally, the workshop will close by setting up a working group to review the needs and options in the technological areas of Danish Astronomy.

**Related event**

**Instrumentation in Danish Astronomy**
Activity: Talks and presentations › Conference presentations

**Five years of INTEGRAL**
Søren Brandt (Participant)

**Related event**

**Five years of INTEGRAL: A Science Workshop in Sardinia**
17/10/2007 → 19/10/2007
Cagliari, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Field campaigns and space missions for studies of high-altitude discharges**
Torsten Neubert (Speaker)

**Related event**

**Field campaigns and space missions for studies of high-altitude discharges**
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Analysis of thunderstorm systems and lightning activity associated with sprites observed during the Eurosprite campaigns:
1- Statistical studies
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics
Description
Place: Beijing, Kina

Analysis of thunderstorm systems and lightning activity associated with sprites observed during the Eurosprite campaigns:
2- Case studies
Olivier Chanrion (Speaker)
National Space Institute
Solar System Physics
Description
Place: Beijing, Kina
Analysis of thunderstorm systems and lightning activity associated with sprites observed during the Eurosprite campaigns:

1- Statistical studies

Period: 2 Jul 2007 → 13 Jul 2007

Olivier Chanrion (Speaker)
National Space Institute
Solar System Physics

The chemical impact of transient luminous events in the middle atmosphere

Period: 2 Jul 2007 → 13 Jul 2007

Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Place: Perugia, Italy

Compact objects and relativistic astrophysics

Period: 29 May 2007 → 1 Jun 2007

Jérôme Chenevez (Lecturer)
Astrophysics
National Space Institute
Links:

Related external organisation
University of Copenhagen
2D axisymmetrical particle modelling of the production of thermal runaway electrons by sprite streamers
Period: 16 Apr 2007 → 20 Apr 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics
Description
Place: Vienna
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

2D axisymmetrical particle modelling of the production of thermal runaway electrons by sprite streamers
Period: 16 Apr 2007 → 20 Apr 2007
Olivier Chanrion (Speaker)
National Space Institute
Solar System Physics
Description
Place: Vienna
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

3. Analysis of lightning associated with a sprite displaced from its parent positive cloud to ground lightning flash
Period: 16 Apr 2007 → 20 Apr 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics
Description
Place: Vienna
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Coupling of thunderstorms to the stratosphere, mesosphere, and ionosphere
Period: 16 Apr 2007 → 20 Apr 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics
Description
Place: Vienna
Related external organisation
Unknown external organisation
"Early"-type VLF perturbations observed in relation to sprites and elves during the eurosprite campaigns
Period: 16 Apr 2007 → 20 Apr 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Place: Vienna

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Sprite and lightning infrasound measurements during the 2005 Eurosprite campaign
Period: 16 Apr 2007 → 20 Apr 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Place: Vienna

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

2 gange liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Rødovre gymnasium

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

A semi-autonomous optical observatory for sprite observations; COST-P18
Period: 1 Jan 2007 → …
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Astrofysikken bag Mariko Moris kunst
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
Astrophysics
National Space Institute
Description
Place: AROS
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: Vanløse Kulturhus, Vanløse
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: Nyhollænder Skole, Frederiksberg
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: Busses Skole, Gentofte
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Vangeboskolen, Holte

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Pilegaardskolen, Kastrup

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Langhøjskolen, Hvidovre

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics

Description
Place: Nyhollænder Skole, Frederiksberg

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Byggeklodser til et Hurtigt Voksende Univers
Period: 1 Jan 2007 → …
Carol Anne Oxborrow (Speaker)
National Space Institute
Astrophysics
Description
Place: Langebjergskolen, Humlebæk
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Co-ordinated ground observations in support of the ASIM and TARANIS missions; COST-P18
Period: 1 Jan 2007
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics
Description
Place: Vienna
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Cosmological Consequences of the Formation of Cosmic Strings
Period: 1 Jan 2007 → …
Martin Landriau (Speaker)
National Space Institute
Astrophysics
Description
Place: McGill University, Canada
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Data access technical panel - status report I 2007
Period: 1 Jan 2007 → …
Gerhard Joos (Speaker)
National Space Institute
Geodesy
Description
Place: Digital Geospatial Information Working Group meeting and conference, Köln, Germany
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Data access technical panel - status report II 2007
Period: 1 Jan 2007 → …
Gerhard Joos (Speaker)
National Space Institute
Geodesy

Description
Place: Digital Geospatial Information Working Group meeting, Lillehammer, Norway

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

De ydre planeter: 2. dels kursus om Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

DRCs højdemodelaktiviteter: Dialogmøde om ny højdemodel
Period: 1 Jan 2007 → …
Thomas Knudsen (Speaker)
National Space Institute
Geodesy

Description
Place: Kort- og Matrikelstyrelsen

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet
Period: 1 Jan 2007 → …
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics

Description
Place: Hyltebjerg Skole i Vanløse

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

En rejse i rummet
Period: 1 Jan 2007 → …
Jérôme Chenevez (Speaker)
National Space Institute

Astrophysics

**Description**
Place: Bernadotteskolen i Hellerup

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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Field-aligned and ionospheric currents during northward IMF: Multi-satellite observations and global modelling: Invited presentation at the IUGG XXIV General Assembly
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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Forstå klimaforandringer i Arktis
Period: 1 Jan 2007 → …
Susanne Hanson (Speaker)
National Space Institute
Geodynamics

**Description**
Place: Teknisk Gymnasium, Silkeborg

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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Fyrtårne på nattetimmien
Period: 1 Jan 2007 → …
Allan Hornstrup (Speaker)
National Space Institute
Astrophysics

**Description**
Place: Køge bugt

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

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**Fyrtårne på nattehimlen**
Period: 1 Jan 2007 → …
Allan Hornstrup (Speaker)
National Space Institute

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**Global and local tide modeling; EGM2007- G9-1WE4O-001: Linear and non-linear tides from altimetry and GPS**
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute

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**Hydrograv - Improving Hydrological Models with Ground-Based and Space-Borne Time-lapse Gravity Surveys**
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute

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**INTEGRAL User Group (External organisation)**
Period: 1 Jan 2007 → …
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Description**
The INTEGRAL User Group is an advisory group for ESA's high energy observatory INTEGRAL. The task include:

1) Advise the Project Scientist on all matters relevant to maximising the scientific return of INTEGRAL within the boundary conditions.
2) Advise the Project Scientist on how to ensure that INTEGRAL maintains the principal characteristics of an observatory satisfying the objectives of the scientific community at large.
3) Act as a focus for the interests of the scientific community in INTEGRAL and act as an advocate for INTEGRAL within that community.
4) Maintain contact with the wider scientific community on matters specific to INTEGRAL (e.g. coordinated observations, science operations and General Observer interface) and to provide a route so that the community can advise ESA on INTEGRAL's scientific goals from a general point of view.
5) Monitor the ISOC and ISDC activities to ensure that they best meet the needs of the user community within the resources available.
6) Identify, in consultation with the Integral Operations Coordination Group (IOCG), a coherent calibration and performance verification policy.
7) Advise, in consultation with the IOCG, on the maintenance and possible further enhancement of the science ground segment with particular reference to the operational scenario, observatory products and database structure.
8) Participate in major programme reviews.

Body type: ESA INTEGRAL mission advisory group
Degree of recognition: International
Links:
http://www.rssd.esa.int/index.php?project=INTEGRAL&page=IUG (The INTEGRAL Users Group (IUG))

**Related external organisation**

**INTEGRAL User Group**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Integrating Satellite altimetry and tide gauge data for sea level mapping**
Period: 1 Jan 2007 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

**Description**
Place: Toulouse

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Integrating Satellite altimetry and tide gauge data for sea level mapping**
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

**Description**
Place: Toulouse

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations
International standards on data quality description
Period: 1 Jan 2007 → …
Gerhard Joos (Speaker)
National Space Institute
Geodesy

Description
Place: Herning, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Least Squares Adjustment: Linear and Nonlinear Weighted Regression Analysis
Period: 1 Jan 2007 → …
Allan Aasbjerg Nielsen (Other)
Geodesy
National Space Institute
Activity: Other

Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Folkeuniversitetet

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: 5 skoler

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics
Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Liv i Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Local to Regional Hydrological Model Calibration for the Okavango River Basin From In-Situ and Spaceborne Gravity Data
Period: 1 Jan 2007 → …
Pernille Engelbrekt Krogh (Speaker)
National Space Institute
Geodesy
Local to Regional Hydrological Model Calibration for the Okavango River Basin From In-Situ and Spaceborne Gravity Data
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Long X-ray burst monitoring with INTEGRAL: Dansk Fysisk Selskab årsmøde 2007
Period: 1 Jan 2007 → …
Jérôme Chenevez (Speaker)
National Space Institute
Astrophysics

Magnetospheric contributions to the near Earth magnetic field: Invited presentation at the IUGG XXIV General Assembly
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Mars Surface Magnetic Observatory: Presentation at the first GEP consortium meeting
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics
Mars Surface Magnetic Observatory: Presentation at the first GEP consortium meeting
Period: 1 Jan 2007 → …
José M.G. Merayo (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Merging GRACE gravimetry, satellite altimetry and in-situ data for Terrestrial water storage and flood monitoring;
EGU2007 G3-1WE2O-001
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Morphology and possible Causes of magnetic Disturbances near Mars: Invited presentation at the EGU General Assembly
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Multi-satellite estimation of the large-scale current system and convection pattern in the polar ionosphere – Comparison with groundbased measurements: Presentation at the Greenland Space Science Symposium
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics
Multi-satellite estimation of the large-scale current system and convection pattern in the polar ionosphere – Comparison with groundbased measurements: Presentation at the Greenland Space Science Symposium
Period: 1 Jan 2007 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Nyt fra Solsystemet
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics
Description
Place: Orion Planetariet
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Ocean tides in GRACE monthly averaged gravity fields; EGU2007 G9-1WE4O-004
Period: 1 Jan 2007 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy
Description
Place: EGU 2007 Meeting, Vienna, Austria
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Ocean tides in GRACE monthly averaged gravity fields; EGU2007 G9-1WE4O-004
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
Ocean tides in GRACE monthly averaged gravity fields II; EGU2007 G3-1WE5P-0348
Period: 1 Jan 2007 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

Proton Testing of Micro Advanced Stellar Compass: TEC-QCA Support Activity to PROBA-II
Period: 1 Jan 2007 → …
Peter Buch Guldager (Speaker)
National Space Institute
Measurement and Instrumentation Systems

Registrierungsdienste für Geoelemente unter besonderer Berücksichtigung von Datenqualitätsmaßen
Period: 1 Jan 2007 → …
Gerhard Joos (Participant)
**Geodesy**
National Space Institute

**Description**
Registrierungsdienste für Geoelemente unter besonderer Berücksichtigung von Datenqualitätsmaßen

Place: Leipzig, Germany

**Related event**
Registrierungsdienste für Geoelemente unter besonderer Berücksichtigung von Datenqualitätsmaßen
01/01/2007 → …
Leipzig, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Solen – at leve med en stjerne**
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

**Description**
Place: Folkeuniversitetet i Frederikssund

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**Solsystemet**
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Lecturer)
Astrophysics
National Space Institute

**Description**
Note: 12 times 2 lessons

**Related external organisation**
Folkeuniversitetet i Emdrup
Aarhus Universitet, Campus Emdrup, Tuborgvej 164, 2400, København NV, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**Terraforming**
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

**Description**
Place: SF Festival

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Terrestrial Water Storage Monitoring from GRACE and Satellite Altimetry in Bangladesh and the Okawango Delta (Botswana)
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Description
Place: ESA Hydrospace conference, Geneva, Switzerland

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

The ASIM payload for the International Space Station
Period: 1 Jan 2007 → …
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Place: Nara, Japan

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

The DNSC07 global marine gravity field
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Description
Place: San Francisco, CA

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
The DNSC07 global marine gravity field
Period: 1 Jan 2007 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

Description
Place: San Francisco, CA

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

The magnetic effect of atmospheric escape at Mars: Presentation at the EGU General Assembly
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

The Once and Future Moon
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: SF Festival

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

The sun, the solar wind and its interaction with the planets: Kursus i Planetfysik
Period: 1 Jan 2007 → …
Susanne Vennerstrøm (Guest lecturer)
Solar System Physics
National Space Institute

Related external organisation
Kenyatta University
Kenya
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

The world expedition Galathea 3 seen from Satellite Eye; EGU2007-ES3-1TH4O-001
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
Towards the next generation EGM, Progress in high order spherical harmonic expansion of the geopotential field
Period: 1 Jan 2007 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Towards the next generation EGM; Progress in satellite altimetry
Period: 1 Jan 2007 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

Using Covariance Descriptors for Image Based Change Detection and Revision of GIS Data: "Kortdage 2007"
Period: 1 Jan 2007 → …
Thomas Knudsen (Speaker)
National Space Institute
Geodesy

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Venus
Period: 1 Jan 2007 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Planetariet

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

X- and Gamma-ray Detector Development at DNSC
Period: 1 Jan 2007 → …
Irfan Kuvvetli (Speaker)
National Space Institute
Astrophysics

Description
Place: Sabanci Un. Karakoy Comm. Center

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Grønland rundt med POF’en: Foredrag i Dansk Geofysisk Forening
Period: 13 Dec 2006
Lars Stenseng (Participant)
National Space Institute
Geodynamics

Description
Grønland rundt med POF’en: Foredrag i Dansk Geofysisk Forening

Related event

Grønland rundt med POF’en: Foredrag i Dansk Geofysisk Forening
13/12/2006 → 13/12/2006
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Automatic change detection for semi-automatic map updates
Period: 16 Nov 2006
Thomas Knudsen (Participant)
National Space Institute
Geodesy

Related event

**Automatic change detection for semi-automatic map updates**
Map revision workshop, ProCaptura, Oslo
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Study of an Improved Comprehensive Magnetic Field Inversion Analysis for Swarm**
Period: 1 Nov 2006 → 30 Nov 2006
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

**Description**
Place: Swarm E2Eplus Progress Meeting 1, Copenhagen

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Blue Planet arrangement**
Period: 12 Sep 2006
Niels Lund (Speaker)
National Space Institute

**Description**
Place: Rockefeller Komplekset, København Ø.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Blue Planet arrangement**
Period: 12 Sep 2006
René Forsberg (Speaker)
National Space Institute
Geodynamics

**Description**
Place: Rockefeller Komplekset, København Ø.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Blue Planet arrangement**
Period: 12 Sep 2006
Henrik Svensmark (Speaker)
National Space Institute
Sunclimate

**Description**
Place: Rockefeller Komplekset, København Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Blue Planet arrangement
Period: 12 Sep 2006
Finn Erlend Christensen (Speaker)
National Space Institute
Astrophysics

Description
Place: Rockefeller Komplekset, København Ø.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Blue Planet arrangement
Period: 12 Sep 2006
Ulla Svensmark (Organizer)
National Space Institute

Related event

Blue Planet arrangement
København Ø., Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The 2005 Eurosprite Observation Campaign
Period: 28 Aug 2006 → 1 Sep 2006
Olivier Chanrion (Participant)
National Space Institute
Solar System Physics

Related event

The 2005 Eurosprite Observation Campaign
28/08/2006 → 01/09/2006
33rd Annual European Meeting on Atmospheric Studies by Optical Methods, Kiruna, Sweden.
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The 2005 Eurosprite Observation Campaign
Period: 28 Aug 2006 → 1 Sep 2006
Steen Laursen (Participant)
National Space Institute
Electronic Engineering

Related event

The 2005 Eurosprite Observation Campaign
28/08/2006 → 01/09/2006
33rd Annual European Meeting on Atmospheric Studies by Optical Methods, Kiruna, Sweden.
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
The 2005 Eurosprite Observation Campaign  
Period: 28 Aug 2006 → 1 Sep 2006  
Torsten Neubert (Participant)  
National Space Institute  
Solar System Physics  

Related event  
The 2005 Eurosprite Observation Campaign  
28/08/2006 → 01/09/2006  
33rd Annual European Meeting on Atmospheric Studies by Optical Methods, Kiruna, Sweden.  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

How Damaging are Time Gaps in Vector Data Coverage to Global Field Models?  
Period: 1 Aug 2006  
Nils Olsen (Participant)  
National Space Institute  
Solar System Physics  

Related event  
How Damaging are Time Gaps in Vector Data Coverage to Global Field Models?  
01/08/2006 → 01/08/2006  
GEOSPACE Consortium Meeting, Edinburgh  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The 6th INTEGRAL Workshop  
Period: 2 Jul 2006 → 8 Jul 2006  
Søren Brandt (Participant)  
National Space Institute  
Astrophysics  

Related event  
The 6th INTEGRAL Workshop: The Obscured Universe  
02/07/2006 → 08/07/2006  
Moscow, Russian Federation  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Detektion af bygninger i analoge og digitale billeder  
Period: 4 Apr 2006  
Thomas Knudsen (Participant)  
National Space Institute  
Geodesy  

Related event  
Detektion af bygninger i analoge og digitale billeder  
04/04/2006 → 04/04/2006  
Geoforum temamøde  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Study of an Improved Comprehensive Magnetic Field Inversion Analysis for Swarm  
Nils Olsen (Speaker)
Gravity geoid and geophysics – from data to models
Period: 27 Feb 2006
Gabriel Strykowski (Participant)
National Space Institute
Geodynamics

Particle simulation of sprite streamer
Period: 8 Jan 2006 → 11 Jan 2006
Olivier Chanrion (Speaker)
National Space Institute
Solar System Physics

High resolution Global gravity field from retracted 2-Hz ERS-1 altimetry
Period: 1 Jan 2006 → …
Ole Baltazar Andersen (Speaker)
National Space Institute
High resolution Global gravity field from retracked 2-Hz ERS-1 altimetry
Period: 1 Jan 2006 → …
Per Knudsen (Speaker)
National Space Institute

On the CHAOS Magnetic Field Model and a Space-Domain Approach to Study Secular Variation using Satellite Data
Period: 1 Jan 2006 → …
Nils Olsen (Participant)
National Space Institute

Probing Mantle Conductivity From Space and Ground
Period: 1 Jan 2006 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

**Description**
Probing Mantle Conductivity From Space and Ground

**Place:** GFZ-Potsdam/Germany

**Related event**
Probing Mantle Conductivity From Space and Ground
01/01/2006 → ...
GFZ-Potsdam, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Solen i udbred: Foredrag holdt i forbindelse med foredragsrække om Solen arrangeret af Folkeuniversitetet i København og Århus
Period: 1 Jan 2006 → ...
Susanne Vennerstrøm (Guest lecturer)
Solar System Physics
National Space Institute

**Related external organisation**
Folkeuniversitetet i København
Lærdestræde 34, 2, 1201 , København, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Study of an Improved Comprehensive Magnetic Field Inversion Analysis for Swarm
Period: 1 Jan 2006 → ...
Nils Olsen (Speaker)
Solar System Physics
National Space Institute

**Description**
Place: Swarm E2Eplus Mid-Term Review, ESTEC

**Related event**
Swarm E2Eplus: Mid Term Review ESTEC
01/03/2006 → ...
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Laser måling af indlandsis og havis for klimaovervågning
Period: 1 Dec 2005
Sine Munk Hvidegaard (Speaker)
National Space Institute
Geodynamics

**Description**
Place: Geoforum meeting, Danish National Space Center

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations
**Solsystemet**  
Period: 30 Nov 2005  
Ib Lundgaard Rasmussen (Speaker)  
National Space Institute  
Astrophysics  

Description  
Place: Frederiksværk Gymnasium  

Related external organisation  

Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

**Gamma-Ray Bursts in the Swift Era**  
Period: 29 Nov 2005 → 2 Dec 2005  
Søren Brandt (Participant)  
National Space Institute  
Astrophysics  

Related event  

**Gamma-Ray Bursts in the Swift Era: Sixteenth Maryland Astrophysics Conference**  
29/11/2005 → 02/12/2005  
Washington DC, United States  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

**Planeterne før og nu**  
Period: 22 Nov 2005  
Ib Lundgaard Rasmussen (Speaker)  
National Space Institute  
Astrophysics  

Description  
Place: Dansk Selskab for Rumfartsforskning  

Related external organisation  

Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

**Coupling of Atmospheric Layers – EU FP5 RTN Project: Training and Outreach Programme**  
Period: 14 Nov 2005 → 15 Nov 2005  
Olivier Chanrion (Participant)  
National Space Institute  
Solar System Physics  

Related event  

**Coupling of Atmospheric Layers – EU FP5 RTN Project: Training and Outreach Programme**  
14/11/2005 → 15/11/2005  
Communicating European Research 2005 International Conference. Brussels, Belgium  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

**Luftbårne Observationer i Danmarks Rumcenter**  
Period: 1 Nov 2005  
Lars Stenseng (Speaker)
National Space Institute
Geodynamics

**Description**
Place: Day of Geophysics, University of Copenhagen, Denmark

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Sorte huller - hvad er det?**
Period: 1 Oct 2005
Niels Lund (Speaker)
National Space Institute
Astrophysics

**Description**
Place: Kulturnatten, Rumcenteret

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Med isen i hånden**
Period: 30 Sep 2005
René Forsberg (Participant)
National Space Institute
Geodynamics

**Related event**

**Med isen i hånden: CryoSat aktiviteter i Grønland og Polhavet**
30/09/2005 → 30/09/2005
Tycho Brahe Planetarium
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Kursus i Mission Analysis**
Period: 21 Sep 2005
Per Lundahl Thomsen (Speaker)
National Space Institute
Administration

**Related event**

**Kursus i Mission Analysis**
21/09/2005 → 21/09/2005
DTU
Activity: Other

**Long-term sea level and sea surface temperature characteristics from satellite**
Period: 4 Sep 2005 → 6 Sep 2005
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Description
Note: ESEAS final workshop
Place: Split, Croatia

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Long-term sea level and sea surface temperature characteristics from satellite
Period: 4 Sep 2005 → 6 Sep 2005
Per Knudsen (Speaker)
National Space Institute

Geodesy

Description
Note: ESEAS final workshop
Place: Split, Croatia

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Danish CryoSat pre-launch event
Period: 1 Sep 2005
René Forsberg (Speaker)
National Space Institute

Geodynamics

Description
Presentation, posters and instrument demonstration.

Related event
Danish CryoSat pre-launch event
01/09/2005 → 01/09/2005
Planetariet, Denmark
Activity: Talks and presentations › Conference presentations

Danish CryoSat pre-launch event
Period: 1 Sep 2005
Lars Stenseng (Speaker)
National Space Institute

Geodynamics

Description
Presentation, posters and instrument demonstration.

Related event
Danish CryoSat pre-launch event
01/09/2005 → 01/09/2005
Planetariet, Denmark
Activity: Talks and presentations › Conference presentations
Danish CryoSat pre-launch event
Period: 1 Sep 2005
Sine Munk Hvidegaard (Speaker)
National Space Institute
Geodynamics

Description
Presentation, posters and instrument demonstration.

Related event
Danish CryoSat pre-launch event
01/09/2005 → 01/09/2005
Planetariet, Denmark
Activity: Talks and presentations › Conference presentations

Combining altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region
Period: 15 Aug 2005 → 29 Aug 2005
René Forsberg (Speaker)
National Space Institute
Geodynamics

Description
Note: IAG Dynamic Planet
Place: Cairns Australia

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Mean sea surface, geoid and bathymetry from multiple satellites in the Arctic region
Period: 15 Aug 2005 → 29 Aug 2005
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Description
Note: IAG Dynamic Planet
Place: Cairns, Australia

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Mean sea surface, geoid and bathymetry from multiple satellites in the Arctic region
Period: 15 Aug 2005 → 29 Aug 2005
Per Knudsen (Speaker)
National Space Institute
Geodesy

Description
Note: IAG Dynamic Planet
Place: Cairns, Australia

Related external organisation
**Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium**

**Period:** 15 Aug 2005 → 29 Aug 2005

**Per Knudsen (Participant)**

National Space Institute

**Geodesy**

**Description**
Combining altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region

**Note:** IAG Dynamic Planet
**Place:** Cairns Australia

**Related event**

**Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium**

22/08/2005 → 26/08/2005

Cairns, Australia

Activity: Attending an event › Participating in or organising a conference

**Ole Baltazar Andersen (Participant)**

National Space Institute

**Geodesy**

**Description**
Combining altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region

**Note:** IAG Dynamic Planet
**Place:** Cairns Australia

**Degree of recognition:** International

**Related event**

**Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium**

22/08/2005 → 26/08/2005

Cairns, Australia

Activity: Attending an event › Participating in or organising a conference

**Henning Pontoppidan Föh (Participant)**

National Space Institute

**Description**
Combining altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region

**Note:** IAG Dynamic Planet
**Place:** Cairns Australia

**Degree of recognition:** International

**Related event**

**Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium**

22/08/2005 → 26/08/2005

Cairns, Australia

Activity: Attending an event › Participating in or organising a conference
Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium
Period: 15 Aug 2005 → 29 Aug 2005
Arne Vestergaard Olesen (Participant)
National Space Institute
Geodynamics

**Description**
Combining altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region

Note: IAG Dynamic Planet
Place: Cairns Australia

**Related event**

Monitoring and Understanding a Dynamic Planet with Geodetic and Oceanographic Tools IAG Symposium
22/08/2005 → 26/08/2005
Cairns, Australia
Activity: Attending an event › Participating in or organising a conference

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The 2003 European heat wave observed by GRACE
Period: 15 Aug 2005 → 29 Aug 2005
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

**Description**
Note: IAG Dynamic Planet
Place: Cairns, Australia

**Related external organisation**

Unknown external organisation
Activity: Talks and presentations › Conference presentations

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The DNSC05 high resolution global marine gravity field, mean sea surface and bathymetry
Period: 15 Aug 2005 → 29 Aug 2005
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

**Description**
Note: IAG Dynamic Planet
Place: Cairns, Australia

**Related external organisation**

Unknown external organisation
Activity: Talks and presentations › Conference presentations

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The DNSC05 high resolution global marine gravity field, mean sea surface and bathymetry
Period: 15 Aug 2005 → 29 Aug 2005
Per Knudsen (Speaker)
National Space Institute
Geodesy

**Description**
Xth Scientific Assembly of International Association of Geomagnetism and Aeronomy  
Period: 18 Jul 2005 → 28 Jul 2005  
Torsten Neubert (Participant)  
National Space Institute  
Solar System Physics  

Description  
Results from the EuroSprite2003 campaign  
Place: IAGA, Toulouse  

Related event  
IAGA 2005 The 10th Scientific Assembly  
18/07/2005 → 29/07/2005  
Toulouse, France  
Activity: Attending an event › Participating in or organising a conference  

Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESat, GRACE and airborne measurements  
Period: 26 Jun 2005 → 22 Aug 2005  
René Forsberg (Speaker)  
National Space Institute  
Geodynamics  

Description  
Note: Dynamic Planet  
Place: Cairns Australia  

Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESat, GRACE and airborne measurements  
Period: 26 Jun 2005 → 22 Aug 2005  
Henriette Skourup (Speaker)  
National Space Institute  
Geodynamics  

Description  
Note: Dynamic Planet  
Place: Cairns Australia  

Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations  

Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESat, GRACE and airborne measurements  
Period: 26 Jun 2005 → 22 Aug 2005  
Sine Munk Hvidegaard (Speaker)  
National Space Institute  
Geodynamics  

Description  
Note: Dynamic Planet  
Place: Cairns Australia  

Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations
Description
Note: Dynamic Planet
Place: Cairns Australia

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

CAL Mid-Term Review and Science Meeting
Period: 20 Jun 2005 → 24 Jun 2005
Torsten Neubert (Participant)
National Space Institute
Solar System Physics

Description
Overview of the ASIM mission

Place: CAL Mid-Term Review, Creta

Related event

CAL Mid-Term Review and Science Meeting
20/06/2005 → 24/06/2005
Elounda, Crete, Greece
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

CAL Mid-Term Review and Science Meeting
Period: 20 Jun 2005 → 24 Jun 2005
Torsten Neubert (Participant)
National Space Institute
Solar System Physics

Description
The World Sprite-Watch Partnership

Place: CAL Mid-Term Review, Creta
Degree of recognition: International

Related event

CAL Mid-Term Review and Science Meeting
20/06/2005 → 24/06/2005
Elounda, Crete, Greece
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Simulation of streamer initiation using a particle in cell code with Monte Carlo collisions: application to sprite ignition
Period: 20 Jun 2005 → 24 Jun 2005
Olivier Chanrion (Participant)
National Space Institute
Solar System Physics

Related event

Simulation of streamer initiation using a particle in cell code with Monte Carlo collisions: application to sprite ignition
20/06/2005 → 24/06/2005
Elounda, Crete, Greece
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Nøglen til succes i rummet
Period: 15 Jun 2005
Per Lundahl Thomsen (Speaker)
National Space Institute
Administration

Description
Place: DRC Åbningskonference

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Soludbrud og storme i rummet
Period: 18 May 2005
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Foredrag arr. af Eksperimenterende Danske Radiomatører (EDR).

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Udforskningen af Solsystemet
Period: 12 May 2005
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Forskningens dag på Ingeniøren

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Simulation of streamer propagation using a PIC-MCC code: Application to sprite discharges
Period: 9 May 2005 → 13 May 2005
Olivier Chanrion (Participant)
National Space Institute
Solar System Physics

Related event

Simulation of streamer propagation using a PIC-MCC code: Application to sprite discharges: The multiscale nature of spark precursors and high altitude lightning
09/05/2005 → 13/05/2005
Leiden, The Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Turen går til Titan**
Period: 1 May 2005
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Solar System Physics

**Description**
Place: Dansk Selskab for Rumfartsforskning

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Vejr og Klima på Gasplaneterne**
Period: 25 Apr 2005 → 2 May 2005
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

**Description**
Place: Folkeuniversitetet

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**EGU General Assemblies**
Period: 24 Apr 2005 → 29 Apr 2005
Eigil Friis-Christensen (Participant)
National Space Institute
Management

**Description**
Observed and simulated field-aligned currents during northward

Place: EGS Spring Meeting, Vienna, Austria

**Related event**

**EGU General Assemblies**
24/04/2005 → 29/04/2005
Vienna, Austria
Activity: Attending an event › Participating in or organising a conference

**39TH ESLAB Symposium on Trends in Space Science and Cosmic Vision 2020**
Period: 19 Apr 2005 → 21 Apr 2005
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Related event**
39TH ESLAB Symposium on Trends in Space Science and Cosmic Vision 2020
19/04/2005 → 21/04/2005
Noordwijk, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Resultater fra Cassini/Huygens
Period: 13 Apr 2005
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Description
Place: Astronomisk forening Køge bugt

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Storme i rummet
Period: 22 Mar 2005
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Place: Montebelloobservatoriet

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Modelling non linear shallow water tides from multi mission satellite altimetry
Period: 10 Mar 2005 → 11 Mar 2005
Ole Baltazar Andersen (Speaker)
National Space Institute
Geodesy

Description
Note: Colloquium in honor of C. Le Provost
Place: Toulouse

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Sorte huller
Period: 1 Mar 2005
Niels Lund (Speaker)
National Space Institute
Astrophysics

Description
Place: Montebello-observatoriet, Helsingør
Saturns måne Titan og livets opståen på Jorden
Period: 1 Feb 2005
Jens Olaf Pepke Pedersen (Speaker)
National Space Institute
Solar System Physics
Description
Place: Myrtuegård, Esbjerg

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Bursts observed with JEM-X: reconstructing light curves, exemplified by bright bursts from SGR 1806-20
Period: 18 Jan 2005
Søren Brandt (Speaker)
National Space Institute
Astrophysics
Description
Place: INTEGRAL Science Workshop, ESTEC, The Netherlands
Documents:
- Bursts observed with JEM-X - reconstructing light curves
- JEM-X: status, scientific performance, calibration

Related event
Internal INTEGRAL Science Workshop
18/01/2005 → 21/01/2005
Noordwijk, Netherlands
Activity: Talks and presentations › Conference presentations

Internal INTEGRAL Science Workshop
Period: 18 Jan 2005 → 21 Jan 2005
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
Internal INTEGRAL Science Workshop
18/01/2005 → 21/01/2005
Noordwijk, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Saturn System
Period: 15 Jan 2005
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics
Description
Arrangement in Connection with the Huygens landing on Titan.
Place: Tycho Brahe Planetariet

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

2005 AGU Fall Meeting
Period: 1 Jan 2005 → …
Torsten Neubert (Participant)
National Space Institute
Solar System Physics

Description
Results from the EuroSprite2003 campaign

Place: American Geophysical Union, San Francisco

Related event
2005 AGU Fall Meeting
05/12/2005 → 09/12/2005
San Francisco, CA, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

A modular model of the Earth's magnetic field
Period: 1 Jan 2005 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
A modular model of the Earth’s magnetic field

Place: GFZ-Potsdam/Germany

Related event
A modular model of the Earth's magnetic field
01/01/2005 → …
Potsdam, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Arctic Ocean mean-sea surface, geoid and gravity from surface data, ICESAT and GRACE – a reference for CryoSat sea-ice mapping
Period: 1 Jan 2005 → …
René Forsberg (Speaker)
National Space Institute
Geodynamics

Description
Note: First International CryoSat Workshop, ESA ESRIN
Place: Frascati, Italy

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Arctic Ocean mean-sea surface, geoid and gravity from surface data, ICESAT and GRACE – a reference for CryoSat sea-ice mapping
Period: 1 Jan 2005 → …
Henriette Skourup (Speaker)
National Space Institute
Geodynamics

Description
Note: First International CryoSat Workshop, ESA ESRIN
Place: Frascati, Italy

Related external organisation

Combing altimetric/gravimetric and ocean model mean dynamic topography models in the GOCINA region
Period: 1 Jan 2005 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

Description
Note: EGU 2006
Place: Vienna

Related external organisation

Discharges observed in the high-altitude atmosphere over Europe
Period: 1 Jan 2005 → …
Torsten Neubert (Participant)
National Space Institute
Solar System Physics

Related event
Leiden workshop on streamers
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

EGS Spring Meeting
Period: 1 Jan 2005 → …
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Description
Observed and simulated field-aligned currents during northward

Place: EGS Spring Meeting, Vienna, Austria

Related event

EGS Spring Meeting
01/01/2005 → …
Vienna, Austria
Activity: Attending an event › Participating in or organising a conference

Erforschung des Erdmagnetfeldes mittels Satelliten - Ørsted
Period: 1 Jan 2005 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
Erforschung des Erdmagnetfeldes mittels Satelliten - Ørsted

Place: CHAMP und Swarm, Univ of Münster/Germany

Related event

Erforschung des Erdmagnetfeldes mittels Satelliten - Ørsted
01/01/2005 → …
Germany
Activity: Attending an event › Participating in or organising a conference

Error Characteristics of Dynamic Topography Models Derived from Altimetry and GOCE Gravimetry
Period: 1 Jan 2005 → …
Per Knudsen (Speaker)
National Space Institute
Geodesy

Description
Note: IAG Dynamic Planet
Place: Cairns Australia

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Experimental investigation of ultrafine aerosol formation
Period: 1 Jan 2005 → …
Jens Olaf Pepke Pedersen (Participant)
National Space Institute
Geodynamics

Description
Note: AGU fall meeting

Related event

**Geoid, mean sea level and ice thickness in the Arctic Ocean from GRACE and ICESAT**
01/01/2005 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
Period: 1 Jan 2005 → …
René Forsberg (Participant)
National Space Institute

Geodynamics

Description
Note: IAG General Assembly

Related event

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
Period: 1 Jan 2005 → …
Henriette Skourup (Participant)
National Space Institute

Geodynamics

Description
Note: IAG General Assembly

Related event

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
Period: 1 Jan 2005 → …
Sine Munk Hvidegaard (Participant)
National Space Institute

Geodynamics

Description
Note: IAG General Assembly

Related event

**Geoid, mean sea level and ice thickness in the Arctic Ocean from ICESAT, GRACE and airborne measurements**
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Gravity field determination by combination of satellite, airborne and surface gravity data
Period: 1 Jan 2005 → …
René Forsberg (Participant)
National Space Institute
Geodynamics

Description
Note: IAG General Assembly

Related event

Gravity field determination by combination of satellite, airborne and surface gravity data
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

GreenICE field campaign 2004 – airborne laser measurements
Period: 1 Jan 2005 → …
Henriette Skourup (Participant)
National Space Institute
Geodynamics

Related event

GreenICE field campaign 2004 – airborne laser measurements
01/01/2005 → …
Rungsted, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
GreenICE field campaign 2004 – airborne laser measurements
Period: 1 Jan 2005 → …
Sine Munk Hvidegaard (Participant)
National Space Institute
Geodynamics

Related event
GreenICE field campaign 2004 – airborne laser measurements
01/01/2005 → …
Rungsted, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Magnetic measurements from space: some approaches to image 3-D conductivity anomalies in the mantle
Period: 1 Jan 2005 → …
Unknown Person (Participant)
National Space Institute

Related event
Magnetic measurements from space: some approaches to image 3-D conductivity anomalies in the mantle
01/01/2005 → …
Institute of Geophysics, Warsaw, Poland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Marine gravity from satellite altimetry
Period: 1 Jan 2005 → …
Ole Baltazar Andersen (Participant)
National Space Institute
Geodesy

Description
Note: GOCINA International Workshop

Related event
Marine gravity from satellite altimetry
01/01/2005 → …
Luxembourg-Kirchberg
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Mass change of the Greenland ice sheet from GRACE and a climatological-glaciological model
Period: 1 Jan 2005 → …
René Forsberg (Participant)
National Space Institute
Geodynamics

Description
Note: IAG General Assembly

Related event
Mass change of the Greenland ice sheet from GRACE and a climatological-glaciological model
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Mass change of the Greenland ice sheet from GRACE and a climatological-glaciological model
Period: 1 Jan 2005 → …
Niels Reeh (Participant)
National Space Institute
Microwaves and Remote Sensing

Description
Note: IAG General Assembly

Related event

Mass change of the Greenland ice sheet from GRACE and a climatological-glaciological model
01/01/2005 → …
Cairns Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

MSS improvements and errors
Period: 1 Jan 2005 → …
Ole Baltazar Andersen (Participant)
National Space Institute
Geodesy

Description
Note: GOCINA International Workshop

Related event

MSS improvements and errors
01/01/2005 → …
Luxembourg-Kirchberg
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Observationer af havis
Period: 1 Jan 2005 → 1 Feb 2005
Sine Munk Hvidegaard (Speaker)
National Space Institute
Geodynamics

Description
Presentation for geography teacher students
Place: Danish National Survey and Cadastre

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Results of the CryoSat Validation Experiment – CryoVEx-2003
Period: 1 Jan 2005 → …
Sine Munk Hvidegaard (Speaker)
National Space Institute
Geodynamics

Description
Note: First International CryoSat Workshop, ESA ESRIN
Place: Frascati, Italy
Results of the CryoSat Validation Experiment – CryoVEx-2003
Period: 1 Jan 2005 → …
René Forsberg (Speaker)
National Space Institute
Geodynamics

Description
Note: First International CryoSat Workshop, ESA ESRIN
Place: Frascati, Italy

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Results of the CryoSat Validation Experiment – CRYOVEX-2003
Period: 1 Jan 2005 → …
Sine Munk Hvidegaard (Participant)
National Space Institute
Geodynamics

Description
Note: Workshop on Arctic sea ice thickness

Related event

Results of the CryoSat Validation Experiment – CRYOVEX-2003
01/01/2005 → …
Rungsted, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Results of the CryoSat Validation Experiment – CRYOVEX-2003
Period: 1 Jan 2005 → …
René Forsberg (Speaker)
National Space Institute
Geodynamics

Description
Note: Workshop on Arctic sea ice thickness

Related event

Results of the CryoSat Validation Experiment – CRYOVEX-2003
01/01/2005 → …
Rungsted, Denmark
Activity: Talks and presentations › Conference presentations

Satellite geomagnetic missions: step toward 3-D imaging of the mantle conductivity
Period: 1 Jan 2005 → …
Unknown Person (Participant)
National Space Institute

Related event
**Satellite geomagnetic missions: step toward 3-D imaging of the mantle conductivity**

01/01/2005 → …

Dublin Institute of Advanced Science, Dublin, Ireland

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

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**Sea-ice freeboard heights in the Arctic Ocean from ICESat and airborne lidar – a comparison**

Period: 1 Jan 2005 → …

Henriette Skourup (Speaker)

National Space Institute

Geodynamics

**Description**

Place: American Geophysical Union Fall meeting

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**Sea-ice freeboard heights in the Arctic Ocean from ICESat and airborne lidar – a comparison**

Period: 1 Jan 2005 → …

René Forsberg (Speaker)

National Space Institute

Geodynamics

**Description**

Place: American Geophysical Union Fall meeting

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**Space - some of the strange things**

Period: 1 Jan 2005 → …

Allan Hornstrup (Speaker)

National Space Institute

Astrophysics

**Description**

Place: Beach Elementary School, Piedmont, CA, USA.

**Related external organisation**

Unknown external organisation

Activity: Talks and presentations › Conference presentations

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**Swarm MAG meeting, ESTEC**

Period: 1 Jan 2005 → …

Nils Olsen (Participant)

National Space Institute

Solar System Physics

**Description**

Towards a Multi-Satellite Alignment: On The CHAOS Magnetic Field Modelling Effort

Place: Swarm MAG meeting, ESTEC
Related event

Swarm MAG meeting, ESTEC
01/01/2005 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Swarm MAG meeting, ESTEC
Period: 1 Jan 2005 → …
Lars Tøffner-Clausen (Participant)
National Space Institute
Solar System Physics

Description
Towards a Multi-Satellite Alignment: On The CHAOS Magnetic Field Modelling Effort

Place: Swarm MAG meeting, ESTEC

Related event

Swarm MAG meeting, ESTEC
01/01/2005 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The European Sprite 2003 campaign
Period: 1 Jan 2005 → …
Torsten Neubert (Participant)
National Space Institute
Solar System Physics

Related event

The European Sprite 2003 campaign
01/01/2005 → …
EGU Vienna
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Upper atmospheric lightning
Period: 1 Jan 2005 → …
Torsten Neubert (Participant)
National Space Institute

Related external organisation

Bulgarian Institute of Meteorology and Hydrology
Activity: Other

First INTEGRAL Data Analysis Workshop
Period: 5 Oct 2004 → 6 Oct 2004
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

First INTEGRAL Data Analysis Workshop
05/10/2004 → 06/10/2004
Geneva, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
The 5th INTEGRAL Workshop
Period: 16 Feb 2004 → 20 Feb 2004
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
The 5th INTEGRAL Workshop : The INTEGRAL Universe
16/02/2004 → 20/02/2004
Münich, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Frascati Workshop
Period: 25 May 2003 → 28 May 2003
Niels Lund (Participant)
National Space Institute
Astrophysics

Description
An X-ray perspective on a gamma-ray mission
Note: Frascati Workshop
Place: Vulcano, Italy

Related event
Frascati Workshop
25/05/2003 → 28/05/2003
Vulcano, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Comparison of ionospheric dynamo currents and magnetic perturbations modeled by the TIEGCM with CM3e model results
Period: 1 Jan 2003 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Det Danske Småsatellitprogram
Period: 1 Jan 2003 → …
Per Lundahl Thomsen (Speaker)
National Space Institute

Description
Note: E-Gruppen, Danmarks Ingeniørforening

Related external organisation
Unknown external organisation
Exploring the external geomagnetic field using space- and groundbased magnetometers
Period: 1 Jan 2003
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Related event
EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France

Exploring the external geomagnetic field using space- and groundbased magnetometers
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France

Hvad fortæller Ørsted satellitten om Jordens magnetfelt?
Period: 1 Jan 2003 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Note: Foredrag ved den Naturvidenskabelige Alumneforening ved Københavns Universitet (NAKU)

Related external organisation
Unknown external organisation

Jordens magnetfelt
Period: 1 Jan 2003 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Note: Foredrag ved årsmødet af lærer i fysik og geografi, Gentofte

Related external organisation
Unknown external organisation
Magnetometry missions during the International Decade for Geopotential Field Research: Results, opportunities and challenges
Period: 1 Jan 2003 → …
Eigil Friis-Christensen (Speaker)
National Space Institute

Description
Place: European Geophysical Union meeting, Nice

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Realistic estimates of the variances of spherical harmonic geomagnetic field models derived from satellite data
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event

EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Secular variation and secular acceleration determined from Ørsted satellite data
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event

EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Solar wind interaction with Mars - IMF by asymmetries
Period: 1 Jan 2003 → …
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Description
Note: EGS/AGU/EGU general assembly

Related event

Solar wind interaction with Mars - IMF by asymmetries
01/01/2003 → …
Nice, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Solar wind interaction with Mars - IMF by asymmetries
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France
Activity: Talks and presentations » Conference presentations

SWARM - a constellation to study the dynamics of the Earth's magnetic field and its interactions with the Earth system
Period: 1 Jan 2003 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Place: European Geophysical Union meeting, Nice

Related external organisation
Unknown external organisation
Activity: Talks and presentations » Conference presentations

Swarm, a new opportunity to improve global magnetic field models
Period: 1 Jan 2003 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Place: International Union of Geodesy and Geophysics, Sapporo, Japan

Related external organisation
Unknown external organisation
Activity: Talks and presentations » Conference presentations

Swarm, a perfect mission to further advance our understanding of the geomagnetic field
Period: 1 Jan 2003 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Place: International Union of Geodesy and Geophysics, Sapporo, Japan

Related external organisation
Unknown external organisation
Activity: Talks and presentations » Conference presentations

Swarm End-To-End Mission Performance Study, Presentation of Draft Task 2 Report
Period: 1 Jan 2003 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
Note: Progress Meeting 2 of the Swarm End-To-End Mission performance Simulator, ESTEC

Related event
Swarm End-To-End Mission Performance Study, Presentation of Draft Task 2 Report
01/01/2003 → …
Potsdam, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Swarm End-To-End Mission Performance Study, Presentation of Final Task 2 Report
Period: 1 Jan 2003 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
Note: Mid Term Review of the Swarm End-To-End Mission performance Simulator, DSRI

Related event
Swarm End-To-End Mission Performance Study, Presentation of Final Task 2 Report
01/01/2003 → …
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Swarm End-To-End Mission Performance Study, Presentation of Task 1 Report
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
Progress Meeting 1 of the Swarm End-To-End Mission performance Simulator, ESTEC
01/01/2003 → …
Noordwijk, Netherlands
Activity: Talks and presentations › Conference presentations

The present state of geomagnetic comprehensive models and their applications
Period: 1 Jan 2003
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
EGS/AGU/EGU general assembly
01/01/2003 → …
Nice, France
Activity: Talks and presentations › Conference presentations
The swarm constellation: Mission concept and closed-loop system simulations
Period: 1 Jan 2003 → …
Nils Olsen (Speaker)
National Space Institute

Description
Place: 2nd CHAMP Science Meeting, Postdam, Germany

Related event
2nd CHAMP Science Meeting
01/09/2003 → 04/09/2003
Potsdam, Germany
Activity: Talks and presentations › Conference presentations

Highlights from AGU's 2nd virtual session: New magnetic field satellites
Period: 28 May 2002
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
AGU spring meeting
28/05/2002 → 31/05/2002
Washington DC, United States
Activity: Talks and presentations › Conference presentations

Investigating ionospheric current systems with Ørsted, CHAMP and Ørsted-2/SAC-C magnetic field measurements
Period: 28 May 2002
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
AGU spring meeting
28/05/2002 → 31/05/2002
Washington DC, United States
Activity: Talks and presentations › Conference presentations

A magnetic field model derived from Ørsted, CHAMP and Ørsted 2/SAC-C observations
Period: 1 Jan 2002
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Related event
AGU spring meeting
28/05/2002 → 31/05/2002
Washington DC, United States
Activity: Talks and presentations › Conference presentations

External, static internal and electromagnetically induced contributions in Mars Globas Surveyor magnetic observations
Period: 1 Jan 2002
Nils Olsen (Speaker)
External, static internal and electromagnetically induced contributions in Mars Global Surveyor magnetic observations
Period: 1 Jan 2002
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Highlights from AGU's 2nd virtual session: New magnetic field satellites
Period: 1 Jan 2002
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Investigation of external current systems with low altitude, polar orbiting satellites (solicited)
Period: 1 Jan 2002 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
Note: EGS XXVII general assembly

Mars NetLander/MAGNET
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: Presented at MAGNET workshop

Related event

Mars NetLander/MAGNET: the Danish science interests
01/01/2002 → …
Paris, France
Activity: Talks and presentations › Conference presentations

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Note: AGU spring meeting

Related event

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: AGU spring meeting

Related event

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: AGU spring meeting

Related event

Monitoring magnetospheric contributions using data from Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations
Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: EGS XXVII general assembly

Related event

Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Note: EGS XXVII general assembly

Related event

Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
Period: 1 Jan 2002 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: EGS XXVII general assembly

Related event

Monitoring magnetospheric sources with Ørsted, CHAMP and Ørsted-2/SAC-C
01/01/2002 → …
Nice, France
Activity: Talks and presentations › Conference presentations

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: AGU spring meeting
Related event

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites: Field-aligned currents in the polar cap and cusp during northward IMF
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Conference presentations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites: Field-aligned currents in the polar cap and cusp during northward IMF
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Conference presentations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: AGU spring meeting

Related event

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Multi-satellite observations of field-aligned currents in the day-side cusp and polar cap
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites: Field-aligned currents in the polar cap and cusp during northward IMF
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Conference presentations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Eigil Friis-Christensen (Speaker)
National Space Institute
Management
Related event

New results from the Ørsted and CHAMP satellites: Field-aligned currents in the polar cap and cusp during northward IMF
01/01/2002 → …
NASA, Goddard Space Flight Center, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

New results from the Ørsted and CHAMP satellites
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Related event

Night-side current systems in the polar region during quiet geomagnetic conditions
Period: 1 Jan 2002 → …
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: AGU spring meeting

Related event

Night-side current systems in the polar region during quiet geomagnetic conditions
01/01/2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Night-side current systems in the polar region during quiet geomagnetic conditions
Period: 1 Jan 2002 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Note: AGU spring meeting

Related event

Night-side current systems in the polar region during quiet geomagnetic conditions
01/01/2002 → …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Night-side current systems in the polar region during quiet geomagnetic conditions
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics
Description
Note: AGU spring meeting

Related event
Night-side current systems in the polar region during quiet geomagnetic conditions
01/01/2002 – …
Washington DC, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

S-RAMP Climate Activities
Period: 1 Jan 2002 – …
Eigil Friis-Christensen (Speaker)
National Space Institute

Description
Place: COSPAR meeting in Houston, USA

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Swarm: a new generation of magnetic field research satellites
Period: 1 Jan 2002 – …
Eigil Friis-Christensen (Speaker)
National Space Institute

Description
Place: Ørsted International Science Team Meeting No., 4, Copenhagen

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

The low-frequency array (LOFAR) and LOIS, the LOFAR outrigger in Scandinavia
Period: 1 Jan 2002 – …
Unknown Person (Participant)
National Space Institute

Related event
The low-frequency array (LOFAR) and LOIS, the LOFAR outrigger in Scandinavia: Prospects for space physics
01/01/2002 – …
Sodankylä Geophysical Observatory
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The magnetic field near Mars and its variation with the solar wind
Period: 1 Jan 2002 – …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Related event
The magnetic field near Mars and its variation with the solar wind
01/01/2002 – …
The magnetic field near Mars and its variation with the solar wind
Period: 1 Jan 2002 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics
Related event
The magnetic field near Mars and its variation with the solar wind
01/01/2002 → …
NASA, Goddard Space Flight Center, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations
Related event
The magnetic field near Mars and its variation with the solar wind parameters
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics
Description
Note: COSPAR meeting
Related event
The magnetic field near Mars and its variation with the solar wind parameters
01/01/2002 → …
Houston, Texas, USA
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations
Related event
The optical/near-IR spectral energy distribution of the GRB 000210 host galaxy
Period: 1 Jan 2002 → …
Niels Lund (Speaker)
National Space Institute
Astrophysics
Related event
The optical/near-IR spectral energy distribution of the GRB 000210 host galaxy
The utility of simultaneous multi-satellite data and the virtual session concept
Period: 1 Jan 2002 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: EGS XXVII general assembly

Related event
The utility of simultaneous multi-satellite data and the virtual session concept
01/01/2002 → …
Nice, France
Activity: Talks and presentations › Conference presentations

The utility of simultaneous multi-satellite data and the virtual session concept
Period: 1 Jan 2002 → …
Nils Olsen (Speaker)
National Space Institute
Geomagnetism

Description
Note: EGS XXVII general assembly

Related organisation
The utility of simultaneous multi-satellite data and the virtual session concept
Olsen, N. (Speaker)
1 Jan 2002 → …
Activity: Talks and presentations › Conference presentations

Do solar variations affect our climate?
Period: 17 Dec 2001 → 19 Dec 2001
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Space weather workshop: Looking towards a European space weather programme, ESTEC.

Related event
Do solar variations affect our climate?
17/12/2001 → 19/12/2001
Noordwijk, Holland
Activity: Talks and presentations › Conference presentations

Solens formodede indflydelse på klimavariationer
Period: 27 Nov 2001
Eigil Friis-Christensen (Participant)
National Space Institute
Management
Description
Debate meeting on the global warming of the Earth. Are the reasons for global warming caused by an interaction between the physics of the Sun the Earth's atmosphere or in a man-made increase of the green-house effect?. Educational course for high school teachers.

Related event
Solens formodede indflydelse på klimavariationer
Frederiksberg Gymnasium
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Klimaændringer - solpletter eller drivhusteori?
Period: 23 Oct 2001
Eigil Friis-Christensen (Lecturer)
Management
National Space Institute

Description
Lecture given as a part of a series of lectures on research results arranged by the Ministry of Education in co-operation with Grønt Forum.

Related external organisation
Steno Museet
C. F. Mellers Allé 2, 8000, Aarhus C, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Klimaændringer - solpletter eller drivhusteori?
Period: 9 Oct 2001
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Lecture given as a part of a series of lectures on research results arranged by the Ministry of Education in co-operation with Grønt Forum, Institute of Geography.

Related external organisation
University of Copenhagen
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Polar cap and cusp currents measured with Ørsted
Period: 1 Oct 2001
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Related event
Polar cap and cusp currents measured with Ørsted: Ørsted science team meeting
01/10/2001 → 01/10/2001
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Status of the data-calibration of the Ørsted-2/SAC-C projects
Period: 1 Oct 2001
Nils Olsen (Participant)
Related event

**Status of the data-calibration of the Ørsted-2/SAC-C projects: Ørsted science team meeting**
01/10/2001 → 01/10/2001
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Cosmic rays and climate**
Period: 8 Sep 2001 → 13 Sep 2001
Henrik Svensmark (Speaker)
National Space Institute
Solar System Physics

Description
Place: 3rd Euroconference on atomic physics at accelerators, Århus

Related external organisation

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Space technology innovation activities in Denmark**
Period: 6 Sep 2001 → 7 Sep 2001
Flemming Hansen (Speaker)
National Space Institute
IT-Department

Description
Place: Presentation at the ESA space technology innovation workshop, Copenhagen, Denmark

Related external organisation

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**The Danish national satellite programme for space science**
Period: 5 Sep 2001 → 6 Sep 2001
Eigil Friis-Christensen (Participant)
National Space Institute
Management

Description
Workshop on space science mission in the European context. Swedish National Space Board and the Italian Space Agency.

Related event

**The Danish national satellite programme for space science**
05/09/2001 → 06/09/2001
Stockholm, Sweden
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Global opvarmning - har Solen en rolle?**
Period: 1 Jun 2001
Eigil Friis-Christensen (Participant)
National Space Institute

Management

Description
Seminar on climatic changes.

Related event

Global opvarmning - har Solen en rolle?
01/06/2001 → 01/06/2001
DHL
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Why Mercury?
Period: 30 May 2001 → 31 May 2001
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Related event

Why Mercury?
30/05/2001 → 31/05/2001
International MERMAG meeting at Imperial College, London, England
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Why Mercury?
Period: 30 May 2001 → 31 May 2001
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Related event

Why Mercury?
30/05/2001 → 31/05/2001
International MERMAG meeting at Imperial College, London, England
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Why Mercury?
Period: 30 May 2001 → 31 May 2001
Eigil Friis-Christensen (Participant)
National Space Institute
Management

Related event

Why Mercury?
30/05/2001 → 31/05/2001
International MERMAG meeting at Imperial College, London, England
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Er Solens variede aktivitet årsag til klimavariationer?
Period: 16 May 2001
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Lecture and panel discussion on "Climatic variations, natural or antropogenic?", Svenska Geofysiska Föreningen (SGF), in co-operation with Sällskabet Riksdagsmän och Forskare (RIFO).

Related external organisation
Svenska Geofysiska Föreningen
Stockholm, Sweden
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Danmark i rummet
Period: 26 Apr 2001
Eigil Friis-Christensen (Speaker)
National Space Institute

Management

Description
Lecture arranged by "Unges Naturvidenskabelige Forening" (UNF).

Related external organisation
Aarhus University
Inge Lehmanns Gade 10, 8000, Aarhus C, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Er kosmisk stråling årsag til klimaforandringer?
Period: 19 Apr 2001
Eigil Friis-Christensen (Participant)
National Space Institute

Management

Description
Theme meeting: "Global opmarmning - fup eller fakta", Interessegruppen for Gasanalyse, Dansk Selskab for Miljøkemi og GOGCI.

Related event
Er kosmisk stråling årsag til klimaforandringer?
19/04/2001 → 19/04/2001
H.C. Ørsted Institute, University of Copenhagen
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The correlation between GCR's and cloud cover
Period: 18 Apr 2001 → 20 Apr 2001
Henrik Svensmark (Organizer)
National Space Institute
Solar System Physics

Related event
The correlation between GCR's and cloud cover
18/04/2001 → 20/04/2001
Workshop on ion-aerosol-cloud interactions, CERN, Genève, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Is climate change due to our varying Sun?
Period: 2 Apr 2001
Eigil Friis-Christensen (Speaker)
National Space Institute

Related event
Is climate change due to our varying Sun?
02/04/2001 → 02/04/2001
ESA Space Weather Working Team (SWWT) meeting, Paris, France
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

A field model derived from Ørsted and CHAMP data
Period: 1 Apr 2001
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Description
Seminar at GeoForschungsZentrum, Potsdam, Germany.

Related event
A field model derived from Ørsted and CHAMP data
01/04/2001 → 01/04/2001
Potsdam, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Solar wind interaction with Mars
Period: 1 Feb 2001
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Related event
Solar wind interaction with Mars: International Mars NetLander meeting
01/02/2001 → 01/02/2001
Paris, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

NetLander - Mission to Mars
Period: 1 Jan 2001 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: Invited talk at Danish Meteorological Institute
Place: Danish Meteorological Institute

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Ørsted and Ørsted-2/SAC-C: Mission status and data availability
Period: 1 Jan 2001 → …
Nils Olsen (Speaker)
National Space Institute
Solar System Physics

Description
Place: AGU spring meeting, Boston, Massachusetts, USA

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Ørsted and Ørsted-2/SAC-C: Mission status and data availability
Period: 1 Jan 2001 → …
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Place: AGU spring meeting, Boston, Massachusetts, USA

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Dansk Naturvidenskabsfestival
Period: 1 Oct 2000
Allan Hornstrup (Participant)
National Space Institute
Astrophysics

Description
Galaksehobe

Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

Related event
Dansk Naturvidenskabsfestival: Galaksehobe
01/10/2010 → 01/10/2010
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Hvor kommer kosmisk stråling fra?
Period: 1 Oct 2000
Niels Lund (Speaker)
National Space Institute
Astrophysics

Description
Place: Danish Space Research Institute

Related external organisation
**Rømer-satellitten**
Period: 1 Oct 2000
Flemming Hansen (Speaker)
National Space Institute
IT-Department

**Description**
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Big Bang**
Period: 30 Sep 2000 → 1 Oct 2000
Hans Ulrik Nørgaard-Nielsen (Speaker)
National Space Institute
Astrophysics

**Description**
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Dansk Naturvidenskabsfestival**
Period: 30 Sep 2000
Nils Olsen (Participant)
National Space Institute
Solar System Physics

**Description**
Ørsted satellitten og Jordens magnetfelt

Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

**Related event**

**Dansk Naturvidenskabsfestival 2000: Ørsted satellitten og Jordens magnetfelt**
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
På stjernekig med Superman

Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

Related event

Dansk Naturvidenskabsfestival 2000: På stjernekig med Superman
30/09/2000 – 01/10/2000
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Hvad er en komet?
Period: 30 Sep 2000 – 1 Oct 2000
Allan Hornstrup (Speaker)
National Space Institute
Astrophysics

Description
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Hvordan observeres røntgenstråling?
Period: 30 Sep 2000
Niels Jørgen Stenfeldt Westergaard (Speaker)
National Space Institute
Astrophysics

Description
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Sorte huller
Period: 30 Sep 2000 – 1 Oct 2000
Niels Lund (Speaker)
National Space Institute
Astrophysics

Description
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"
Place: Danish Space Research Institute

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Indirect mechanisms of solar-terrestrial relations
Period: 25 Sep 2000 – 30 Sep 2000
Henrik Svensmark (Participant)
National Space Institute
Solar System Physics

Description
Note: Euroconference "The Solar Cycle and Terrestrial Climate"

Related event
Indirect mechanisms of solar-terrestrial relations
Tenerife, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
Third Microquasar Workshop
Period: 11 Sep 2000 → 13 Sep 2000
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
Third Microquasar Workshop: Granada Workshop on Galactic Relativistic Jet Sources
Granada, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
4th INTEGRAL Workshop
Period: 4 Sep 2000 → 8 Sep 2000
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
4th INTEGRAL Workshop: Exploring the gamma-ray universe
Alicante, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

New results for the CZT drift-strip detector
Period: 30 Aug 2000
Irfan Kuvvetli (Participant)
National Space Institute
Astrophysics

Description
Note: TÜBITAK High-Energy Astrophysics working group, workshop 1

Related event

New results for the CZT drift-strip detector
30/08/2000 → 30/08/2000
Sabanci University, Istanbul, Turkey
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Astronomy from space
Period: 6 Jul 2000
Allan Hornstrup (Speaker)
National Space Institute
Astrophysics

Description
Note: Lecture for high-school students attending "Kopernikursus 2000"

Related event

Kopernikursus 2000
02/07/2000 → 09/07/2000
Activity: Other

Kopernikursus 2000
Allan Hornstrup (Organizer)
National Space Institute
Astrophysics

Description
Summer course for high-school students

Related event

Kopernikursus 2000
02/07/2000 → 09/07/2000
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Possible effects of cosmic ray ionisation in the atmosphere
Period: 30 May 2000 → 3 Jun 2000
Henrik Svensmark (Participant)
National Space Institute
Solar System Physics

Description
Note: AGU spring meeting, A16 "Atmospheric Ions: ROles in Aerosol Formation and Chemistry"

Related event

Possible effects of cosmic ray ionisation in the atmosphere
30/05/2000 → 03/06/2000
Washington DC, USA
Solar system science in Denmark
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: Space Science International Partnership Conference

Related event

Space astrophysics in Denmark
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: Space Science International Partnership Conference

Related event

Period: 25 Apr 2000 → 28 Apr 2000
Torsten Neubert (Speaker)
National Space Institute
Solar System Physics

Description
Note: presented at General assembly of the European Geophysical Society
Place: Nice, France

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
New ground-based proxies for the IMF By- and Bz-components

Period: 25 Apr 2000 → 28 Apr 2000
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Description
Note: General assembly of the European Geophysical Society

Related event

New ground-based proxies for the IMF By- and Bz-components
25/04/2000 → 28/04/2000
Nice, France
Activity: Talks and presentations › Conference presentations

Dansk indsats i rummet, visioner og muligheder

Period: 14 Apr 2000
Eigil Friis-Christensen (Participant)
National Space Institute
Management

Description
Dansk indsats i rummet, visioner og muligheder
Place: Danish Space Research Institute, Copenhagen

Related event

Dansk indsats i rummet, visioner og muligheder
14/04/2000 → 14/04/2000
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Space Research, Space Technology and Space Industry

Period: 14 Apr 2000
Eigil Friis-Christensen (Participant)
National Space Institute
Management

Description
Den nationale dimension i et internationalt samarbejde

Note: Conference on Space Research, Space Technology and Space Industry
Place: Danish Space Research Institute, Copenhagen

Related event
High-Energy Spectroscopic Astrophysics
Period: 3 Apr 2000 → 8 Apr 2000
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
High-Energy Spectroscopic Astrophysics: Saas Fee Advanced Course 30
03/04/2000 → 08/04/2000
Les Diablerets, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Climatic effects of energetic particles
Period: 5 Mar 2000
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: NASA Sun-Climate Workshop

Related event
Climatic effects of energetic particles: An overview
05/03/2000 → 05/03/2000
Tucson, Arizona, USA
Activity: Talks and presentations › Conference presentations

Danish space activities
Period: 14 Feb 2000
Eigil Friis-Christensen (Speaker)
National Space Institute
Management

Description
Note: Arctic Winter Cities Conference

Related event
Danish space activities
14/02/2000 → 14/02/2000
Kiruna, Sweden
Activity: Talks and presentations › Conference presentations

Danish space research
Period: 25 Jan 2000
Allan Hornstrup (Speaker)
National Space Institute
Astrophysics

Description
Note: Visit by a high-school class
Place: Danish Space Research Institute

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Hard X-ray optics for future high-energy astrophysics missions
Period: 13 Jan 2000
Finn Erland Christensen (Speaker)
National Space Institute
Astrophysics

Related event

Hard X-ray optics for future high-energy astrophysics missions
13/01/2000 → 13/01/2000
Caltech Space Radiation Laboratory, Pasadena, USA
Activity: Talks and presentations › Conference presentations

Denmark's Rømer satellite
Period: 1 Jan 2000 → …
Per Lundahl Thomsen (Speaker)
National Space Institute

Related event

Denmark's Rømer satellite
01/01/2000 → …
Canberra, Australia
Activity: Talks and presentations › Conference presentations

Ionospheric response to sudden commencements
Period: 1 Jan 2000 → …
Unknown Person (Participant)
National Space Institute

Description
Note: GEM summer workshop

Related event

Ionospheric response to sudden commencements
01/01/2000 → …
Colorado, USA
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ionospheric travelling convection vortices
Period: 1 Jan 2000 → …
Unknown Person (Participant)
National Space Institute

Description
Note: Joint DMI-DSRI seminar

Related event

Ionospheric travelling convection vortices
Solen under lup
Period: 1 Jan 2000 → …
Susanne Vennerstrøm (Lecturer)
Solar System Physics
National Space Institute

Description
Note: Lecture at public libraries and schools in connection with "Dansk Naturvidenskabsfestival"
Activity: Other

Solvinden og dens vekselvirkning med planeterne i solsystemet
Period: 1 Jan 2000 → …
Susanne Vennerstrøm (Speaker)
Solar System Physics
National Space Institute

Description
Note: Lecture at course for high-school teachers

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Solvinden og rumstørme
Period: 1 Jan 2000 → …
Susanne Vennerstrøm (Participant)
Solar System Physics
National Space Institute

Description
Solvinden og rumstørme
Note: Lecture during visit by high-school students

Related event
Solvinden og rumstørme
01/01/2000 → …
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The auroral electrojet as measured by the Ørsted satellite for the March 18-20 electrojet challenge period
Period: 1 Jan 2000 → …
Unknown Person (Participant)
National Space Institute

Description
Note: GEM summer workshop

Related event
The auroral electrojet as measured by the Ørsted satellite for the March 18-20 electrojet challenge period
01/01/2000 → …
The solar wind sources of storms: a statistical study
Period: 1 Jan 2000 → …
Susanne Vennerstrøm (Participant)
National Space Institute
Solar System Physics

Related external organisation
University of Oulu
Finland
Activity: Other

5th Huntsville Symposium
Period: 19 Oct 1999 → 22 Oct 1999
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
5th Huntsville Symposium
19/10/1999 → 22/10/1999
Huntville, AL, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Scientific problems and practical applications related to the magnetic field in the Earth's environment
Period: 9 Jul 1999
Eigil Friis-Christensen (Participant)
National Space Institute

Related event
Scientific problems and practical applications related to the magnetic field in the Earth's environment: Festkolloquium
09/07/1999 → 09/07/1999
GeoForschungsZentrum, Potsdam, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Solar wind - magnetosphere coupling processes, solar-terrestrial relationships: Forum for climate and global change
Period: 2 Jul 1999
Eigil Friis-Christensen (Participant)
National Space Institute

Related external organisation
Swiss Academy of Sciences, Bern, Switzerland
Activity: Other

In-flight calibration methods used for the Ørsted mission
Period: 9 Mar 1999
Nils Olsen (Participant)
National Space Institute
Solar System Physics
Related event

In-flight calibration methods used for the Ørsted mission: workshop on calibration of space-borne magnetometers
09/03/1999 → 09/03/1999
Braunschweig, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Small missions for energetic astrophysics
Period: 22 Feb 1999 → 26 Feb 1999
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

Small missions for energetic astrophysics: Ultraviolet to gamma-ray
22/02/1999 → 26/02/1999
Los Alamos, NM, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Gamma-ray bursts
Period: 6 Feb 1999 → 11 Feb 1999
Niels Lund (Speaker)
National Space Institute
Astrophysics

Description
Note: Presentation and poster at the workshop

Related event

Gamma Ray Bursts: The first three minutes
06/02/1999 → 11/02/1999
Gräftavallen, Sweden
Activity: Talks and presentations › Conference presentations

Erste Ergebnisse des Ørsted Satelliten
Period: 1 Jan 1999 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Related event

Erste Ergebnisse des Ørsted Satelliten
01/01/1999 → …
Geophysical Institute, University of Göttingen, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Erste Ergebnisse des Ørsted Satelliten
Period: 1 Jan 1999 → …
Nils Olsen (Participant)
National Space Institute
Solar System Physics

Related event
Erste Ergebnisse des Ørsted Satelliten  
01/01/1999 → …  
Institute of Geophysics and Meteorology, Technical University of Braunschweig, Germany  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ionospheric response to sudden commencements  
Period: 1 Jan 1999 → …  
Unknown Person (Participant)  
National Space Institute  
Related event

Ionospheric travelling convection vortices  
Period: 1 Jan 1999 → …  
Unknown Person (Participant)  
National Space Institute  
Related event

Ørsted internal field science and initial field models  
Period: 1 Jan 1999 → …  
Nils Olsen (Speaker)  
National Space Institute  
Solar System Physics  
Related event

Recent progress in exploring the near-Earth magnetic field with low-altitude satellites: IUGG meeting  
Period: 1 Jan 1999 → …  
Nils Olsen (Speaker)  
National Space Institute  
Solar System Physics  
Description  
Place: Birmingham, England  
Related external organisation  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations

Fysik i perspektiv  
Henrik Svensmark (Lecturer)
Solar System Physics
National Space Institute

**Related event**

**Fysik i perspektiv: sol og klima**
Odense
Activity: Talks and presentations › Conference presentations

**The Ørsted satellite and the Earth's magnetic field on the Internet**
Period: 3 Oct 1998
Unknown Person (Participant)
National Space Institute

**Related event**

The Ørsted satellite and the Earth's magnetic field on the Internet
03/10/1998 → 03/10/1998
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**What can one find on the Ministry of Research's homepage for popular science "rummet.dk" ?**
Period: 1 Oct 1998
Unknown Person (Participant)
National Space Institute

**Related event**

What can one find on the Ministry of Research's homepage for popular science "rummet.dk" ?: Lecture on Danish activity within the areas of space research and space technology
01/10/1998 → 01/10/1998
Danish Space Research Institute
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Hard X-ray multilayers for X-ray space research**
Period: 7 Sep 1998
Finn Erland Christensen (Participant)
National Space Institute
Astrophysics

**Related event**

Hard X-ray multilayers for X-ray space research: ERSF seminar, European Synchrotron Radiation Facility
Grenoble, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**The Danish Space Research Institute**
Period: 7 Sep 1998 → 8 Sep 1998
Eigil Friis-Christensen (Participant)
National Space Institute

**Related external organisation**

Nordic Graduate Physics Programme, NORDITA, Niels Bohr Institute, Theoretical Astrophysics Center, Copenhagen
Activity: Other
Kvant. Tidsskrift for Fysik og Astronomi (External organisation)
Period: 1 Jul 1998 → …
Jens Olaf Pepke Pedersen (Participant)
National Space Institute

Suncclimate

Description
Medlem af redaktionen
Links:
http://www.kvant.dk

Related external organisation

Kvant. Tidsskrift for Fysik og Astronomi
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

1998 Annual meeting of the Danish Physical Society
Period: 3 Jun 1998
Niels Lund (Participant)
National Space Institute
Astrophysics

Description
Micro-Ballerina - a Danish microsatellite?

Place: Danish Physical Society's annual meeting, Nyborg Strand
Degree of recognition: National

Related event

1998 Annual meeting of the Danish Physical Society
03/06/1998 → 04/06/1998
Nyborg, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DSRI: Present projects and the future
Period: 3 Jun 1998
Eigil Friis-Christensen (Speaker)
National Space Institute

Related event

DSRI: Present projects and the future: Annual meeting of the Danish Physical Society and Danish Astronomical Society
03/06/1998 → 03/06/1998
Nyborg Strand
Activity: Talks and presentations › Conference presentations

Opportunities with INTEGRAL
Period: 3 Jun 1998
Niels Lund (Speaker)
National Space Institute
Astrophysics

Description
Place: Danish Physical Society's annual meeting, Nyborg Strand

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Climate variations with solar activity
Period: 26 May 1998
Eigil Friis-Christensen (Participant)
National Space Institute

Related event
Climate variations with solar activity
26/05/1998 → 26/05/1998
ESTEC, Noordwijk, Holland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Kvant (Journal)
Period: 1 Apr 1998 → …
Jens Olaf Pepke Pedersen (Editor)
National Space Institute
Solar System Physics
Sunclimate

Description
Kvant. Tidsskrift for Fysik og Astronomi
Populærfagligt tidsskrift for astronimi, fysik og geofysik, udgives af Astronomisk Selskab, Dansk Fysisk Selskab, Selskabet for Naturlærens Udbredelsen samt Dansk Geofysisk Forening
Links:
http://www.kvant.dk

Related journal
Kvant
0905-8893
ISI indexed (2013): ISI indexed no
Central database
Activity: Communication › Journal editor

The dual role of the magnetic field in controlling and disclosing the physics of planets and their environment in the solar system: Lecture at the annual meeting of the German Geophysical Society
Eigil Friis-Christensen (Lecturer)
National Space Institute

Related external organisation
Göttingen, Germany
Activity: Talks and presentations › Conference presentations

Galaxy clusters and X-ray astronomy
Period: 19 Feb 1998
Unknown Person (Participant)
National Space Institute

Related event
Galaxy clusters and X-ray astronomy: Lecture for high-school classes and teacher student classes from Vordingborg
19/02/1998 → 19/02/1998
Danish Space Research Institute
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**The INTEGRAL satellite: Lecture for Danish Society for Space Research**
Period: 9 Feb 1998
Niels Jørgen Stenfeldt Westergaard (Guest lecturer)
Astrophysics
National Space Institute

**Related external organisation**
University of Copenhagen
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**Påvirker solens varierede aktivitet vores klima**
Period: 2 Feb 1998
Eigil Friis-Christensen (Participant)
National Space Institute
Activity: Other

**Comets: Lecture in connection with "Dansk Naturvidenskabsfestival"**
Period: 1 Jan 1998 → …
Allan Hornstrup (Lecturer)
Astrophysics
National Space Institute

**Related event**
Dansk Naturvidenskabsfestival
01/01/1998 → …
Helsingør Gymnasium
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

**Constellation-X: Next generation X-ray observatory**
Period: 1 Jan 1998 → …
Finn Erland Christensen (Participant)
National Space Institute
Astrophysics

**Related event**
Constellation-X: Next generation X-ray observatory
01/01/1998 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Global warming - is the Sun the culprit ?: Colloquium at the Institute of Physics, University of Odense**
Period: 1 Jan 1998 → …
Eigil Friis-Christensen (Speaker)
National Space Institute

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations
Ørsted satellitten
Period: 1 Jan 1998 → …
Unknown Person (Participant)
National Space Institute

Related event
Ørsted satellitten: Lecture in connection with "Dansk Naturvidenskabsfestival"
01/01/1998 → …
Danish Space Research Institute
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Space Research in Denmark and the Ørsted satellite
Period: 1 Jan 1998 → …
Eigil Friis-Christensen (Participant)
National Space Institute

Related event
Space Research in Denmark and the Ørsted satellite: Lecture for "Forskerspirer"
01/01/1998 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Storme i rummet
Period: 1 Jan 1998 → …
Unknown Person (Participant)
National Space Institute

Related event
Storme i rummet: Lecture in connection with "Dansk Naturvidenskabsfestival"
01/01/1998 → …
Danish Space Research Institute
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The creation and development of the solar system
Period: 1 Jan 1998 → …
Ib Lundgaard Rasmussen (Speaker)
National Space Institute
Astrophysics

Related event
The creation and development of the solar system
01/01/1998 → …
Danish Space Research Institute
Activity: Talks and presentations › Conference presentations

The Earth's magnetic field as seen by the Ørsted satellite
Period: 1 Jan 1998 → …
Unknown Person (Participant)
National Space Institute

Related event
The Earth's magnetic field as seen by the Ørsted satellite
The NGC 3258 group of galaxies as a cosmological probe
Period: 1 Jan 1998 → …
Unknown Person (Participant)
National Space Institute

Related event
The NGC 3258 group of galaxies as a cosmological probe
01/01/1998 → …
Nyborg Strand
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Sun
Period: 1 Jan 1998 → …
Susanne Vennerstrøm (Speaker)
National Space Institute
Solar System Physics

Related external organisation
University of Copenhagen
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Do variations in solar activity affect our climate?
Period: 28 Nov 1997
Eigil Friis-Christensen (Speaker)
National Space Institute

Description
Place: Oulu University, Oulu, Finland

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Meeting of the AAS High Energy Astrophysics Division
Period: 4 Nov 1997 → 7 Nov 1997
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event
Meeting of the AAS High Energy Astrophysics Division
04/11/1997 → 07/11/1997
Estes Park, CO, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Nordic Conference in Theoretical High-Energy Astrophysics
Period: 14 Sep 1997 → 16 Sep 1997
Søren Brandt (Participant)
National Space Institute
Astrophysics

**Related event**

**Nordic Conference in Theoretical High-Energy Astrophysics**
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**COBRAS/SAMBA: ESA's neste kosmiske obseivatorirrm**
Period: 11 Sep 1996
Hans Ulrik Nørgaard-Nielsen (Speaker)
National Space Institute
Astrophysics

**Description**
H. C. Ørsted Institute

**Related external organisation**

**University of Copenhagen**
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**The X-ray Space Research Program at the Danish Space Research Institute**
Period: 19 Aug 1996
Finn Erland Christensen (Speaker)
National Space Institute
Astrophysics

**Related external organisation**

**Lawrence Livermore National Lab., USA**
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**29th ESLAB Symposium**
Period: 25 Apr 1995 → 27 Apr 1995
Søren Brandt (Organizer)
National Space Institute
Astrophysics

**Description**
Member of local organizing committee.

**Related event**

**29th ESLAB Symposium: Towards the Source of Gamma-ray Bursts**
Period: 25/04/1995 → 27/04/1995
Noordwijk, Netherlands
Activity: Attending an event › Participating in or organising a conference

**International Workshop on Imaging in High Energy Astronomy**
Period: 26 Sep 1994 → 30 Sep 1994
Søren Brandt (Participant)
National Space Institute
Astrophysics
Degree of recognition: International

Related event

International Workshop on Imaging in High Energy Astronomy
Anacapri, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

30th COSPAR Scientific Assembly
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

30th COSPAR Scientific Assembly
Hamburg, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

The Gamma Ray Sky with Compton GRO and SIGMA
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

The Gamma Ray Sky with Compton GRO and SIGMA: NATO Advanced Study Institute
25/01/1994 → 04/02/1994
Les Houches, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Gamma Ray Bursts
Søren Brandt (Participant)
National Space Institute
Astrophysics
Degree of recognition: International

Related event

Gamma Ray Bursts: Second Workshop
19/10/1993 → 21/10/1993
Huntsville, AL, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Toulouse International Colloquium
Søren Brandt (Participant)
National Space Institute
Astrophysics
Related event

Toulouse International Colloquium: Recent Advances in High Energy Astronomy
17/03/1992 → 20/03/1992
Toulouse, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Compton Centennial International Symposium on Gamma Ray Astronomy
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

Compton Centennial International Symposium on Gamma Ray Astronomy
15/01/1992 → 17/01/1992
St. Louis, MO, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Workshop on Nova Muscae 1991
Søren Brandt (Organizer)
National Space Institute
Astrophysics

Related event

Workshop on Nova Muscae 1991
14/05/1991 → 16/05/1991
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Texas-ESO/CERN Symposium on Relativistic Astrophysics, Cosmology, and Fundamental Physics
Period: 16 Dec 1990 → 21 Dec 1990
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

Texas-ESO/CERN Symposium on Relativistic Astrophysics, Cosmology, and Fundamental Physics
16/12/1990 → 21/12/1990
Brighton, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

28th Plenary Meeting of COSPAR
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

28th Plenary Meeting of COSPAR
25/06/1990 → 06/07/1990
The Hague, Netherlands
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

23rd ESLAB Symposium on two topics in X-Ray Astronomy
Period: 13 Sep 1989 → 20 Sep 1989
Søren Brandt (Participant)
National Space Institute
Astrophysics

Related event

23rd ESLAB Symposium on two topics in X-Ray Astronomy: X-ray Binaries
Bologna, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Prizes:

Årets Danske Forskningsresultat 2016
Jens Olaf Pepke Pedersen (Recipient)
National Space Institute, Innovation and Research-based consultancy

Description
Valgt af læserne på videnskab.dk

Details
Awarded date: 28 Apr 2017
Degree of recognition: National
Granting Organisations: videnskab.dk
Prize: Prizes, scholarships, distinctions

E-gruppens 100 års jubilæum og uddeling af E-priser
Jonas Bækby Bjarnø (Recipient)
National Space Institute, Measurement and Instrumentation Systems

Description
Ingeniørforeningens Elektrofond har netop uddelt årets E-priser, som i år var mangedoblet i antal pga. 100-året for etableringen af E-gruppen.

Andreas Härstedt Jørgensen, DTU Space og Jonas Bækby Bjarnø, DTU Space
Prismodtagere; Andreas Härstedt Jørgensen, DTU Space og Jonas Bækby Bjarnø, DTU Space

Details
Awarded date: 16 Apr 2012
Granting Organisations: Ingeniørforeningens Elektrofond
Prize: Prizes, scholarships, distinctions

NASA Group Achievement Award: Juno Earth Flyby ASC Earth-Moon Movie Development
Alessandro Salvatore Massaro (Recipient)
National Space Institute, Measurement and Instrumentation Systems

Description
For outstanding technical accomplishment in the imaging, production and release of the captivating Juno Earth Flyby 4-day Earth-Moon Movie

Details
Awarded date: 2014
Granting Organisations: NASA, National Aeronautics and Space Administration
Prize: Prizes, scholarships, distinctions
Press clippings:

**Musk-mission sætter gang i guldfeber i rummet**
Søren Brandt
12/03/2018
National Space Institute, Astrophysics and Atmospheric Physics

**Media contribution (1)**

**Musk-mission sætter gang i guldfeber i rummet**
12/03/2018
DR P1 Morgen, Denmark
https://www.dr.dk/radio/p1/p1-morgen/p1-morgen-2018-02-12/02:01:15
Søren Brandt
Press / Media

**Kosmisk kollision var årets største videnskabelige gennembrud**
Søren Brandt
26/12/2017
National Space Institute, Astrophysics and Atmospheric Physics

**Media coverage (1)**

**Kosmisk kollision var årets største videnskabelige gennembrud**
26/12/2017
Ekstra Bladet, Denmark
https://ekstrabladet.dk/nyheder/videnskab_og_teknik/kosmisk-kollision-var-aarets-stoerste-videnskabelige-gennembrud/6971874
Søren Brandt

**Relations**
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
Press / Media

**Årets 10 største videnskabelige opdagelser**
Søren Brandt
24/12/2017
National Space Institute, Astrophysics and Atmospheric Physics

**Media coverage (1)**

**Årets 10 største videnskabelige opdagelser**
24/12/2017
Politiken (National), Denmark, Web
Lasse Foghsgaard
https://politiken.dk/viden/art6264429/%C3%85rets-%C3%B8rst-%C3%B8rste-videnskabelige-opdagelser
Søren Brandt

**Relations**
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
Press / Media

**Science: Neutronstjerners sammenstød er årets videnskabelige gennembrud**
Søren Brandt
21/12/2017
National Space Institute, Astrophysics and Atmospheric Physics

**Media contribution (1)**

**Science: Neutronstjerners sammenstød er årets videnskabelige gennembrud**
21/12/2017
Henrik Bendix
https://videnskab.dk/naturvidenskab/science-neutronstjerners-sammenstoed-er-aarets-videnskabelige-gennembrud

Søren Brandt

Relations
Research outputs:
GCN CIRCULAR 21672, LIGO/Virgo G298048: INTEGRAL pointed follow-up observations
GCN CIRCULAR 21507, LIGO/Virgo G298048: INTEGRAL detection of a prompt gamma-ray counterpart
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Press / Media
Ugens podcast: Dansk rumudstyr bidrog til årets astronyhed
Søren Brandt
27/10/2017
National Space Institute, Astrophysics and Atmospheric Physics

Media coverage (1)

Ugens podcast: Dansk rumudstyr bidrog til årets astronyhed
27/10/2017
Videnskab.dk (National), Denmark, Web
Jais Baggestrøm Koch
http://videnskab.dk/teknologi-innovation/ugens-podcast-dansk-rumudstyr-opdagede-aarets-astro-nyhed
Søren Brandt

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Press / Media
Ugens profil: "Vi fejrer en milepæl i astronomien"
Søren Brandt
19/10/2017
National Space Institute, Astrophysics and Atmospheric Physics

Media coverage (1)

Ugens profil: "Vi fejrer en milepæl i astronomien"
19/10/2017
Magisterbladet (National), Denmark, Web
Troels Kølln
Søren Brandt

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
Activities:
INTEGRAL 2017

Press / Media
DTU researchers involved in historic discovery in outer space
Søren Brandt
18/10/2017

Subject
Gravitational waves
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

DTU researchers involved in historic discovery in outer space
18/10/2017
DTU News (International), Denmark, Web
Morten Garly Andersen
The INTEGRAL space craft has measured signals originating from a collision of two neutron stars. For the first time ever, gravitational waves and gamma rays have been recorded from the same event. With the discovery of this phenomenon, which Einstein predicted, and for which the Nobel prize was recently awarded, the DTU researchers have secured their place in history.
Søren Brandt

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
Press / Media

Einstein havde ret
Søren Brandt
17/10/2017
National Space Institute, Astrophysics and Atmospheric Physics, Niels Bohr Institute

Media coverage (1)

Einstein havde ret
17/10/2017
BT (National), Denmark, Print
Lars Lindevall
side 16-17
Søren Brandt
Niels Bohr Institute

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817 and GRB 170817A
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
Press / Media

Sensationelt fund: 59 kvadrillioner kg guld
Søren Brandt
17/10/2017
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Sensationelt fund: 59 kvadrillioner kg guld
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Dansk røntgendetektor på rumfartøj står bag historisk fund
Søren Brandt
16/10/2017
National Space Institute, Astrophysics and Atmospheric Physics

'Menneskeheden har aldrig set noget lignende': Forskere afslører banebrydende observationer
Søren Brandt & Allan Hornstrup
16/10/2017
National Space Institute, Astrophysics and Atmospheric Physics

Sensationel tyngdebølgemåling åbner nyt kapitel i udforskningen af rummet
Søren Brandt
16/10/2017
National Space Institute, Astrophysics and Atmospheric Physics
Media coverage (1)

Sensationel tyngdebølgemåling åbner nyt kapitel i udforskningen af rummet
16/10/2017
Videnskab.dk, Denmark
http://videnskab.dk/naturvidenskab/sensationel-tyngdeboelgemaaling-aabner-nyt-kapitel-i-udforskningen-af-rummet
Serén Brandt

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Localization and Broadband Follow-Up of the Gravitational-Wave Transient GW150914
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Astronomer jubler over den første observation af sammenstød mellem to neutronstjerner
Serén Brandt
16/10/2017
National Space Institute, Astrophysics and Atmospheric Physics, Niels Bohr Institute

Media contribution (1)

Astronomer jubler over den første observation af sammenstød mellem to neutronstjerner
16/10/2017
Ingeniøren (National), Denmark, Web
Jens Ramskov
https://ing.dk/artikel/astronomer-jubler-forste-observation-sammenstoed-mellem-to-neutronstjerner-
207276?utm_source=nyhedsbrev&utm_medium=email&utm_campaign=daglig&cx_newsletter=daglig&cx_newsletterid=20
5424&utm_source=ING+V2+Common&utm_campaign=ec5e42e230-
EMAIL_CAMPAIGN_2017_10_17&utm_medium=email&utm_term=0_e43d1267b1-ec5e42e230-48727989
Serén Brandt
Niels Bohr Institute

Relations
Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO
The JEM-X X-ray monitor on INTEGRAL
Activities:
The New Era of Multi-messenger Astrophysics

DTU researchers involved in historic discovery in outer space
Serén Brandt & Jérôme Chenevez
16/10/2017

Description
The INTEGRAL space craft has measured signals originating from a collision of two neutron stars. For the first time ever, gravitational waves and gamma rays have been recorded from the same event. With the discovery of this phenomenon, which Einstein predicted, and for which the Nobel prize was recently awarded, the DTU researchers have secured their place in history.

Subject
Gravitational waves
National Space Institute, Astrophysics and Atmospheric Physics
The INTEGRAL space craft has measured signals originating from a collision of two neutron stars. For the first time ever, gravitational waves and gamma rays have been recorded from the same event. With the discovery of this phenomenon, which Einstein predicted, and for which the Nobel prize was recently awarded, the DTU researchers have secured their place in history.

Søren Brandt & Jérôme Chenevez
National Space Institute, Astrophysics and Atmospheric Physics

Research outputs:
INTEGRAL Detection of the First Prompt Gamma-Ray Signal Coincident with the Gravitational-wave Event GW170817
Multi-messenger Observations of a Binary Neutron Star Merger

Activities:
INTEGRAL 2017

Europa får helt nyt supervindue mod rummet
Søren Brandt
22/06/2017
National Space Institute, Astrophysics and Atmospheric Physics

Små, billige nanosatellitter sætter dansk rumforskning på verdenskortet
Jens Olaf Pepke Pedersen
09/06/2017
National Space Institute, Innovation and Research-based consultancy

Små, billige nanosatellitter sætter dansk rumforskning på verdenskortet
Jens Olaf Pepke Pedersen
06/06/2017
National Space Institute, Innovation and Research-based consultancy

Nanosatellitter sætter dansk rumforskning på verdenskortet
Jens Olaf Pepke Pedersen
06/06/2017
National Space Institute, Innovation and Research-based consultancy
Kühle Folgen der Schmelze
Jens Olaf Pepke Pedersen
13/05/2017

Description
Interview om Arktis med Neues Deutschland

Subject
Klimaændringer i Arktis
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Kühle Folgen der Schmelze
13/05/2017
Neues Deutschland (National), Germany, Print
Andreas Knudsen
Jens Olaf Pepke Pedersen
Press / Media

Ugens Podcast: Årets Danske Forskningsresultat
Jens Olaf Pepke Pedersen
05/05/2017

Description
I denne uges podcast kan du høre dialekter fra hele landet, og hvad de siger om os. Du kan også møde vinderne af Årets Danske Forskningsresultat, der fortæller om deres klimaprojekt.
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Årets Danske Forskningsresultat
05/05/2017
Videnskab.dk (National), Denmark, Radio
30 min
http://videnskab.dk/kultur-samfund/ugens-podcast-vores-dialekter-sladrer-om-samfundet
Jens Olaf Pepke Pedersen
Press / Media

En deprimerende konklusion er årets danske forskningsresultat
Jens Olaf Pepke Pedersen
28/04/2017

Description
Danskerne har talt: En noget deprimerende konklusion om fremtidens globale klima er valgt til årets danske forskningsresultat.
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

En deprimerende konklusion er årets danske forskningsresultat
28/04/2017
Berlingske (National), Denmark, Web
Lars Henrik Aagaard
Jens Olaf Pepke Pedersen
Let adgang til satellitdata skal skabe grundlag for nye virksomheder
Jens Olaf Pepke Pedersen
27/04/2017

Description
I et nyt projekt vil danske forskere bringe orden og systematik i de enorme mængder af globale data om havstrømme, bølger og vind. Flere virksomheder står på spring til at udnytte disse til nye forretningsmuligheder.
National Space Institute, Innovation and Research-based consultancy

Media coverage (1)

Let adgang til satellitdata skal skabe grundlag for nye virksomheder
27/04/2017
Ingeniøren (National), Denmark, Web
Jens Ramskov
https://ing.dk/artikel/let-adgang-satellitdata-skal-skabe-grundlag-nye-virksomheder-197709
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

Hvad skal vi sige til børnene: Klimadebatten skal være mere nuanceret
Jens Olaf Pepke Pedersen
26/04/2017

Description
Klimaforskeren Jens Olaf Pepke er skeptisk overfor om konsekvenserne af klimaforandringerne er så store, som mange af hans kolleger mener.
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Klimaforskeren Jens Olaf Pepke er skeptisk overfor om konsekvenserne af klimaforandringerne er så store, som mange af hans kolleger mener.
26/04/2017
DR (National), Denmark, Web
DR Viden
2 min
Jens Olaf Pepke Pedersen
Press / Media

Affaldshåndtering halter i bygderne
Jens Olaf Pepke Pedersen
27/01/2017

Subject
Camp Century, oprydning på lossepladser og dumpe i Grønland
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Affaldshåndtering halter i bygderne
27/01/2017
Sermitsiaq, Print
Trine Juncher Jørgensen
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

Når vandet kommer
Carlo Sass Sørensen
26/01/2017
Subject
water related challenges and climate impacts
National Space Institute, Geodesy

Media contribution (1)

Når vandet kommer
26/01/2017
DR tv, Television
Primeview Aps v/ Jes Petersen
1 time
https://www.dr.dk/tv/se/nar-mennesket-leger-gud/-/nar-vandet-kommer
Carlo Sass Sørensen
National Space Institute, Geodesy

Relations
Projects:
Coastal flooding hazards due to storm surges and subsidence
Press / Media

Forskere uenige om forureningsfare
Jens Olaf Pepke Pedersen
13/01/2017

Description
Klimaforsker ved DTU mener, at man hellere skal bruge resourser på at få ryddet op på de lokale dumpe end at rydde op ved Camp Century.

Subject
Camp Century
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Forskere uenige om forureningsfare
13/01/2017
Sermitsiaq, Print
Trine Juncher Jørgensen
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

P4 Weekend: 'The Sunday guest'
Carlo Sass Sørensen
08/01/2017

Description
The Sunday guest, (8 Jan 2017 9-10 am).

Subject
Climate changes, projections and adaptations - Coastal Floods, water-related challenges, and satellite based knowledge, in particular
National Space Institute, Geodesy

Media contribution (1)

P4 Weekend: 'The Sunday guest'
08/01/2017
DR P4 Midvest, Radio
Torben Møller
1 hour
http://www.dr.dk/playlister/p4vest/2017-01-08/p4-weekend-2017-01-08-07-03-2
Link to radio program
Carlo Sass Sørensen
National Space Institute, Geodesy
Sigurd and Snake trust science. They trust facts. But do they trust laws of nature so much that they are willing to put their life on the line? What would it for instance require to survive a fatal drop? Hopefully they will soon find out. Otherwise they'll be dead before the program ends.

Sigurd and Snake trust science. They trust facts. But do they trust laws of nature so much that they are willing to put their life on the line? What would it for instance require to survive a fatal drop? Hopefully they will soon find out. Otherwise they'll be dead before the program ends.

To astronomers with sensational claim: We have 234 signs of life in the universe: Two American astronomers have presented research results that indicate intelligent life in space has tried to contact us.

We have found signals from aliens

Vi har fundet signaler fra aliens
Sensationel påstand: »Vi har fundet signaler fra aliens«: To astronomer hævder, at de har fundet signaler fra intelligente væsner fra 234 forskellige steder i rummet
Jens Olaf Pepke Pedersen
26/10/2016

Description
Man har ledt efter dem i århundreder. Men nu hævder to amerikanske astronomer, at de langt om længe har fundet dem - vaskeægte intelligente signaler fra rummet.

Subject
Aliens
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

DTU delivering equipment for Mars2020: PIXL instrument
David Arge Klevang Pedersen
12/10/2016

Description
Explanation of mission objective and DTU deliveries for the PIXL instrument onboard NASAs Mars2020 mission
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Rosetta har en sidste opgave inden den styrter
Kristoffer Leer
30/09/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)
Water plumes på Europa
Kristoffer Leer
26/09/2016

Description
Interview om geysere på Europa (Jupiter månen) ca. kl 16.40
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Water plumes på Europa
26/09/2016
TV2 News, Television
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

P1 eftermiddag
Kristoffer Leer
08/09/2016

Description
Interview om OSIRIS Rex missionen
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

P1 eftermiddag
08/09/2016
DR, Radio
10 min
http://www.dr.dk/radio/ondemand/p1/p1-eftermiddag-2016-09-08/#!/
Forste 10 min
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

丹麦加大对无人机和格陵兰岛投入,旨在支持北极主权宣示申请: 近期,丹麦王国一直聚焦其北极领土,不仅对北极一大块狭长地带宣示了主权,还全力准备加强在北极的军事布防。丹麦拟发射卫星、投放无人侦察机,并依靠格陵兰人来加强其在北极地区的安全。
Jens Olaf Pepke Pedersen
08/09/2016

Subject
Droner og satellitter i Arktis
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

丹麦加大对无人机和格陵兰岛投入,旨在支持北极主权宣示申请: 近期,丹麦王国一直聚焦其北极领土,不仅对北极一大块狭长地带宣示了主权,还全力准备加强在北极的军事布防。丹麦拟发射卫星、投放无人侦察机,并依靠格陵兰人来加强其在北极地区的安全。
08/09/2016
Polar and Ocean Portal, Web
http://polaroceanportal.com/article/1157
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy

Rumsonde forsvundet i to år på komet: Nu jubler forskerne igen
Kristoffer Leer
06/09/2016
National Space Institute, Astrophysics and Atmospheric Physics
Rumsonde forsvundet i to år på komet: Nu jubler forskerne igen
06/09/2016
TV2, Web
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

Bornholms miljøplan helt uden klimaeffekt: Bornholms Regionskommunes stort anlagte klimapolitik betyder absolut intet for klimaet.
Jens Olaf Pepke Pedersen
06/09/2016
National Space Institute, Innovation and Research-based consultancy

Danmarks klimahensigter betyder intet for klimaet: Regeringens 2025-plan har fået hug for ikke at være ambitiøs nok på klimaområdet. Men danske klima-tiltag har ingen større betydning, siger klimaforsker. De er ren symbolpolitik
Jens Olaf Pepke Pedersen
05/09/2016
National Space Institute, Innovation and Research-based consultancy

Mystisk signal fra rummet skal undersøges: Prøver nogen at skabe kontakt?
Søren Brandt
01/09/2016
National Space Institute, Astrophysics and Atmospheric Physics

Danmarks første astronaut bliver forfatter
Jens Olaf Pepke Pedersen
01/09/2016

Subject
Andreas Mogensen og effekten på forskning og uddannelse
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Danmarks første astronaut bliver forfatter
01/09/2016
DR2 Morgen, Television
10 min
https://www.dr.dk/tv/se/dr2-morgen/dr2-morgen-2016-09-01#!/01:31:41
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy

Description
Danmark Stakes on Drones and Greenlanders to Back Its Arctic Claims
Jens Olaf Pepke Pedersen
01/09/2016

Recently, the Kingdom of Denmark has been focusing on its Arctic domains. Besides making a territorial claim on large
swaths of the Arctic, Denmark is all set to bolster its military presence in the region. Copenhagen aims to launch satellite
and drone surveillance, but is also counting on Greenlanders to strengthen the region's security.
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

'Dystisk' signal fra rummet er formentlig en fejl
Søren Brandt
31/08/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Forskere tror på fagre nye droneverden: Færøske fugle, piratfiskeri, skovbrande og oliespild. Droner, der engang blev
regnet for ubrugelige i Arktis, kan anvendes til en række ting og bør være en del af dansk rumprogram, vurderer en ny
rapport.
Jens Olaf Pepke Pedersen
29/08/2016
National Space Institute, Innovation and Research-based consultancy
Satellitter og droner i Arktis
Jens Olaf Pepke Pedersen
29/08/2016
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Satellitter og droner i Arktis
29/08/2016
P1 morgen, Radio
6 minutes
http://www.dr.dk/radio/ondemand/p1/p1-morgen-2016-08-29#/
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy

6 mennesker på Hawaii i Marsforsøg
Kristoffer Leer
29/08/2016
Subject
I programmet Datolinien, sidste indslag
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

6 mennesker på Hawaii i Marsforsøg
29/08/2016
Radio 24/7, Radio
8 minutes
http://www.radio24syv.dk/programmer/datolinjen/
Sidste indslag d. 29. august
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

Danmark skal investere i droner og satellitter i Arktis
Jens Olaf Pepke Pedersen
29/08/2016
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Danmark skal investere i droner og satellitter i Arktis
29/08/2016
DR2 Dagen, Television
12 min
https://www.dr.dk/tv/se/dr2-dagen/dr2-dagen-2016-08-29
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy

Drone og satellitter skal sikre retten til Nordpolens havbund
Jens Olaf Pepke Pedersen
29/08/2016
Droner og satellitter skal sikre retten til Nordpolens havbund
29/08/2016
KNR Grønland, Web
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

Droner og satellitter er fremtiden for Arktis: Forskere fra DTU Space har undersøgt potentialet i at investere i rumbaseret overvågning
29/08/2016
DR, Web
Morten Greve
http://www.dr.dk/nyheder/viden/tech/droner-og-satellitter-er-fremtiden-arktis
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

Droner i Arktis
29/08/2016
TV2 News, Television
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media

Storstilet satsning på droner kan styrke Danmarks rolle i Arktis: En eksplosiv udvikling i teknologien bag droner får forskere til at anbefale en storstilet satsning på de flyvende maskiner i Arktis. Anbefalingen fremgår af en regeringsbestilt rapport, som DTU Space fremlægger mandag
29/08/2016
Sermitsiaq, Web
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy
Press / Media
Доклад: отправляйте в Арктику беспилотники: В результате стремительного развития технологий специалисты рекомендуют в Арктике делать ставку на беспилотники.

Jens Olaf Pepke Pedersen
29/08/2016
National Space Institute, Innovation and Research-based consultancy

Media contribution (1)

Mars simulation på Hawaii
Kristoffer Leer
29/08/2016

Description
Interview om Mars simulering på Hawaii

Subject
DR2 dagen
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Seks personer har været på Mars
Kristoffer Leer
29/08/2016

Description
Indslag i TV-Avisen om Mars forsøg på Hawaii
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Rapport: Send droner til Arktis: En eksplosiv udvikling i teknologi får forskere til anbefale satsning på droner i Arktis.
Jens Olaf Pepke Pedersen
29/08/2016
National Space Institute, Innovation and Research-based consultancy
Rapport: Send droner til Arktis: En eksplosiv udvikling i teknologi får forskere til anbefale satsning på droner i Arktis.
29/08/2016
Politiken, Print
Adam Hannestad
http://politiken.dk/indland/ECE3360181/rapport-send-droner-til-arktis/
Jens Olaf Pepke Pedersen
National Space Institute, Innovation and Research-based consultancy

Hvis Solen lå 25 m fra Jorden ville Proxima b ligge i Chicago
Kristoffer Leer
27/08/2016

Description
Interview om ny exoplanet
National Space Institute, Astrophysics and Atmospheric Physics

Hvis Solen lå 25 m fra Jorden ville Proxima b ligge i Chicago
27/08/2016
Politiken, Web
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

Jagten på bølgerne fra universet
Søren Brandt
10/08/2016
National Space Institute, Astrophysics and Atmospheric Physics

Jagten på bølgerne fra universet
10/08/2016
DR P1 Videnskabens Verden, Radio
Kristoffer Frøkjær, Marie Hougaard
http://www.dr.dk/p1/videnskabens-verden/videnskabens-verden-2016-08-10
Søren Brandt
National Space Institute, Astrophysics and Atmospheric Physics

Funding eller forskning: Hvad er bedst for produktiviteten?: Der skal fokus på vidensdeling mellem forskermiljø og SMVer og investeringer, hvis Danmark skal få sat skub i produktiviteten.
Jens Olaf Pepke Pedersen
01/07/2016

Subject
Smart Innovation
National Space Institute, Sunclimate

Funding eller forskning: Hvad er bedst for produktiviteten?: Der skal fokus på vidensdeling mellem forskermiljø og SMVer og investeringer, hvis Danmark skal få sat skub i produktiviteten.
01/07/2016
Trendsonline, Web

Jens Olaf Pepke Pedersen
27/06/2016
National Space Institute, Sunclimate

Media contribution (1)


Jens Olaf Pepke Pedersen
24/06/2016
National Space Institute, Sunclimate

Media contribution (1)

Selvforstærkende klimaeffekt opdaget: CO2-effekten øges, når temperaturen stiger: Forskere fra bl.a. DTU og KU har vist, at den globale opvarmning som følge af udledning af CO2 til atmosfæren vokser mere og mere, i takt med at temperaturen øges.

Jens Olaf Pepke Pedersen
23/06/2016
National Space Institute, Sunclimate

Media contribution (1)
Estudio advierte que la Tierra podría calentarse en 10°C: Científicos detectaron fenómeno que amplifica el cambio climático. En la investigación participaron expertos de universidades chilenas.

Jens Olaf Pepke Pedersen
23/06/2016
National Space Institute, Sunclimate

Media contribution (1)

Estudio advierte que la Tierra podría calentarse en 10°C: Científicos detectaron fenómeno que amplifica el cambio climático. En la investigación participaron expertos de universidades chilenas.

23/06/2016
La Tercera, Print
Carlos González Isla
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

DTU PIXL
David Arge Klevang Pedersen
24/05/2016

Subject
Mars2020, PIXL
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

DTU PIXL
24/05/2016
Alt Om Data, Web
http://www.altomdata.dk/dtu-kamera-gaar-paa-jagt-liv-paa-mars
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media

Arktisk milliardfond skal sætte skub i Grønland: Ambassadør Peter Taksøe-Jensens forslag om en særlig arktisk fond til investeringer i Grønland vækker jubel i Grønland og i PensionDanmark. Statsminister Lars Løkke Rasmussen (V) siger, at han afventer et udspil i sagen fra det officielle Grønland.

Jens Olaf Pepke Pedersen
06/05/2016

Description
Faktaboks: "Satellitter og droner – en gave til Grønland"

Subject
Satellites in Arctic, telecommunication
National Space Institute, Sunclimate

Media contribution (1)

Arktisk milliardfond skal sætte skub i Grønland: Ambassadør Peter Taksøe-Jensens forslag om en særlig arktisk fond til investeringer i Grønland vækker jubel i Grønland og i PensionDanmark. Statsminister Lars Løkke Rasmussen (V) siger, at han afventer et udspil i sagen fra det officielle Grønland.

06/05/2016
Berlingske, Print
Bent Hejgaard Sørensen
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media
TAKSØE-RAPPORT DTU Space ser gerne flere droner over Grønland: Seniorforsker Jens Olaf Pepke Pedersen fra DTU Space er begejstret over den netop offentliggjorte Taksøe-rapports anbefalinger om at Danmark bør fokusere mere på sin indsats i Arktis og afsøge mulighederne for satellitbaserede løsninger i Arktis.

Jens Olaf Pepke Pedersen
03/05/2016
National Space Institute, Sunclimate

Media contribution (1)

TAKSØE-RAPPORT DTU Space ser gerne flere droner over Grønland: Seniorforsker Jens Olaf Pepke Pedersen fra DTU Space er begejstret over den netop offentliggjorte Taksøe-rapports anbefalinger om at Danmark bør fokusere mere på sin indsats i Arktis og afsøge mulighederne for satellitbaserede løsninger i Arktis.

03/05/2016
KNR, Web
http://knr.gl/da/nyheder/dtu-space-ser-gerne-flere-droner-over-gr%C3%B8nland
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

TAKSØE-RAPPORT Satellitovervågning af Grønland koster 1-2 milliarder: Et større dansk engagement i Arktis er blandt de anbefalinger, som Peter Taksøe-Jensen har gransket sig frem til i sin rapport om fremtiden for dansk udenrigs- og forskningspolitik.

Jens Olaf Pepke Pedersen
03/05/2016
National Space Institute, Sunclimate

Media contribution (1)

Arktis skal overvåges af satellitter
Jens Olaf Pepke Pedersen
03/05/2016

Description
Interview til DR2 Morgen

Subject
Overvågning af arktis med satellitter
National Space Institute

Media contribution (1)

Arktis skal overvåges af satellitter
03/05/2016
DR2. Television
5:00 min
https://www.dr.dk/tv/se/dr2-morgen/dr2-morgen-2016-04-25#!/25:48
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Det giver meget bedre mening at satse på satellitter fremfor kampfly i Arktis.
Jens Olaf Pepke Pedersen
Det giver meget bedre mening at satse på satellitter fremfor kampfly i Arktis. Sådan lyder anbefalingen fra det såkaldte taksøe-udvalg. Og der er både meget bedre mulighed for vækst og bedre overvågning af det grønlandske territorium, lyder det fra DTU Space.

National Space Institute, Sunclimate

Media contribution (1)

Det giver meget bedre mening at satse på satellitter fremfor kampfly i Arktis.
03/05/2016
P1, Radio
6:00 min
http://www.dr.dk/radio/ondemand/p1/p1-morgen-2016-05-03/#l/22:57
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate

Press / Media

Satellitter i Arktis
Jens Olaf Pepke Pedersen
03/05/2016
National Space Institute

Media contribution (1)

Satellitter i Arktis
03/05/2016
P3, Radio
5:00 min
Jens Olaf Pepke Pedersen
National Space Institute

Press / Media

Ny satellit i Grønland skal advare om soludbrud
Kristoffer Leer
02/05/2016

Subject
Soludbrud
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Ny satellit i Grønland skal advare om soludbrud
02/05/2016
JP, Web
http://jyllands-posten.dk/nyviden/ECE8624994/ny-satellit-i-groenland-skal-advare-om-soludbrud/
Kristoffer Leer
National Space Institute, Astrophysics and Atmospheric Physics

Press / Media

Det kan vi bruge tyngdebølger til
Søren Brandt
31/03/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Det kan vi bruge tyngdebølger til
31/03/2016
Jyllandsposten (National), Denmark, Web
Charlotte Price Persson
Søren Brandt

Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Press / Media

Mapping of ground movements to target climate adaptation
Carlo Sass Sørensen
24/03/2016
National Space Institute, Geodesy

Media coverage (1)

Kortlægning af jordbevægelser skal målrette klimatilpasningen
24/03/2016
Ingeniøren (National), Denmark, Print
Julie Lykke-Nedergaard
1 p
https://ing.dk/artikel/kortlaegning-af-jordbevaegelser-skal-malrette-klimatilpasningen-182925
Carlo Sass Sørensen

Relations
Projects:
Coastal flooding hazards due to storm surges and subsidence

Press / Media

Forskere: Disse fund kan vi forvente af tyngdeboelger
Søren Brandt
20/03/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Forskere: Disse fund kan vi forvente af tyngdeboelger
20/03/2016
Videnskab.dk, Web
Charlotte Price Persson
Søren Brandt
National Space Institute, Astrophysics and Atmospheric Physics

Relations
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Press / Media

DTU PIXL
David Arge Klevang Pedersen
11/03/2016

Subject
Mars 2020, PIXL
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

DTU PIXL
11/03/2016
TV2 Nyheder, Television
http://nyheder.tv2.dk/2016-02-26-mars-mission-fyldt-med-dansk-teknologi
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Vil tyngdebølge-sensation ændre dansk forskning?
Søren Brandt
02/03/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Vil tyngdebølge-sensation ændre dansk forskning?
02/03/2016
Videnskab.dk (National), Denmark, Web
Charlotte Price Persson
https://videnskab.dk/miljo-naturvidenskab/vil-tyngdebolge-sensation-aendre-dansk-forskning
Søren Brandt
Press / Media

Rygter: LIGO har målt flere tyngdebølger
Søren Brandt
29/02/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Rygter: LIGO har målt flere tyngdebølger
29/02/2016
Videnskab.dk, Web
Charlotte Price Persson
http://videnskab.dk/miljo-naturvidenskab/rygter-ligo-har-malt-flere-tyngdebolger
Søren Brandt
National Space Institute, Astrophysics and Atmospheric Physics

Relations
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

ESAs Philae: P1 Morgen
Kristoffer Leer
17/02/2016

Description
P1 Morgen ca kl 7.55
National Space Institute, Astrophysics

Media contribution (1)

ESAs Philae: P1 Morgen
17/02/2016
DR, Radio
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

ESA opgiver Philae
Kristoffer Leer
17/02/2016

Description
Interview om ESAs Philaes afslutning
National Space Institute, Astrophysics

Media contribution (1)
ESA opgiver Philae
17/02/2016
DR, Television
7 min
http://www.dr.dk/nyheder/viden/naturvidenskab/esaprogiver-definitivtkometlander#!/00:00
Kristoffer Leer
National Space Institute, Astrophysics

Fysikerne jubler: Vi har fundet tyngdebølger!
Søren Brandt
12/02/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Fysikerne jubler: Vi har fundet tyngdebølger!
12/02/2016
Videnskab.dk, Web
Charlotte Price Persson, Bo Karl Christensen
http://videnskab.dk/miljo-naturvidenskab/fysikerne-jubler-vi-har-fundet-tyngdebolger
Søren Brandt
National Space Institute, Astrophysics and Atmospheric Physics

Relations
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

Danske forskere: Tyngdebølger den største opdagelse i 100 år
Søren Brandt & Alex Nielsen
11/02/2016
National Space Institute, Astrophysics and Atmospheric Physics, Albert-Einstein-Institut, Max-Planck-Institut für Gravitationsphysik, D-30167 Hannover, Germany

Media coverage (1)

Danske forskere: Tyngdebølger den største opdagelse i 100 år
11/02/2016
DR Viden (National), Denmark, Web
Søren Bjørn-Hansen
https://www.dr.dk/nyheder/viden/danske-forskere-tyngdeboelger-den-stoerste-opdagelse-i-100-aar#!/00:38
Søren Brandt & Alex Nielsen
Albert-Einstein-Institut, Max-Planck-Institut für Gravitationsphysik, D-30167 Hannover, Germany

Relations
Projects:
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO

FAKTA: Tyngdebølger er krusninger i rumtiden: De kaldes århundredets opdagelse. Men hvad er de såkaldte gravitationsbølger egentlig for noget?
Søren Brandt
11/02/2016
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

FAKTA: Tyngdebølger er krusninger i rumtiden: De kaldes århundredets opdagelse. Men hvad er de såkaldte gravitationsbølger egentlig for noget?
11/02/2016
DR Viden, Web
Søren Bjørn-Hansen
http://www.dr.dk/nyheder/viden/fakta-tyngdeboelger-er-krusninger-i-rumtiden
Søren Brandt  
National Space Institute, Astrophysics and Atmospheric Physics

Relations  
Projects:  
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO  
Press / Media

Opdagelse af tyngdebølger  
Søren Brandt  
11/02/2016  
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Opdagelse af tyngdebølger  
11/02/2016  
DR2 (National), Denmark, Television  
http://www.dr.dk/nyheder/viden/tyngdeboelger#/

Søren Brandt  
National Space Institute, Astrophysics and Atmospheric Physics

Relations  
Research outputs:  
Localization and Broadband Follow-Up of the Gravitational-Wave Transient GW150914  
Projects:  
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO  
Press / Media

Videnskabelig sensation: Forskere bekræfter Einstein-teori: Den største videnskabelige opdagelse i det nye årtusinde er netop blevet afsløret  
Søren Brandt  
11/02/2016

Subject  
Gravitationsbølger  
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Videnskabelig sensation: Forskere bekræfter Einstein-teori: Den største videnskabelige opdagelse i det nye årtusinde er netop blevet afsløret  
11/02/2016  
Ekstrabladet, Web  
Jonas Skov Nielsen  
http://ekstrabladet.dk/videnskabelig-sensation-forskere-bekraefter-einstein-teori/5948615

Søren Brandt  
National Space Institute, Astrophysics and Atmospheric Physics

Relations  
Projects:  
INTEGRAL follow-up observations of gravitational wave event candidates from LIGO and VIRGO  
Press / Media

Rygtebørsen koger over: Forskere har fundet bevis for tyngdebølger  
Søren Brandt  
10/02/2016  
National Space Institute, Astrophysics and Atmospheric Physics

Media contribution (1)

Rygtebørsen koger over: Forskere har fundet bevis for tyngdebølger  
10/02/2016
Se videoer: Slog meteor ned på Sjælland lørdag aften?
Kristoffer Leer
07/02/2016
National Space Institute, Astrophysics
Press / Media

Så du det? Mystisk lysglimt over Danmark kan være meteor
Kristoffer Leer
07/02/2016
National Space Institute, Astrophysics

Media contribution (1)

Så du det? Mystisk lysglimt over Danmark kan være meteor
Kristoffer Leer
07/02/2016
National Space Institute, Astrophysics

Meteorit i Danmark
Kristoffer Leer
07/02/2016
Description
Interview om meteoritfald over Danmark d. 6 februar 2016 Sendt ca kl 7 d. 7 februar på TV2 News
National Space Institute, Astrophysics

Media contribution (1)

Læserstorm efter brag og lysglimt: Slog meteor ned i Danmark i nat?
Kristoffer Leer
07/02/2016
National Space Institute, Astrophysics

Media contribution (1)

Læserstorm efter brag og lysglimt: Slog meteor ned i Danmark i nat?
Kristoffer Leer
07/02/2016
National Space Institute, Astrophysics

Spacewalk på TV2 News
Kristoffer Leer
15/01/2016
Description
Om spacewalk 46, 15. jan 2016
ca kl 14 om spacewalk
Description
Do you know about Star Wars than the stars on the sky? What's a light-year, a meteor shower and distant galaxies? To night we'll have a hole through to space when DR3 transmits LIVE from the telescope at La Palma in order to fact check the Star Wars films. Is it pure imagination or is there live out there?
Ask questions at #DR3stjernekik.

Ved du mere om Star Wars end om stjernenhimlen? Hvad er et lysår, en meteorregn og fjerne galakser? I aften har vi hul igennem til verdensrummet, når DR3 sender LIVE fra stjernekikkerten på La Palma for at faktatjekke Star Wars-filmene. Er det ren fantasi eller er der liv der ude?
Stil spørgsmål på #DR3stjernekik.

Invited as expert to appear in the studio during the event

Subject
Live TV event
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Live fra stjernerne
14/12/2015
Danish Radio, Television
Lars Ostenfeldt
2h
René Fléron
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Meteorsværm sender masser af stjerneskud over himlen
Kristoffer Leer
14/12/2015
National Space Institute, Astrophysics

Media contribution (1)

Her kan du masser af stjerneskud i nat
Kristoffer Leer
14/12/2015
National Space Institute, Astrophysics
Media contribution (1)

Her kan du masser af stjerneskud i nat
14/12/2015
Web
Kristoffer Leer
National Space Institute, Astrophysics

En illusion at kloden er reddet af en politisk klimaaftale
Jens Olaf Pepke Pedersen
14/12/2015
National Space Institute, Sunclimate

Media contribution (1)

En illusion at kloden er reddet af en politisk klimaaftale
14/12/2015
Byggeeksport, Print
CCR News
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate

MAVEN results
Kristoffer Leer
05/11/2015

Description
Interview on latest results from the MAVEN mission to Mars

Started at 20.45
National Space Institute, Astrophysics

Media contribution (1)

MAVEN results
05/11/2015
TV2 News, Television
Kristoffer Leer
National Space Institute, Astrophysics

Live fra verdensrummet
René Fléron
02/09/2015

Description
DR3 will transmit live from space and you may follow it. We'll send a balloon to the edge of the atmosphere and see how far we'll get before either the connection is lost or the balloon explodes. A TV experiment which no one knows where ends.
DR3 science geeks will be at the ready to answer all questions at #DR3rum.

DR3 sender live fra rummet, og du kan følge med. Vi sender en ballon ud til kanten af atmosfæren og ser hvor langt vi når, inden forbindelsen forsvinder eller ballonen eksploderer. Et tv-eksperiment ingen ved hvor ender. DR3s videnskabsnærder sidder klar og svarer på alle spørgsmål på #DR3rum.

Helped in experiment design, planning and manufacturing. Participated as expert in the studio during the TV event.

Subject
Live TV experiment
National Space Institute, Measurement and Instrumentation Systems
Live fra verdensrummet
02/09/2015
Danish Radio, Television
Lars Ostenfeldt
2h
René Fléron
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Om Andreas Mogensens Mission i rummet
Kristoffer Leer
01/09/2015

Description
kl. 16 om Andreas mission til ISS
National Space Institute, Astrophysics

Om Andreas Mogensens Mission i rummet
01/09/2015
TV2 News, Television
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Chance igen i nat: Sværmen af stjerneskud fortsætter
Kristoffer Leer
13/08/2015
National Space Institute, Astrophysics

Chance igen i nat: Sværmen af stjerneskud fortsætter
13/08/2015
eb.dk, Web
http://ekstrabladet.dk/nyheder/samfund/chance-igen-i-nat-svaermeren-af-stjerneskud-fortsætter/5684023
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Perihlion Rosetta
Kristoffer Leer
13/08/2015
National Space Institute, Astrophysics

Perihlion Rosetta
13/08/2015
TV2 News, Television
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Manglende overvågning af Arktis: Der er næsten ingen dansk overvågning af Arktis
Jens Olaf Pepke Pedersen
01/08/2015
National Space Institute, Sunclimate

Media contribution (1)
Manglende overvågning af Arktis: Der er næsten ingen dansk overvågning af Arktis
01/08/2015
Ekstra Bladet, Print
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

Liv i rummet?
Kristoffer Leer
23/07/2015
National Space Institute, Astrophysics

Media contribution (1)

Liv i rummet?
23/07/2015
TV2, Television
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Pluto
Kristoffer Leer
17/07/2015
National Space Institute, Astrophysics

Media contribution (1)

Pluto
17/07/2015
TV2 News, Web
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Is på komet overflade er lidt af en gåde
Kristoffer Leer
25/06/2015
National Space Institute, Astrophysics

Media contribution (1)

Is på komet overflade er lidt af en gåde
25/06/2015
DR, Web
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Article for bulletins-electroniques.com: Découverte d'une étoile à neutrons et d'un trou noir dans la direction du centre de notre Galaxie
Jérôme Chenevez
27/05/2015

Description
Popular article in french about the discovery of two new X-ray sources with INTEGRAL/JEM-X. Published 27/05/2015.

Subject
Article published on-line by the french Embassy in Denmark.
National Space Institute, Astrophysics

Media contribution (1)
Article for bulletins-electroniques.com: Découverte d'une étoile à neutrons et d'un trou noir dans la direction du centre de notre Galaxie
27/05/2015
BE Danemark, Web
French mininstry of Foreign Affairs
http://www.bulletins-electroniques.com/actualites/78514.htm
Jérôme Chenevez
National Space Institute, Astrophysics
Press / Media

Interview à DR P1 Videnskabens verden
Jérôme Chenevez
07/04/2015

Subject
Interview om opdagelsen af to nye galakstiske rentgenkilder med INTEGRAL/JEM-X
National Space Institute, Astrophysics

Media contribution (1)

Interview à DR P1 Videnskabens verden
07/04/2015
Danmarks Radio P1, Radio
http://www.dr.dk/p1/videnskabens-verden/videnskabens-verden-kunstig-intelligens-far-hoejere-iq
Jérôme Chenevez
Astrophysics, National Space Institute

Relations
Projects:
The JEM-X X-ray monitor on INTEGRAL
Press / Media

Interview à DR P1 Videnskabs verden: Det største sorte hul er fundet
Jérôme Chenevez
24/03/2015

Subject
Interview om det mest massive sorte hul
National Space Institute, Astrophysics

Media contribution (1)

Interview à DR P1 Videnskabs verden: Det største sorte hul er fundet
24/03/2015
Danmarks Radio P1, Radio
http://www.dr.dk/p1/videnskabens-verden/videnskabens-verden-2015-03-24
Jérôme Chenevez
National Space Institute, Astrophysics
Press / Media

Om solformørkelse
Kristoffer Leer
20/03/2015
National Space Institute, Astrophysics

Media contribution (1)

Om solformørkelse
20/03/2015
P1 Morgen, Radio
http://www.dr.dk/radio/ondemand/p1/p1-morgen-2015-03-20/#l/00:37:28
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media
DR2 Morgen: Om solformørkelse
Kristoffer Leer
20/03/2015
National Space Institute, Astrophysics

Media contribution (1)

DR2 Morgen: Om solformørkelse
20/03/2015
DR, Television
https://www.dr.dk/tv/se/dr2-morgen/dr2-morgen-2015-03-20
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Om solformørkelsen næste dag
Kristoffer Leer
19/03/2015
National Space Institute, Astrophysics

Media contribution (1)

Om solformørkelsen næste dag
19/03/2015
TV2 News, Radio
TV2
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Sådan ville Jorden blive uden sin Måne
Kristoffer Leer
19/03/2015
National Space Institute, Astrophysics

Media contribution (1)

Sådan ville Jorden blive uden sin Måne
19/03/2015
DR.dk, Web
http://www.dr.dk/nyheder/viden/naturvidenskab/saadan-ville-jorden-blive-uden-sin-maane
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Forskere find tegn på flydende vand i rummet
Kristoffer Leer
14/03/2015
National Space Institute, Astrophysics

Media contribution (1)

Forskere find tegn på flydende vand i rummet
14/03/2015
DR, Web
5 minutter
http://www.dr.dk/radio/ondemand/p1/p1-morgen-2015-03-14#!/
ca. kl 8.30
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media
Mennesker og medier: Fikseringsfejl
Jens Olaf Pepke Pedersen
13/03/2015

Description
Der er én lighed mellem læger og journalister: De laver begge fejl. Faktisk laver de den samme type fejl, de såkaldte fikseringsfejl, hvor man er så fikseret på at finde netop de symptomer eller citater, som bekræfter ens diagnose eller historie, at man glemmer alt det andet. Men der er også en forskel: Hvor lægerne i årevis har arbejdet med at løse fikseringsfejlene, er journalisterne først blevet opmærksomme på problemet nu, mener forfatterne til den nye bog 'Forelsket i vinklen'. Konsekvensen kan være en dårligere og mere konfliktfyldt debat.

Drøftede kommunikationsafhandling fra RUC i lyset af "fikseringsfejl" samt mediernes valg af kilder i klimadækningen National Space Institute

Media contribution (1)

Mennesker og medier: Fikseringsfejl
13/03/2015
DR P1, Radio
Hakon Mosbech
1 hour
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Historisk: Rumsonde besøger dværgplanet idag
Kristoffer Leer
06/03/2015
National Space Institute, Astrophysics

Media contribution (1)

Historisk: Rumsonde besøger dværgplanet idag
06/03/2015
Ingeniøren, Web
http://ing.dk/artikel/historisk-rumsonde-besoeger-dvaergplanet-i-dag-174588
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Radioavisen
Jens Olaf Pepke Pedersen
11/02/2015

Subject
Anvendelse af droner i Grønland
National Space Institute

Media contribution (1)

Radioavisen
11/02/2015
DR P1, Radio
Kirsten Rosing
2 min
http://www.dr.dk/radio/ondemand/p1/radioavisen-1716#!/
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media
DTU-rapport: Send droner til Grønland
Jens Olaf Pepke Pedersen
11/02/2015
National Space Institute

Media contribution (1)

DTU-rapport: Send droner til Grønland
11/02/2015
Ingeniøren, Print
Steffen McGhie
http://ing.dk/artikel/dtu-rapport-send-droner-til-groenland-174036
Jens Olaf Pepke Pedersen
National Space Institute

Rapporter: Sådan skal Arktis overvåges
Jens Olaf Pepke Pedersen
10/02/2015
National Space Institute

Media contribution (1)

Rapporter: Sådan skal Arktis overvåges
10/02/2015
Sermitsiaq, Print
Søren Duran Duus
http://sermitsiaq.ag/rapporter-arktis-overvaages
Jens Olaf Pepke Pedersen
National Space Institute

Vil droner og satellitter overtage Arktis?
Jens Olaf Pepke Pedersen
10/02/2015
National Space Institute

Media contribution (1)

Vil droner og satellitter overtage Arktis?
10/02/2015
Jyllands Posten, Print
Lars From
Jens Olaf Pepke Pedersen
National Space Institute

Nalunaarusiat: Issittoq ima nakkutigineqassaaq
Jens Olaf Pepke Pedersen
10/02/2015

Description
Kalaallit Nunaat siunissami qanoq nakkutigineqarsinnaersoq DTU Spacetit Illersomissamut ministeriaqarfinniillu
misissomeqalerutterpoq. Qaammataasat atorlugit nakkutiginnissaq tamanit siunnersuutigineqarpq

Subject
Satellites and drones in the Arctic
National Space Institute

Media contribution (1)

Nalunaarusiat: Issittoq ima nakkutigineqassaaq
10/02/2015
IXV test: Artikel på DR om opsendelse
Kristoffer Leer
10/02/2015
National Space Institute, Astrophysics

Media contribution (1)

IXV test: Artikel på DR om opsendelse
10/02/2015
Web
http://www.dr.dk/nyheder/viden/naturvidenskab/europaeisk-rumfart-tester-om-rumfartoej-kan-lande
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Nogle forskere frygter, at deres tro kan svække deres troværdighed
Jens Olaf Pepke Pedersen
05/02/2015
National Space Institute

Media contribution (1)

Nogle forskere frygter, at deres tro kan svække deres troværdighed
05/02/2015
Kristeligt Dagblad, Print
Jannie Iwankow Søgaard
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Monster-asteroide tæt på jorden
Allan Hornstrup
26/01/2015
National Space Institute, Astrophysics, IT-Department

Media contribution (1)

Monster-asteroide tæt på jorden
26/01/2015
TV2 Nyhederne, Print
Morten Bolvinkel
Allan Hornstrup
National Space Institute, Astrophysics, IT-Department
Press / Media

Hvorfor er der nordlys?
Jens Olaf Pepke Pedersen
23/01/2015

Subject
Nordlys
National Space Institute
Hvorfor er der nordlys?
23/01/2015
Politiken, Print
Lasse Foghsgaard
http://politiken.dk/viden/ECE2520871/spoerg-lasse-hvorfor-er-der-nordlys/
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Virkelighedens komplekte klima
Jens Olaf Pepke Pedersen
06/01/2015
National Space Institute

Godmorgen Danmark
Kristoffer Leer
08/12/2014
National Space Institute, Astrophysics

Læserne spørger
Allan Hornstrup
22/11/2014
National Space Institute, Astrophysics, IT-Department

Rummission er succes trods dødt batteri
Kristoffer Leer
15/11/2014
National Space Institute, Astrophysics
Rummission er en succes trods to dages batterilevetid
Kristoffer Leer
15/11/2014
National Space Institute, Astrophysics

Media contribution (1)

Rummission er en succes trods to dages batterilevetid
15/11/2014
Web
http://www.mx.dk/viden/videnskab/story/16749550
Kristoffer Leer
National Space Institute, Astrophysics

Press / Media

Forsker om dødt batteri: Vi håber Philae ringer hjem til sommer: Om Philea
Kristoffer Leer
15/11/2014
National Space Institute, Astrophysics

Media contribution (1)

Forsker om dødt batteri: Vi håber Philae ringer hjem til sommer: Om Philea
15/11/2014
DR, Web
http://www.dr.dk/Nyheder/Viden/Naturvidenskab/2014/11/15110118.htm
Kristoffer Leer
National Space Institute, Astrophysics

Press / Media

TV2 news: kl 20.15
Kristoffer Leer
14/11/2014

Subject
Interview om Rosetta of Philea
National Space Institute, Astrophysics

Media contribution (1)

TV2 news: kl 20.15
14/11/2014
TV2 News, Television
7 min
Kristoffer Leer
National Space Institute, Astrophysics

Press / Media

Phileas landing på kometen 67p
David Arge Klevang Pedersen
14/11/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Phileas landing på kometen 67p
14/11/2014
Kringvarp Føroya, Radio
TV2 News: 4 interviews på tv2 News
Kristoffer Leer
13/11/2014
National Space Institute, Astrophysics

Media contribution (1)

TV2 News: 4 interviews på tv2 News
13/11/2014
TV2 News, Television
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Deltagelse i Godmorgen Danmark
Kristoffer Leer
12/11/2014

Subject
kl 6.40
National Space Institute, Astrophysics

Media contribution (1)

Deltagelse i Godmorgen Danmark
12/11/2014
TV2, Television
7 min
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Kommentarer på TV2 News: Om Philea
Kristoffer Leer
12/11/2014
National Space Institute, Astrophysics

Media contribution (1)

Kommentarer på TV2 News: Om Philea
12/11/2014
TV2 news, Television
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Europæisk rumforskning forsøger historisk komet-landing
Kristoffer Leer
12/11/2014
National Space Institute, Astrophysics

Media contribution (1)

Europæisk rumforskning forsøger historisk komet-landing
12/11/2014
DR.dk, Web
http://www.dr.dk/Nyheder/Viden/2014/11/000323.htm
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Rosetta og Philae
Allan Hornstrup
12/11/2014

Subject
Om Philae landing på kometen 67P
National Space Institute, Astrophysics, IT-Department

Media contribution (1)

Rosetta og Philae
12/11/2014
DR Nyhederne, Television
Allan Hornstrup
National Space Institute, Astrophysics, IT-Department
Press / Media

Rosetta og Philae
Allan Hornstrup
12/11/2014
National Space Institute, Astrophysics, IT-Department

Media contribution (1)

Rosetta og Philae
12/11/2014
P4 København, Radio
Ole Rasmussen
Allan Hornstrup
National Space Institute, Astrophysics, IT-Department
Press / Media

Rosetta og Philae
Allan Hornstrup
12/11/2014
National Space Institute, Astrophysics, IT-Department

Media contribution (1)

Rosetta og Philae
12/11/2014
DR3 Monte Carlo, Television
Peter Falktoft og Esben Bjerre
Allan Hornstrup
National Space Institute, Astrophysics, IT-Department
Press / Media

Phileas landing på kometen 67p
David Arge Klevang Pedersen
12/11/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Phileas landing på kometen 67p
12/11/2014
DR2, Television
Lene Johansen
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media
Videnskabens Verden P1: Om rosetta
Kristoffer Leer
11/11/2014
National Space Institute, Astrophysics

Media contribution (1)

Videnskabens Verden P1: Om rosetta
11/11/2014
Radio
http://www.dr.dk/p1/videnskabens-verden/videnskabens-verden-136
Kristoffer Leer
National Space Institute, Astrophysics
Press / Media

Rosetta og Philae
Allan Hornstrup
11/11/2014
National Space Institute, Astrophysics, IT-Department

Media contribution (1)

Rosetta og Philae
11/11/2014
TV2, Television
Poul Erik Skammelsen
3 minutter
Allan Hornstrup
National Space Institute, Astrophysics, IT-Department
Press / Media

Deadline, DR2
Jens Olaf Pepke Pedersen
02/11/2014

Subject
IPCC
National Space Institute

Media contribution (1)

Deadline, DR2
02/11/2014
DR2, Television
Martik Krasnik
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

FN's klimapanel. Topmøde i Tivolis kongrescenter: Befolkningstilvækst
Jens Olaf Pepke Pedersen
31/10/2014
National Space Institute

Media contribution (1)

FN's klimapanel. Topmøde i Tivolis kongrescenter: Befolkningstilvækst
31/10/2014
TV2, Television
Nyhedsudsendelse
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media
Vindmøller
Jens Olaf Pepke Pedersen
31/10/2014
National Space Institute, Sunclimate

Media contribution (1)

Vindmøller
31/10/2014
TV2 News, Television
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

FN's klimapanel. Topmøde i Tivolis kongrescenter
Jens Olaf Pepke Pedersen
27/10/2014
National Space Institute

Media contribution (1)

FN's klimapanel. Topmøde i Tivolis kongrescenter
27/10/2014
TV2 News, Television
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Klimakampen ved Tivoli
Jens Olaf Pepke Pedersen
25/10/2014
National Space Institute

Media contribution (1)

Klimakampen ved Tivoli
25/10/2014
Berlingske, Print
Lars Henrik Aagaard
http://www.b.dk/nationalt/klimakampen-ved-tivoli
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media

Forsker: Galathea 3 blev en event - drop den slags ekspeditioner
Jens Olaf Pepke Pedersen
14/10/2014

Subject
Galathea3
National Space Institute

Media contribution (1)

Forsker: Galathea 3 blev en event - drop den slags ekspeditioner
14/10/2014
videnskab.dk, Print
http://videnskab.dk/miljo-naturvidenskab/forsker-galathea-3-blev-en-event-drop-den-slags-ekspeditioner
Jens Olaf Pepke Pedersen
National Space Institute
Press / Media
Juno Earth Fly By filmklip: Omkring produktionen af filmklippet og eksponeringen af denne.
David Arge Klevang Pedersen
03/10/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Juno Earth Fly By filmklip: Omkring produktionen af filmklippet og eksponeringen af denne.
03/10/2014
DR P3, Radio
David Mandel
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media

NASA Juno Earth Fly By: Film lavet af danske phd studerende
David Arge Klevang Pedersen
24/09/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

NASA Juno Earth Fly By: Film lavet af danske phd studerende
24/09/2014
TV2 Lorry, Television
Stine Sylvestersen
http://www.tv2lorry.dk/arkiv/2014/9/24?video_id=95439
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media

NASA Juno Earth Fly By: Film lavet af danske pdh studerende
David Arge Klevang Pedersen
17/09/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

NASA Juno Earth Fly By: Film lavet af danske pdh studerende
17/09/2014
TV2 Lorry Nyheder, Television
http://www.tv2lorry.dk/arkiv/2014/9/17?video_id=95205
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media

Danske studerende står bag kæmpe NASA-succes
David Arge Klevang Pedersen
16/09/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Danske studerende står bag kæmpe NASA-succes
16/09/2014
Videnskab, Print
Lise Brix
http://videnskab.dk/teknologi/danske-studerende-star-bag-kaempe-nasa-succes
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Press / Media
Gode chancer for nordlys i aften
Kristoffer Leer
12/09/2014
National Space Institute, Astrophysics

Media contribution (1)

Good chance to see the Northern Lights in Denmark tonight
Kristoffer Leer
11/09/2014
National Space Institute, Astrophysics

Media contribution (1)

Chance for nordlys i aften
Kristoffer Leer
11/09/2014
National Space Institute, Astrophysics

Media contribution (1)

P1Morgen: Mystiske "vikingemus" fundet på Madeira
Jens Olaf Peppe Pedersen
16/07/2014
National Space Institute

Media contribution (1)
Vikingemus på Madeira hjælper dansk klimaforsker
Jens Olaf Pepke Pedersen
16/07/2014
National Space Institute, Sunclime

Media contribution (1)

Vikingemus på Madeira hjælper dansk klimaforsker
16/07/2014
DR Viden, Web
Hanne Kokkegård
http://www.dr.dk/nyheder/viden/miljoe/vikingemus-paa-madeira-hjaelper-dansk-klimaforsker#
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate

Interview i forbindelse med opsendelsen af DTUsat-2: Live optagelse af første pass over Danmark - med tilhørende tracking af første beacons.
René Fléron
19/06/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Interview i forbindelse med opsendelsen af DTUsat-2: Live optagelse af første pass over Danmark - med tilhørende tracking af første beacons.
19/06/2014
TV2 News, Television
1min 40sec
René Fléron
National Space Institute, Measurement and Instrumentation Systems

Interview i forbindelse med opsendelse af DTUsat-2
René Fléron
18/06/2014
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Interview i forbindelse med opsendelse af DTUsat-2
18/06/2014
DR2, Television
Niels Krause-Kjær og Sanne Gram
René Fléron
National Space Institute, Measurement and Instrumentation Systems

Verden går ikke under – uanset hvad FN siger
Jens Olaf Pepke Pedersen
17/04/2014
National Space Institute

Media contribution (1)

Verden går ikke under – uanset hvad FN siger
17/04/2014
Dispatch International, Print
Lars Hedegaard
Jens Olaf Pepke Pedersen
National Space Institute

Press / Media
Opsendelse af radiosonde fra Reading University Atmospheric Observatory
Jens Olaf Pepke Pedersen
11/04/2014
National Space Institute, Sunclimate

Media contribution (1)

Opsendelse af radiosonde fra Reading University Atmospheric Observatory
11/04/2014
Youtube, Web
https://www.youtube.com/watch?v=-tYdxOOHwbY
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate

Antarktis: En ekspedition til Antarktis for 100 år siden gik gruelig galt, formyld blev den forsøgt gentaget.
Jens Olaf Pepke Pedersen
05/02/2014

Subject
Klimaændringer i Arktis.
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Antarktis: En ekspedition til Antarktis for 100 år siden gik gruelig galt, formyld blev den forsøgt gentaget.
05/02/2014
TV2 Lorry, Television
Stine Sylvestersen
8:57 min
http://www.lorry.dk/arkiv/2014/2/5?video_id=87468
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate

Cloud Chamber Mystery: En tur på DTU Space hos Jens Olaf Pepke Pedersen i hans Skylab
Jens Olaf Pepke Pedersen
20/01/2014
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Cloud Chamber Mystery: En tur på DTU Space hos Jens Olaf Pepke Pedersen i hans Skylab
20/01/2014
Discovery, Web
Simon Roneklindt
4:18 min.
http://www.discovery.dk/cloud-chamber/
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate

Hvornår er det fuldmåne andre steder på Jorden?
Kristoffer Leer
12/01/2014
National Space Institute, Astrophysics

Media contribution (1)

Hvornår er det fuldmåne andre steder på Jorden?
12/01/2014
Web
http://videnskab.dk/sporg-videnskaben/hvornar-er-det-fuldmane-andre-steder-pa-jorden
Globale Abkühlung: Steht eine Eiszeit bevor?
Jens Olaf Pepke Pedersen
11/01/2014

Description
Das Klima ändert sich, aber nicht in der Weise, wie es der Haufen der Klimaänderungspropheten vorhergesagt hat. Die Natur hat sich über die Vorhersagen zur globalen Erwärmung einfach hinweg gesetzt. Wer also sind die wirklichen Klimaleugner?

Subject
Klimaänderungen
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Globale Abkühlung: Steht eine Eiszeit bevor?
11/01/2014
EIKE - Europäisches Institut für Klima und Energie, Web
Dale Hurd
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

Global Cooling: Is an Ice Age Coming?
Jens Olaf Pepke Pedersen
08/01/2014

Description
The sun has been very unusual for almost 15 years now,

Subject
Climate change
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Global Cooling: Is an Ice Age Coming?
08/01/2014
CBN News, Television
Dale Hurd
5:30 min
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

Arbejde med Juno Earth Fly By filmklip
David Arge Klevang Pedersen
20/12/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Arbejde med Juno Earth Fly By filmklip
20/12/2013
Kringvarp Føroya, Television
Liv Mikkelsen
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute
Arbejde med billeder fra NASA's rumsonde Juno
David Arge Klevang Pedersen
19/12/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Arbejde med billeder fra NASA's rumsonde Juno
19/12/2013
Kringvarp Føroya, Radio
Rúni Jákupson
http://kvf.fo/netvarp/uv/2013/12/19/arbeir-vi-myndum-sum-fylgisveinurin-juno-tekur
David Arge Klevang Pedersen
Measurement and Instrumentation Systems, National Space Institute

DR2 morgen
Kristoffer Leer
28/11/2013
National Space Institute, Astrophysics

Media contribution (1)

»Klimaskeptikeren« møder »klimaalarmisten«: Er befolkningsæksplosionen eller klimaet menneskets største udfordring?
Jens Olaf Pepke Pedersen
13/10/2013

Subject
Klimaændringer.
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

JUNO Earth Flyby Image Series: Earth and Moon system captured from Juno Spacecraft during Earth Flyby
Mathias Benn
09/10/2013

Description
During the Earth Flyby of the Juno Spacecraft, the DTU developed star compass was retuned for enabling images to be captured of the Earth and the Moon.
The linked video shows the outcome of this process.

Subject
Juno Spacecraft
National Space Institute, Measurement and Instrumentation Systems
JUNO Earth Flyby Image Series: Earth and Moon system captured from Juno Spacecraft during Earth Flyby
09/10/2013
NASA, Web

Mathias Benn
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Galatea3: Selvtilfreds afrapportering
Jens Olaf Pepke Pedersen
01/10/2013
National Space Institute, Sunclimate

Mikrofonholder - Radio24Syv: Interview af DTU professor Henrik Svensmark
Henrik Svensmark
27/06/2013
National Space Institute, Solar System Physics, Sunclimate

Skeptikere vinder terræn i klimadebat
Henrik Svensmark
13/06/2013
National Space Institute, Solar System Physics, Sunclimate

Galathea-projektet skal ikke evalueres
Jens Olaf Pepke Pedersen
01/06/2013
National Space Institute, Sunclimate
Media contribution (1)

**Galathea-projektet skal ikke evalueres**
01/06/2013
Forskerforum, Print
Lasse Højsgaard
Jens Olaf Pepke Pedersen
National Space Institute, Suncimate
Press / Media

**DTU Space hjælper russere på hundeslæderejse**
Roberto Saldo
30/04/2013

**Subject**
Grønlandsisen
National Space Institute, Microwaves and Remote Sensing

Media contribution (1)

**DTU Space hjælper russere på hundeslæderejse**
30/04/2013
Ingeniøren, Print
Theis Holtz Hansen
http://ing.dk/artikel/dtu-space-hjaelper-russere-paa-hundeslaederejse-158320
Roberto Saldo
National Space Institute, Microwaves and Remote Sensing
Press / Media

**Jordens magnetfelt: Forskerportræt af DTU Space professor Nils Olsen**
Nils Olsen
28/04/2013

**Subject**
Swarm projektet skal måle Jordens magnetfelt
National Space Institute, Geomagnetism

Media contribution (1)

**Jordens magnetfelt: Forskerportræt af DTU Space professor Nils Olsen**
28/04/2013
Danskersnes Akademi, Television
08:45
http://www.dr.dk/DR2/Danskernes+akademi/Natur_Matematik/Jordens_magnetfelt
Nils Olsen
National Space Institute, Geomagnetism
Press / Media

**Tre "danske" satellitter skal udforske Jordens magnetfelt**
Nils Olsen
28/04/2013
National Space Institute, Geomagnetism

Media contribution (1)

**Tre "danske" satellitter skal udforske Jordens magnetfelt**
28/04/2013
DR Viden, Print
Hanne Kokkegård
http://www.dr.dk/Nyheder/Viden/Naturvidenskab/2013/04/Tre_danske_satellitter_skal_udforske_jordens_magnetfelt.htm
Nils Olsen
National Space Institute, Geomagnetism
Press / Media
DTU leverer udstyr til nyt NASA-instrument på rumstationen: Nyt røntgenteleskop på rumstationen bliver forsynet med danskudviklet navigationsmodul
John Leif Jørgensen
15/04/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

DTU leverer udstyr til nyt NASA-instrument på rumstationen: Nyt røntgenteleskop på rumstationen bliver forsynet med danskudviklet navigationsmodul
15/04/2013
Ingeniøren, Print
Jens Ramskov
http://ing.dk/artikel/dtu-leverer-udstyr-til-nyt-nasa-instrument-paa-rumstationen-157926
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems

NASA på nye eventyr - vil indfange asteroide
John Leif Jørgensen
10/04/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

NASA på nye eventyr - vil indfange asteroide
10/04/2013
DR2, Television
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems

Minedrift på månen
John Leif Jørgensen
28/03/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Minedrift på månen
28/03/2013
DR/Deadline, Television
Martin
http://www.dr.dk/DR2/deadline2230/seudsendelser.htm#/75052
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems

Til rumstationen med rakelfart
John Leif Jørgensen
28/03/2013
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Til rumstationen med rakelfart
28/03/2013
TV2, Television
kean@tv2.dk
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Kosmisk stråling og El Niño påvirker skyernes højde
Jens Olaf Pepke Pedersen
16/03/2013

Subject
Fysik Meteorologi
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Kosmisk stråling og El Niño påvirker skyernes højde
16/03/2013
Ingeniøren, Web
Jens Ramskov
http://ing.dk/artikel/kosmisk-straaling-og-el-ni-no-paavirker-skyernes-hoejde-156929
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

Russisk meteor skabte højthængede natteskyer
Jens Olaf Pepke Pedersen
22/02/2013

Subject
Meteornedslag, natlysende skyer
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Russisk meteor skabte højthængede natteskyer
22/02/2013
Ingeniøren, Web
Thomas Boel
http://ing.dk/artikel/136690-russisk-meteor-skabte-hoejthaengede-natteskyer
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

Kina stormer frem i rummet: Videnskabens Verden 19. februar 2013 kl. 14:03 på P1
Kristian Pedersen
19/02/2013

Subject
Kinas rolle i rummet.
National Space Institute, Management

Media contribution (1)

Kina stormer frem i rummet: Videnskabens Verden 19. februar 2013 kl. 14:03 på P1
19/02/2013
P1, Radio
Marie Hougaard et al.
I alt 59:00 min.
http://www.dr.dk/P1/Videnskabensverden/Udsendelser/2013/02/19162833.htm
Kristian Pedersen
National Space Institute, Management
Press / Media

Russisk meteor med potentiale til Ragnarok
Kristian Pedersen
16/02/2013
National Space Institute, Management
Media contribution (1)

Russisk meteor med potentiale til Ragnarok
16/02/2013
P1 Morgen, Radio
06:38
http://www.dr.dk/P1/P1Morgen/Udsendelser/2013/02/16/104233.htm
Kristian Pedersen
National Space Institute, Management
Press / Media

Derfor opdagede ingen meteoren: Meteorer af den størrelse, der fredag morgen ramte Ural-regionen i Rusland, er for små til at blive spottet i rummet, forklarer DTU Space
Kristian Pedersen
15/02/2013
National Space Institute, Management

Media contribution (1)

Derfor opdagede ingen meteoren: Meteorer af den størrelse, der fredag morgen ramte Ural-regionen i Rusland, er for små til at blive spottet i rummet, forklarer DTU Space
15/02/2013
Ingeniøren, Print
Malene Breusch Hansen
http://ing.dk/artikel/136472-derfor-opdagede-ingen-meteoren
Kristian Pedersen
National Space Institute, Management
Press / Media

Hvordan undgår vi at verden går under?
Kristian Pedersen
13/02/2013

Subject
Astroider i rummet samt risikoen for at Jorden bliver ramt af en sådan
National Space Institute, Management

Media contribution (1)

Hvordan undgår vi at verden går under?
13/02/2013
Aftenshowet, Television
Ca. 6 min
http://www.dr.dk/DR1/Aftenshowet/Klip+fra+Aftenshowet/#/70453
Kristian Pedersen
National Space Institute, Management
Press / Media

Gasjagten: Skifergas
Jens Olaf Pepke Pedersen
11/02/2013

Subject
Skifergas
National Space Institute, Solar System Physics, Sunclimate

Media contribution (1)

Gasjagten: Skifergas
11/02/2013
SDU Medietorvet, Web
Christian Birk
6:18 min
https://www.youtube.com/watch?v=MtNcLDbosdY&noredirect=1
Man regner med at vi skal bruge ca. en halv gang mere energi i 2050 end i dag. Vi slubrer det i os i takt med vindmøllermotorer, kulminerne bliver dybere og oilstrømmen hoster. Og derfor er vi nødt til at finde nye energiformer.

Og de er kæmpe fordele ved at hente strøm fra rummet fortæller professor på DTU John Leif Jørgensen: "Det vil give os en fantastisk energikilde der er fri for CO₂ og så er der masser af den. Kun ca. 1/10 af den energi som solen sender mod jorden bliver brugt – resten forsvinder bare videre ud i rummet". 

De laver skyer under jorden: Forskere fra DTU Space har studeret, hvor stor betydning kosmiske partikler og solens aktivitet har i dannelsen af skyer

Danske forskere studerer skydannelse 1.100 meter under jorden: En engelsk mine har gennem et par år lagt lokaler til et eksperiment, der skal vise, om ioner kan regulere skydannelsen i atmosfæren.
Danske forskere studerer skydannelse 1.100 meter under jorden: En engelsk mine har gennem et par år lagt lokaler til et eksperiment, der skal vise, om ioner kan regulere skydannelsen i atmosfæren.

28/11/2012
Ingeniøren, Print
Jens Ramskov
http://ing.dk/artikel/134464-danske-forskere-studerer-skydannelse-1100-meter-under-jorden
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

Danmarks største rumforskningsmiljø ligger i Lyngby
Søren Brandt
23/11/2012
National Space Institute, Astrophysics

Danmarks største rumforskningsmiljø ligger i Lyngby
23/11/2012
Det Grenne Område, Print
Signe Steffensen
http://lyngby-taarbaek.lokalavisen.dk/danmarks-stoerste-rumforskningsmiljoe-ligger-i-lyngby-
/20121112/artikler/711278958/1010
Søren Brandt
National Space Institute, Astrophysics
Press / Media

Rumforskning styrket
Kristian Pedersen
23/11/2012
National Space Institute, Management

Rumforskning styrket
23/11/2012
Lorry, Television
Stine Sylvestersen
ca. 2 min.
http://www.lorry.dk/arkiv/2012/11/23
Kristian Pedersen
National Space Institute, Management
Press / Media

Rumforskning styrket
Carol Anne Oxborrow
23/11/2012
National Space Institute, Astrophysics

Rumforskning styrket
23/11/2012
TV2 Lorry, Television
Stine Sylvestersen
ca. 2 min.
http://www.lorry.dk/arkiv/2012/11/23?video_id=73923
Carol Anne Oxborrow
National Space Institute, Astrophysics
Press / Media

**Cryosat, DTU Space**
Henriette Skourup
05/11/2012

**Subject**
ESA og DTU Space samarbejde om satellitten Cryosat
National Space Institute, Geodynamics

**Media contribution (1)**

**Cryosat, DTU Space**
05/11/2012
DTUbroadcast, Web
5:47
http://www.youtube.com/watch?v=0WKZlZeQBjg
Henriette Skourup
National Space Institute, Geodynamics
Press / Media

**Dårligt Nyt**
Jens Olaf Pepke Pedersen
18/10/2012

**Subject**
Solen går amok
National Space Institute, Solar System Physics, Sunclimate

**Media contribution (1)**

**Dårligt Nyt**
18/10/2012
DR1, Television
Anders Lund Madsen
Ca. 7 min
http://www.dr.dk/DR1/Daarligt_Nyt/forside#/58417
Jens Olaf Pepke Pedersen
National Space Institute, Solar System Physics, Sunclimate
Press / Media

**Sætter livet på spil for at sprænge lydmuren**
John Leif Jørgensen
08/10/2012
National Space Institute, Measurement and Instrumentation Systems

**Media contribution (1)**

**Sætter livet på spil for at sprænge lydmuren**
08/10/2012
TV2 nyheder, Television
Jeppe Lykke Hansen
http://nyhederne.tv2.dk/article.php?id=58373102:video-s%C3%A6tter-livet-p%C3%A5-spil-for-at-spr%C3%A6nge-lydmuren.html
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media
NASA giver DTU pris for deltagelse i rummission: Videnskabens Verden
John Leif Jørgensen
02/10/2012
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

NASA giver DTU pris for deltagelse i rummission: Videnskabens Verden
02/10/2012
Videnskabens Verden, Radio
Kristoffer Frøkjær
59:00
http://www.dr.dk/P1/Videnskabensverden/Udsendelser/2012/10/02124129.htm
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

P1 Morgen den 28. sep. 2012: Nasa-pris til DTU Space
John Leif Jørgensen
28/09/2012
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

P1 Morgen den 28. sep. 2012: Nasa-pris til DTU Space
28/09/2012
P1, DR, Radio
http://www.dr.dk/P1/P1Morgen/Udsendelser/2012/09/28/103440.htm
John Leif Jørgensen
Measurement and Instrumentation Systems, National Space Institute
Press / Media

Verden ifølge Gram: Interview med DTU Professor John Leif Jørgensen
John Leif Jørgensen
25/09/2012

Subject
Rumforskningens muligheder og fremtidsperspektiver
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Verden ifølge Gram: Interview med DTU Professor John Leif Jørgensen
25/09/2012
P1, Web
Bjørn Rønhof Qvortrup
http://www.dr.dk/P1/Gram/Udsendelser/2012/09/21102525.htm
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Next stop Mars: Verden ifølge Gram 25. september 2012 kl. 10:03 på P1
John Leif Jørgensen
25/09/2012
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Next stop Mars: Verden ifølge Gram 25. september 2012 kl. 10:03 på P1
25/09/2012
P1, DR, Radio
Steffen Gram
59:00
http://www.dr.dk/P1/Gram/Udsendelser/2012/09/21102525.htm
Aftenshowet: Voyager missionens bedrifter og den teknologi den bygger på: Interview af DTU Professor John Leif Jørgensen
John Leif Jørgensen
05/09/2012

Subject
Interview om missionens bedrifter og dens teknologier
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Aftenshowet: Voyager missionens bedrifter og den teknologi den bygger på: Interview af DTU Professor John Leif Jørgensen
05/09/2012
Aftenshowet, Television
DR
http://www.dr.dk/DR1/Aftenshowet/index.htm
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems

Gå på opdagelse i solsystemet via mobilen: PlanetCards - Play to discover
Kristoffer Leer
05/09/2012
National Space Institute, Solar System Physics

Media contribution (1)

Gå på opdagelse i solsystemet via mobilen: PlanetCards - Play to discover
05/09/2012
Videnskab.dk, Web
Rasmus Yde Post
http://videnskab.dk/teknologi/ga-pa-opdagelse-i-solsystemet-mobilen
Kristoffer Leer
National Space Institute, Solar System Physics

Introduktion til Ingeniørarbejde i geofysik og rumteknologi
René Fléron
21/08/2012

Subject
Kursusbeskrivelse af kursus nr. 30100
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Introduktion til Ingeniørarbejde i geofysik og rumteknologi
21/08/2012
DTUbroadcast, Web
Astrid Degersbøl
12:59
http://www.youtube.com/watch?v=BpiPKqpiErE
René Fléron
National Space Institute, Measurement and Instrumentation Systems

Amatørraket affyret i Østersøen
René Fléron
Media contribution (1)

**Amatørraket affyret i Østersøen**

12/08/2012
TV2, Television
http://nyhederne.tv2.dk/article.php/id-52976253 amatørraket-affyret-i-%C3%B8sters%C3%B8en.html
René Fléron
National Space Institute, Measurement and Instrumentation Systems
Press / Media

**Mars Curiosity: What can we learn from the new Mars rover and what are the perspectives of space exploration?**

Kristoffer Leer
06/08/2012

Description
Broadcast from the program Globus on Radio24-7 sent on August 6th 2012. It is a debate on the perspectives on research to be carried out by the new Mars rover Mars Science Lab (Curiosity) and about space research in the future. The program is in danish.

Subject
Space research
National Space Institute, Solar System Physics

Media contribution (1)

**Mars Curiosity: What can we learn from the new Mars rover and what are the perspectives of space exploration?**

06/08/2012
Radio 24-7, Radio
Globus
40 min.
http://arkiv.radio24syv.dk/video/6656514/globus-06-08-2012
Kristoffer Leer
National Space Institute, Solar System Physics
Press / Media

**Falcon 9 / Dragon to ISS**

Ulla Svensmark
31/05/2012

Description
Registrant

Subject
Beskrivelse af SpaceX Falcon 9 og denne mission/projekt i rummet
National Space Institute

Media contribution (1)

**Falcon 9 / Dragon to ISS**

31/05/2012
JyllandsPosten, Print
Ulla Svensmark
National Space Institute
Press / Media

**Houston, we have an eye problem: En ny undersøgelse viser, at længere tid i rummet kan forårsage dårlige øjne for astronauter**

John Leif Jørgensen
12/03/2012

Subject
Astronauters helbred og påvirkning fra rummet i deres missioner
Atlanta, we have an eyeproblem: En ny undersøgelse viser, at længere tid i rummet kan forårsage dårlige øjne for astronauter
12/03/2012
Metroxpress, Print
Lasse Spang-Hanssen
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Ny satellit skal måle sorte huller og neutronstjener
Søren Brandt
12/02/2012
National Space Institute, Astrophysics

Media contribution (1)

Ny satellit skal måle sorte huller og neutronstjener
12/02/2012
Ingeniøren, Print
Jens Ramskov
http://ing.dk/artikel/126590-ny-satellit-skal-maale-sorte-huller-og-neutronstjener
Online article in Ingeniøren (in Danish)
Søren Brandt
National Space Institute, Astrophysics

Relations
Activities:
LOFT mission concept Science Study Team (External organisation)
Press / Media

Ny satellit skal måle sorte huller og neutronstjener
Carl Budtz-Jørgensen
12/02/2012
National Space Institute, Astrophysics

Media contribution (1)

Ny satellit skal måle sorte huller og neutronstjener
12/02/2012
Rockefeller Komplekset, København Ø., Print
http://ing.dk/artikel/126590-ny-satellit-skal-maale-sorte-huller-og-neutronstjener
EXT-OA
Carl Budtz-Jørgensen
National Space Institute, Astrophysics
Press / Media

Ny satellit skal måle sorte huller og neutronstjener
Niels Lund
12/02/2012
National Space Institute, Astrophysics

Media contribution (1)

Ny satellit skal måle sorte huller og neutronstjener
12/02/2012
Rockefeller Komplekset, København Ø., Print
http://ing.dk/artikel/126590-ny-satellit-skal-maale-sorte-huller-og-neutronstjener
EXT-OA
Niels Lund
National Space Institute, Astrophysics
Danskere udvikler røntgenkamera til kæmpesatellit: Hvis alt går godt, bliver satellitten LOFT sendt ud i rummet i år 2022 med et danskbygget røntgenkamera ombord.

Søren Brandt
02/02/2012
National Space Institute, Astrophysics

Media contribution (1)

Danskere udvikler røntgenkamera til kæmpesatellit: Hvis alt går godt, bliver satellitten LOFT sendt ud i rummet i år 2022 med et danskbygget røntgenkamera ombord.

02/02/2012
Videnskab.dk, Web
Charlotte Price Persson
http://videnskab.dk/teknologi/danskere-udvikler-rontgenkamera-til-kaempesatellit
Søren Brandt
National Space Institute, Astrophysics

Relations
Activities:
LOFT mission concept Science Study Team (External organisation)
Press / Media

Danskere med i stort rumprojekt: Satellitten LOFT sendes i 2022 ud i rummet med et danskbygget røntgenkamera ombord

Søren Brandt
02/02/2012
National Space Institute, Astrophysics

Media contribution (1)

Danskere med i stort rumprojekt: Satellitten LOFT sendes i 2022 ud i rummet med et danskbygget røntgenkamera ombord

02/02/2012
Jyllandsposten, Print
http://jp.dk/nyviden/article2682868.ece
Online article in Jyllandsposten (in Danish)
Søren Brandt
National Space Institute, Astrophysics

Relations
Projects:
LOFT, the Large Observatory For X-ray Timing
Activities:
LOFT mission concept Science Study Team (External organisation)
Press / Media

Dansk forsker angriber FN's klimapanel
Jens Olaf Pepke Pedersen
21/01/2012
National Space Institute, Sunclimate

Media contribution (1)

Dansk forsker angriber FN's klimapanel
21/01/2012
videnskab.dk, Web
Michael Cramer Andersen
http://videnskab.dk/miljo-naturvidenskab/dansk-forsker-angriber-fns-klimapanel
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media
World unlikely to end in 2012, say scientists: The claimed prediction by the ancient Mayas of the end of the world, as popularised in the film '2012', gets a sceptical assessment from the scientific community.
Søren Brandt
30/12/2011
National Space Institute, Astrophysics

Media contribution (1)

World unlikely to end in 2012, say scientists: The claimed prediction by the ancient Mayas of the end of the world, as popularised in the film '2012', gets a sceptical assessment from the scientific community.
30/12/2011
ScienceNordic, Web
Jonas Salomonsen
http://sciencenordic.com/world-unlikely-end-2012-say-scientists
World unlikely to end in 2012, say scientists The claimed prediction by the ancient Mayas of the end of the world, as popularised in the film '2012', gets a skeptical assessment from the scientific community.
Søren Brandt
National Space Institute, Astrophysics
Press / Media

Stjerne bryder med alle teorier
Jérôme Chenevez
30/11/2011
National Space Institute, Astrophysics

Media contribution (1)

Stjerne bryder med alle teorier
30/11/2011
Print
http://jp.dk/nyviden/article2621786.ece
EXT-OA
Jérôme Chenevez
National Space Institute, Astrophysics
Press / Media

Neutronstjernes opførsel bryder med alle teorier
Jérôme Chenevez
29/11/2011
National Space Institute, Astrophysics

Media contribution (1)

Neutronstjernes opførsel bryder med alle teorier
29/11/2011
Print
http://videnskab.dk/miljo-naturvidenskab/neutronstjernes-opfoersel-bryder-med-alle-teorier
DOC-OA
Jérôme Chenevez
National Space Institute, Astrophysics
Press / Media

Dansk solforsker hænges ud i nyt "Climategate"
Henrik Svensmark
24/11/2011
National Space Institute, Sunclimate

Media contribution (1)

Dansk solforsker hænges ud i nyt "Climategate"
24/11/2011
Print
From the Sun: Danish Researchers Will Supply Key Technology for Big Bang Mission

**Description**

Danish researchers will supply crucial technology for a new mission to find evidence for the Big Bang theory. The mission requires technology that can measure distances of five million kilometres with the precision of a picometre — that's 0.00000000001 cm.

**New Laser Meter Will Map the First Second of the Universe:** A new mission to find evidence for the Big Bang theory requires technology that can measure distances of five million kilometres with the precision of a picometre. — That's 0.00000000001 cm.

**Media contribution (1)**

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**Big Bang mission relies on Danish technology**

Søren Brandt
07/11/2011

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**Mars500 experiment: about the project with humans on Mars**

John Leif Jørgensen
31/10/2011
National Space Institute, Measurement and Instrumentation Systems

**Media contribution (1)**

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**Ny laserøl skal afdekke universets første sekunder:** En ny mission for at finde beviser for Big Bang-teorien kræver teknologi, der kan måle en afstand på fem millioner kilometer med en picometers præcision.

Søren Brandt
22/10/2011

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Ny Lasermåler skal afdekke universets første sekunder: En ny mission for at finde beviser for Big Bang-teorien kræver teknologi, der kan måle en afstand på fem millioner kilometer med en picometers præcision
22/10/2011
Videnskab.dk, Web
Berit Viuf
Søren Brandt
National Space Institute, Astrophysics

Væn jer til nedstyrtende satellitter
John Leif Jørgensen
19/10/2011
National Space Institute, Measurement and Instrumentation Systems

Go’Morgen P3: RoSat og aspekter ved genindtræden af skrottede satellitter i atmosfæren
John Leif Jørgensen
14/10/2011
National Space Institute, Measurement and Instrumentation Systems
The Other Climate Theory: Al Gore won't hear it, but heavenly bodies might be driving long-term weather trends.
Henrik Svensmark
07/09/2011

Description
In April 1990, Al Gore published an open letter in the New York Times "To Skeptics on Global Warming" in which he compared them to medieval flat-Earthers. He soon became vice president and his conviction that climate change was dominated by man-made emissions went mainstream. Western governments embarked on a new era of anti-emission regulation and poured billions into research that might justify it. As far as the average Western politician was concerned, the debate was over. But a few physicists weren't worrying about Al Gore in the 1990s. They were theorizing about another possible factor in climate change: charged subatomic particles from outer space, or "cosmic rays," whose atmospheric levels appear to rise and fall with the weakness or strength of solar winds that deflect them from the earth. These shifts might significantly impact the type and quantity of clouds covering the earth, providing a clue to one of the least-understood but most important questions about climate. Heavenly bodies might be driving long-term weather trends. National Space Institute, Sunclimate

Støtte til omstridt dansk klimateori
Henrik Svensmark
25/08/2011
National Space Institute, Sunclimate

Klima: Eksperiment i CERN understøtter Svensmark teorier
Jens Olaf Pepke Pedersen
25/08/2011
National Space Institute, Sunclimate
Media contribution (1)

Klima: Eksperiment i CERN understøtter Svensmark teorier
25/08/2011
Videnskab.dk, Television
Henrik Prætorius
http://videnskab.dk/miljo-naturvidenskab/klima-eksperiment-i-cern-understotter-svensmarks-teorier
EXT-OA
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

Dansk teknologi på Jupiter-rumfartøj
John Leif Jørgensen
19/08/2011
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Dansk teknologi på Jupiter-rumfartøj
19/08/2011
DR2 Deadline, Television
http://www.dr.dk/DR2/deadline2230/seusendelser.htm#15712
EXT-OA
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Rumsonden Juno på vej mod Jupiter
Peter Siegbjørn Jørgensen
05/08/2011
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Rumsonden Juno på vej mod Jupiter
05/08/2011
TV2, Television
http://nyhederne.tv2.dk/article.php/id-42349665:rumsonden-juno-p%C3%A5-vej-mod-jupiter.html
EXT-OA
Peter Siegbjørn Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Rumsonden Juno er sendt mod Jupiter
John Leif Jørgensen
05/08/2011
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Rumsonden Juno er sendt mod Jupiter
05/08/2011
DR, Television
http://www.dr.dk/Nyheder/Udland/2011/08/05/194457.htm
EXT-OA
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Rumsonden Juno er sendt mod Jupiter
Peter Siegbjørn Jørgensen
05/08/2011
Dansker forskere med i eliten: Danske forskere har udviklet et kamera som skal med NASA til Jupiter
Peter Siegbjørn Jørgensen
01/08/2011
National Space Institute, Measurement and Instrumentation Systems

"Satellitten SMOS" ved DTU Space professor Niels Skou
Niels Skou
09/07/2011

Vi så stor meteor over Middelfar: Meteor brændte op i luften over Skrillinge ved Middelfart
John Leif Jørgensen
28/06/2011
National Space Institute, Measurement and Instrumentation Systems
Press / Media

**Asteroide kommer usædvanligt tæt på**
John Leif Jørgensen  
27/06/2011  
National Space Institute, Measurement and Instrumentation Systems

**Media contribution (1)**

**Asteroide kommer usædvanligt tæt på**  
27/06/2011  
Print  
EXT-OA  
John Leif Jørgensen  
National Space Institute, Measurement and Instrumentation Systems  

Press / Media

**Klima og miljø: Danske forskere sikrer bedre klimamodeller**
Henriette Skourup  
27/06/2011  
National Space Institute

**Media contribution (1)**

**Klima og miljø: Danske forskere sikrer bedre klimamodeller**  
27/06/2011  
DR, P1 - klima og miljø, Radio  
http://www.dr.dk/P1/klimaogmiljoe/Udsendelser/2011/06/20110627111016.htm  
REL-OA  
Henriette Skourup  
National Space Institute  

Press / Media

**Asteroide tæt på Jorden**
John Leif Jørgensen  
27/06/2011  
National Space Institute, Measurement and Instrumentation Systems

**Media contribution (1)**

**Asteroide tæt på Jorden**  
27/06/2011  
DR1, TV Avisen kl. 18.30, Television  
John Leif Jørgensen  
National Space Institute, Measurement and Instrumentation Systems  

Press / Media

**Cryosat Ground validation campaign**
Henriette Skourup  
06/06/2011

**Description**
To guarantee ESA's CryoSat mission is delivering the best data possible, scientists took part in a major expedition to the Arctic, part of a collaborative effort between ESA and NASA to gather ice measurements as the satellite orbits above. CryoSat was launched in April 2010 to monitor the changes in the thickness of marine ice in the polar oceans and in the vast ice sheets that blanket Greenland and Antarctica. As with any Earth observation mission, it is important to validate the readings acquired from space. This involves comparing the satellite data with measurements taken in situ, usually on the ground and from the air. For CryoSat, that meant sending teams to one of the harshest environments on Earth. This video shows this activity near Ilulissat on the west coast of Greenland and also on some camps located on the greenlandic ice cap above the arctic circle. It includes interviews of Malcom Davidson, ESA Cryosat Validation Manager (in english and french), Santiago De La Peña, Research Associate, University of Edinburgh (in english and spanish), Henriette Skourup, Denmark National Space Institute (in english and danish). More background information can be found on:  
http://www.esa.int/esaLP/LPcryosat.html
Når den sidste rumfærge er gået...
John Leif Jørgensen
22/05/2011
National Space Institute, Measurement and Instrumentation Systems

Endeavour på sin sidste mission i rummet
John Leif Jørgensen
16/05/2011
National Space Institute, Measurement and Instrumentation Systems

85 timer i fly over arktisk is
Henriette Skourup
13/05/2011
National Space Institute, Geodynamics

Sådan bliver en stjerne født
Hans Ulrik Nørgaard-Nielsen
27/04/2011
National Space Institute
Sådan bliver en stjerne født
27/04/2011
DR, P1; Videnskabernes Verden., Radio
http://www.dr.dk/P1/Videnskabensverden/
EXT-OA
Hans Ulrik Nørgaard-Nielsen
National Space Institute
Press / Media

Japanske kædereaktioner
Jens Olaf Pepke Pedersen
18/03/2011

Description
Atomskræk. Den mest ødelæggende konsekvens af Fukushima 1 ser ud til at blive den stemning af frygt, som lynhurtigt breder sig. De konkrete skader er minimale i forhold til de lidelser, jordskælvet ellers har udsat japanerne for.
Note: Atomulykker
National Space Institute, Sunclimate, Weekendavisen

Media contribution (1)

Japanske kædereaktioner
18/03/2011
Weekendavisen (National), Print
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate, Weekendavisen
Press / Media

Japan-skælv har forkortet døgnet
Per Knudsen
15/03/2011
National Space Institute, Geodesy

Media contribution (1)

Japan-skælv har forkortet døgnet
15/03/2011
Print
http://nyhederne.tv2.dk/article.php/id-38180874:japansk%C3%A6lv-har-forkortet-d%C3%B8gnet.html
EXT-OA
Per Knudsen
National Space Institute, Geodesy
Press / Media

Universets første lys
Allan Hornstrup
06/10/2010
National Space Institute, Astrophysics

Media contribution (1)

Universets første lys
06/10/2010
Danskernes Akademi, DR, Television
EXT-OA
Allan Hornstrup
National Space Institute, Astrophysics
Press / Media
Et enkelt lille tal - om Jorden, Månen og livets opståen
Ib Lundgaard Rasmussen
24/09/2010
National Space Institute, Astrophysics

Media contribution (1)

Et enkelt lille tal - om Jorden, Månen og livets opståen
24/09/2010
Danskernes Akademi, DR, Television
http://www.dr.dk/akademiet
EXT-OA
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Røde feer i atmosfæren
Torsten Neubert
31/08/2010
National Space Institute, Solar System Physics

Media contribution (1)

Røde feer i atmosfæren
31/08/2010
Radio
http://www.dr.dk/P1/Videnskabenkort/Udsendelser/2010/08/20100420113505_9_2_1_1_1.htm
PUB-OA
Torsten Neubert
National Space Institute, Solar System Physics
Press / Media

Dansk rumraket er bygget på simple løsninger
John Leif Jørgensen
30/08/2010
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Dansk rumraket er bygget på simple løsninger
30/08/2010
Viden.jp.dk, Print
Maj Bach Madsen
http://viden.jp.dk/rummet/rummet/rumfart/default.asp?cid=150076
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media

Hvad sker der, hvis alle kinesere hopper samtidig?
Niels Jørgen Stenfeldt Westergaard
07/04/2010
National Space Institute, Astrophysics

Media contribution (1)

Hvad sker der, hvis alle kinesere hopper samtidig?
07/04/2010
Kbh., Print
http://videnskab.dk/content/dk/sporg_videnskaben/hvad_sker_der_hvis_alle_kinesere_hopper_samtidig
DOC-OA
Niels Jørgen Stenfeldt Westergaard
National Space Institute, Astrophysics
Press / Media
Spinoff: Rumteknologi i vores hverdag: Tema: Det nye rumkapløb
Mathias Benn
22/02/2010
National Space Institute

Media contribution (1)

Spinoff: Rumteknologi i vores hverdag: Tema: Det nye rumkapløb
22/02/2010
DR, København, Television
http://www.dr.dk/DR2/DR2+Udland/Nyheder/2010/04/19/150454.htm
EXT-OA
Mathias Benn
National Space Institute
Press / Media

Richardson havde ikke travlt med korrektion
Jens Olaf Pepke Pedersen
01/02/2010
National Space Institute, Sunclimate

Media contribution (1)

Richardson havde ikke travlt med korrektion
01/02/2010
Forskerforum, Print
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

Kosmisk forsker går under jorden
Martin Andreas Bødker Enghoff
03/11/2009
National Space Institute, Sunclimate

Media contribution (1)

Kosmisk forsker går under jorden
03/11/2009
FORSKERforum 229, Print
Martin Andreas Bødker Enghoff
National Space Institute, Sunclimate
Press / Media

Svensmark og hans solteorier er troværdige: Peter Laut mangler forståelse for videnskabelig metode, og derfor er hans forsøg på karaktermord på en lødig forsker forfjellet
Eigil Friis-Christensen
31/10/2009
National Space Institute, Solar System Physics

Media contribution (1)

Svensmark og hans solteorier er troværdige: Peter Laut mangler forståelse for videnskabelig metode, og derfor er hans forsøg på karaktermord på en lødig forsker forfjellet
31/10/2009
Information, Print
Eigil Friis-Christensen
http://www.information.dk/213645
Eigil Friis-Christensen
National Space Institute, Solar System Physics
Press / Media

Søren Brandt
21/10/2009

**Subject**
National Space Institute, Astrophysics

**Media contribution (1)**

21/10/2009
Videnskab.dk, Web
Jonas Salomonsen
http://videnskab.dk/kultur-samfund/dommedag-udsat-2012-er-ren-spekulation
Søren Brandt
National Space Institute, Astrophysics
Press / Media

**Klimabekymrede kontra skeptikerne**
Jens Olaf Pepke Pedersen
01/10/2009
National Space Institute, Sunclimate

**Media contribution (1)**

Klimabekymrede kontra skeptikerne
01/10/2009
Forserforkum. Print
Lasse Højsgaard
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

**Klimaskepsis: Richardson misinformerer – og Lomborg er ikke skeptiker**
Jens Olaf Pepke Pedersen
01/10/2009
National Space Institute, Sunclimate

**Media contribution (1)**

Klimaskepsis: Richardson misinformerer – og Lomborg er ikke skeptiker
01/10/2009
Forserforkum. Print
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate
Press / Media

The Svensmark Cosmic Ray Theory Explained
Martin Andreas Bødker Enghoff
24/02/2009
National Space Institute, Sunclimate

**Media contribution (1)**

The Svensmark Cosmic Ray Theory Explained
24/02/2009
DTU Space, interview med Christian Broadcasting Network, Television
Sorte Huller: Om INTEGRAL projektets danske forbindelse
Søren Brandt
09/11/2008

Description
Interview på Hven i anledning af den 7. INTEGRAL Workshop i Eigtveds pakhus i København, 2008.
http://www.youtube.com/watch?v=H7GKROfdidk
National Space Institute, Astrophysics

Media contribution (1)

Sorte huller undersøges med dansk teknologi
Søren Brandt
11/09/2008
National Space Institute, Astrophysics

Media contribution (1)

Sjældne røntgenglimt afslører hvid dværg
Jérôme Chenevez
25/06/2008
National Space Institute, Astrophysics

Media contribution (1)

Indlandsisen smelter
René Forsberg
24/05/2008
National Space Institute, Geodynamics

Media contribution (1)
Indlandsisen smelter
Sine Munk Hvidegaard
24/05/2008
National Space Institute, Geodynamics

Media contribution (1)

Indlandsisen smelter
24/05/2008
DR P1, Television
Sine Munk Hvidegaard
National Space Institute, Geodynamics

Media contribution (1)

Indlandsisen smelter
Shfaqat Abbas Khan
24/05/2008
National Space Institute, Geodesy

Media contribution (1)

Dansk teori om global opvarmning under angreb
Henrik Svensmark
30/04/2008
National Space Institute, Sunclimate

Media contribution (1)

Ophedet diskussion om global opvarmning: Klimaforskerne fortolker globale temperaturmålinger vidt forskelligt
Jens Olaf Pepke Pedersen
01/02/2008
National Space Institute, Sunclimate

Media contribution (1)
Koks i klimaet
Shfaqat Abbas Khan
01/01/2008
National Space Institute, Geodesy

Media contribution (1)

Koks i klimaet
01/01/2008
Nordjyske Stiftstidende, Print
http://www.nordjyske.dk/Nyheder/indland.aspx?ctrl=10&data=2%2c2709024%2c5%2c4
Shfaqat Abbas Khan
National Space Institute, Geodesy

Computer der kan holde i 900 år
John Leif Jørgensen
03/10/2007

Subject
Interview-indlæg på P1 den 4. Okt. 2007, kl. 20:03
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Computer der kan holde i 900 år
03/10/2007
DR's Harddisk, Radio
16:37
http://www.dr.dk/P1/harddisken/Udsendelser/2007/10/04234536.htm
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems

50 forskere skriver konklusion om klimaforandringer
Jens Olaf Pepke Pedersen
09/02/2007
National Space Institute, Sunclimate

Media contribution (1)

50 forskere skriver konklusion om klimaforandringer
09/02/2007
Ingeniøren, Print
Jens Ramskov
Jens Olaf Pepke Pedersen
National Space Institute, Sunclimate

Spaceweather and climate
Henrik Svensmark
01/01/2007
National Space Institute, Solar System Physics

Media contribution (1)

Spaceweather and climate
01/01/2007
EuroNews, Television
Henrik Svensmark
National Space Institute, Solar System Physics

Press / Media
Rätselhafter Schutzschirm
01/01/2007
Print
http://www.planet-erde.de/aktuelles/planeterde-news/ratselhafter-schutzschirm/
Nils Olsen
National Space Institute, Solar System Physics
Press / Media

North by Northwest: The planet's wandering magnetic poles help reveal history of Earth and humans
Nils Olsen
01/01/2007
National Space Institute, Solar System Physics

Media contribution (1)

North by Northwest: The planet's wandering magnetic poles help reveal history of Earth and humans
01/01/2007
Print
Nils Olsen
National Space Institute, Solar System Physics
Press / Media

Reportage fra TARA is lejer
Susanne Hanson
01/01/2007
National Space Institute, Geodynamics

Media contribution (1)

Reportage fra TARA is lejer
01/01/2007
Television
Susanne Hanson
National Space Institute, Geodynamics
Press / Media

Klimaet styres fra rummet
Henrik Svensmark
21/11/2006
National Space Institute, Solar System Physics

Media contribution (1)

Klimaet styres fra rummet
21/11/2006
Viden om. DR2, Television
Henrik Svensmark
National Space Institute, Solar System Physics
Press / Media

Stjerne eksplosioner giver højere temperaturer på vores klode
Henrik Svensmark
04/10/2006
National Space Institute, Solar System Physics

Media contribution (1)

Stjerne eksplosioner giver højere temperaturer på vores klode
04/10/2006
Deadline, DR2, Television
Henrik Svensmark
National Space Institute, Solar System Physics
Universets mystiske energi
Hans Ulrik Nørgaard-Nielsen
03/10/2006
National Space Institute, Astrophysics

Media contribution (1)

Universets mystiske energi
03/10/2006
Viden Om, DR2, Television
Hans Ulrik Nørgaard-Nielsen
National Space Institute, Astrophysics
Press / Media

Udforskningen af Solsystemet
Ib Lundgaard Rasmussen
22/10/2005
National Space Institute, Astrophysics

Media contribution (1)

Udforskningen af Solsystemet
22/10/2005
DR P1 Videnskabens verden, Radio
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Jordens magnetfelt
Ib Lundgaard Rasmussen
16/10/2005
National Space Institute, Astrophysics

Media contribution (1)

Jordens magnetfelt
16/10/2005
dk4 Natura Est, Television
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Flotte månedbilleder med dansk bidrag: Præcise danske stjernekameraer er forudsætningen for skarpe billeder af Månen, som strømmer ned fra ESA’s mission SMART-1
John Leif Jørgensen
20/06/2005

Subject
Stjernekamera på europæisk rumfartsorganisation ESA’s fartøj, SMART-1
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Flotte månedbilleder med dansk bidrag: Præcise danske stjernekameraer er forudsætningen for skarpe billeder af Månen, som strømmer ned fra ESA’s mission SMART-1
20/06/2005
ESA Danmark, Web
http://www.esa.int/dan/ESA_in_your_country/Denmark/Flotte_maanebilleder_med_dansk_bidrag
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Press / Media
Til Mars fra Danmark
Eigil Friis-Christensen
01/05/2005
National Space Institute, Management

Media contribution (1)

Til Mars fra Danmark
01/05/2005
Ud & Se, s. 60-64, Print
Eigil Friis-Christensen
National Space Institute, Management
Press / Media

Mars Express
Ib Lundgaard Rasmussen
30/04/2005
National Space Institute, Astrophysics

Media contribution (1)

Mars Express
30/04/2005
DR P1 Videnskabens verden, Radio
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Hyugens og Titan
Ib Lundgaard Rasmussen
22/01/2005
National Space Institute, Astrophysics

Media contribution (1)

Hyugens og Titan
22/01/2005
DR P1 Videnskabens verden, Radio
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Huygens landingen
Ib Lundgaard Rasmussen
15/01/2005
National Space Institute, Astrophysics

Media contribution (1)

Huygens landingen
15/01/2005
TV2 nyhederne, Television
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Astrobiologi
Ib Lundgaard Rasmussen
01/01/2005
National Space Institute, Astrophysics

Media contribution (1)
Astrobiologi
01/01/2005
YLE Finland, Television
Ib Lundgaard Rasmussen
National Space Institute, Astrophysics
Press / Media

Opsendelsesmuligheder til rummet
Per Lundahl Thomsen
24/10/2004
National Space Institute

Media contribution (1)

Opsendelsesmuligheder til rummet
24/10/2004
Television
Per Lundahl Thomsen
National Space Institute
Press / Media

Finansiering af Rømer projektet
Per Lundahl Thomsen
13/11/2003
National Space Institute

Media contribution (1)

Finansiering af Rømer projektet
13/11/2003
Københavns lokalradioer, Radio
Per Lundahl Thomsen
National Space Institute
Press / Media

Finansiering af Rømer projektet
Per Lundahl Thomsen
12/11/2003
National Space Institute

Media contribution (1)

Finansiering af Rømer projektet
12/11/2003
TV2 Nyhederne, Television
Per Lundahl Thomsen
National Space Institute
Press / Media

Gammastråler og Supernovaer
Niels Lund
24/04/2003
National Space Institute, Astrophysics

Media contribution (1)

Gammastråler og Supernovaer
24/04/2003
Radio
Niels Lund
National Space Institute, Astrophysics
Press / Media
Forskningens betydning for samfundet/Dansk Rumforskning
Carl Budtz-Jørgensen
02/04/2003
National Space Institute, Astrophysics

Media contribution (1)

Forskningens betydning for samfundet/Dansk Rumforskning
Carl Budtz-Jørgensen
02/04/2003
Danmarks Erhvervs-TV, Kanal København, Television
Carl Budtz-Jørgensen
National Space Institute, Astrophysics
Press / Media

Forskningens betydning for samfundet/Dansk Rumforskning
Carl Budtz-Jørgensen
30/03/2003
Danmarks Erhvervs-TV, TV Danmark, Television
Carl Budtz-Jørgensen
National Space Institute, Astrophysics
Press / Media

Han studerer Jordens fysik fra luftrommet over hele verden: Portræt: For seniorforsker Arne Vestergaard Olesen fra DTU
Space er feltarbejdet kernen.
Arne Vestergaard Olesen
03/03/2003
National Space Institute, Geodynamics

Media contribution (1)

Han studerer Jordens fysik fra luftrommet over hele verden: Portræt: For seniorforsker Arne Vestergaard Olesen fra DTU
Space er feltarbejdet kernen.
03/03/2003
Ingeniøren, Print
http://ing.dk/artikel/han-studerer-jordens-fysik-fra-luftrommet-over-hele-verden-136784
Arne Vestergaard Olesen
National Space Institute, Geodynamics
Press / Media

Det "umuligt" præcise kamera
John Leif Jørgensen
27/05/2002

Subject
Den europæiske rumfartsorganisation ESAs satellit Proba, som blev opsendt i efteråret 2001, er nu kørt ind og har
gennemført en række observationer af Jorden med meget stor nøjagtighed. Blandt andet er der fra 600 kilometers højde
taget billeder, der er så skarpe, at man kan se variationen i vegetationen inden for få meter.
National Space Institute, Measurement and Instrumentation Systems

Media contribution (1)

Det "umuligt" præcise kamera
27/05/2002
ESA Danmark, Web
http://www.esa.int/dan/ESA_in_your_country/Denmark/Det_umuligt_praecise_kamera
John Leif Jørgensen
National Space Institute, Measurement and Instrumentation Systems
Die Pole verschieben sich: Die Veränderungen sind dramatischer als angenommen. Das Magnetfeld wird schwächer.

Nils Olsen
01/01/2002
National Space Institute, Solar System Physics

Media contribution (1)

Die Pole verschieben sich: Die Veränderungen sind dramatischer als angenommen. Das Magnetfeld wird schwächer.
01/01/2002
Print
Nils Olsen
National Space Institute, Solar System Physics
Press / Media

Virtual reality feature on "Danish space challenge"
29/05/2001
National Space Institute

Media contribution (1)

Virtual reality feature on "Danish space challenge"
29/05/2001
"Viden Om", DR2, Television
National Space Institute
Press / Media

RØMER satellitten
Per Lundahl Thomsen
20/03/2001

Description
TV documentary on the Rømer satellite.
National Space Institute, Administration

Media contribution (1)

RØMER satellitten
20/03/2001
"Viden Om", DR2, Television
Per Lundahl Thomsen
National Space Institute, Administration
Press / Media

Exploration of planetary magnetic fields: Radio interview in "Principia"
Fritz Primdahl
24/02/2001
National Space Institute, Solar System Physics

Media contribution (1)

Exploration of planetary magnetic fields: Radio interview in "Principia"
24/02/2001
DR P1, Radio
Fritz Primdahl
National Space Institute, Solar System Physics
Press / Media

Kampen om klimaet: TV documentary
Henrik Svensmark
01/02/2001
Media contribution (1)

Kampen om klimaet: TV documentary
01/02/2001
DR1, Television
Henrik Svensmark
National Space Institute, Solar System Physics
Press / Media

The Chandra X-ray telescopes' observations of the galaxy cluster Hydra A
01/01/1999
National Space Institute

Media contribution (1)

The Chandra X-ray telescopes' observations of the galaxy cluster Hydra A
01/01/1999
Berlingske Tidende, Print
National Space Institute
Press / Media