Cryogenic Preamplifiers for Magnetic Resonance Imaging

Pursuing the ultimate limit of detection in magnetic resonance imaging (MRI) requires cryogenics to decrease the thermal noise of the electronic circuits. As cryogenic coils for MRI are slowly emerging cryogenic preamplifiers are required to fully exploit their potential. A cryogenic preamplifier operated at 77 K is designed and implemented for C imaging at 3 T (32.13 MHz), using off-the-shelves components. The design is based on a high electron mobility transistor (ATF54143) in a common source configuration. Required auxiliary circuitry for optimal cryogenic preamplifier performance is also presented consisting of a voltage regulator (noise free supply voltage and optimal power consumption), switch, and trigger (for active detuning during transmission to protect the preamplifier). A gain of 18 dB with a noise temperature of 13.7 K is achieved. Performing imaging experiments in a 3 T scanner showed an 8% increased signal-to-noise ratio from 365 to 399 when lowering the temperature of the preamplifier from 296 to 77 K while keeping the coil at room temperature. This paper thus enables the merger of cryogenic coils and preamplifiers in the hopes of reaching the ultimate limit of detection for MRI.

General information
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Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Electromagnetic Systems, Electromagnetic Systems Group, Technical University of Denmark
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Web of Science (2018): Indexed yes
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Scopus rating (2016): CiteScore 3.21 SJR 0.985 SNIP 1.857
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.061 SNIP 1.587 CiteScore 3.28
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.27 SNIP 1.96 CiteScore 3.97
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.707 SNIP 2.54 CiteScore 4.83
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.93 SNIP 1.903 CiteScore 3.34
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.546 SNIP 1.445
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.907 SNIP 1.728
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.642 SNIP 1.097
Original language: English
Biomedical electronics, Cryogenic electronics, Hyperpolarization, Low noise amplifier, Magnetic resonance imaging, preamplifiers
Column leaching from a Danish forest soil amended with wood ashes: fate of major and trace elements

Application of wood ashes onto two Danish forest soil horizons (A- and O-horizons) was investigated through a series of column experiments for ash dosages of 3, 9 and 30 Mg ha\(^{-1}\). Developments in the composition of the percolating soil solutions were investigated both in a short- (below 0.5 m\(^3\) m\(^{-2}\) of infiltrating water) and long-term perspective (until 2.0 m\(^3\) m\(^{-2}\) of infiltrating water). The higher the ash dosage, the higher the percolation of readily soluble elements (K, Cl, Mg and S) occurred within a short-term perspective. This initial washout of soluble elements resulted in the exchange of ions in the soil, thereby causing other soil bound elements to be released and the pH to decrease temporarily. Wood ash application also promoted an increase in the long-term leaching of As, Cu, K, P and Si beyond the O-horizon layer (until ∼2.0 m\(^3\) m\(^{-2}\)), while the migration of trace elements through this soil horizon appeared to be of limited concern compared with Danish groundwater quality criteria. Relatively similar effects were observed for both the use of 3 and 9 Mg ha\(^{-1}\) dosages on the composition of the percolating soil solutions. Low mobility of Cd, Co, Cr, Cu, Mo, Ni, Pb, Se, V and Zn was observed. The released amounts were generally limited to a few percentage points of their total contents in the columns. The potential accumulation of trace elements within the forest soil should be evaluated with respect to the specific case, if high ash dosages are intended for spreading.
Occurrence of cyclic imines in European commercial seafood and consumers risk assessment

Cyclic imines constitute a quite recently discovered group of marine biotoxins that act on neural receptors and that bioaccumulate in seafood. They are grouped together due to the imino group functioning as their common pharmacore, responsible for acute neurotoxicity in mice. Cyclic imines (CIs) have not been linked yet to human poisoning and are not regulated in the European Union (EU), although the European Food Safety Authority (EFSA) requires more data to perform conclusive risk assessment for consumers. Several commercial samples of bivalves including raw and processed samples from eight countries (Italy, Portugal, Slovenia, Spain, Ireland, Norway, The Netherlands and Denmark) were obtained over 2 years. Emerging cyclic imine concentrations in all the samples were analysed on a LC-3200QTRAP and LC-HRMS QExactive mass spectrometer. In shellfish, two CIs, pinnatoxin G (PnTX-G) and 13-desmethylspirolide C (SPX-1) were found at low concentrations (0.1–12 µg/kg PnTX-G and 26–66 µg/kg SPX-1), while gymnodimines and pteriatoxins were not detected in commercial (raw and processed) samples. In summary, SPX-1 (n: 47) and PnTX-G (n: 96) were detected in 9.4% and 4.2% of the samples, respectively, at concentrations higher than the limit of quantification (LOQ), and in 7.3% and 31.2% of the samples at concentrations lower than the LOQ (25 µg/kg for SPX-1 and 3 µg/kg for PnTX-G), respectively. For the detected cyclic imines, the average exposure and the 95th percentile were calculated. The results obtained indicate that it is unlikely that a potential health risk exists through the seafood diet for CIs in the EU. However, further information about CIs is necessary in order to perform a conclusive risk assessment.

General information
State: Published
Organisations: National Food Institute, Research Group for Analytical Food Chemistry, IRTA - Institute of Agrifood Research and Technology, Norwegian Veterinary Institute, National Research Council of Canada, Ghent University, I.P. (IPMA), Aeiforia s.r.l, University of Maribor, Wageningen University & Research, AquaTT
Number of pages: 7
The fungal genus of Aspergillus is highly interesting, containing everything from industrial cell factories, model organisms, and human pathogens. In particular, this group has a prolific production of bioactive secondary metabolites (SMs). In this...
work, four diverse Aspergillus species (A. campestris, A. novofumigatus, A. ochraceoroseus, and A. steynii) have been whole-genome PacBio sequenced to provide genetic references in three Aspergillus sections. A. taichungensis and A. candidus also were sequenced for SM elucidation. Thirteen Aspergillus genomes were analyzed with comparative genomics to determine phylogeny and genetic diversity, showing that each presented genome contains 15–27% genes not found in other sequenced Aspergilli. In particular, A. novofumigatus was compared with the pathogenic species A. fumigatus. This suggests that A. novofumigatus can produce most of the same allergens, virulence, and pathogenicity factors as A. fumigatus, suggesting that A. novofumigatus could be as pathogenic as A. fumigatus. Furthermore, SMs were linked to gene clusters based on biological and chemical knowledge and analysis, genome sequences, and predictive algorithms. We thus identify putative SM clusters for aflatoxin, chlorflavonin, and ochrindol in A. ochraceoroseus, A. campestris, and A. steynii, respectively, and novofumigatonin, ent-cycloechinulin, and epiaszonalenins in A. novofumigatus. Our study delivers six fungal genomes, showing the large diversity found in the Aspergillus genus; highlights the potential for discovery of beneficial or harmful SMs; and supports reports of A. novofumigatus pathogenicity. It also shows how biological, biochemical, and genomic information can be combined to identify genes involved in the biosynthesis of specific SMs.

General information
State: Published
Organisations: Department of Biotechnology and Biomedicine, Network Engineering of Eukaryotic Cell factories, Fungal Chemodiversity, Natural Product Discovery, Department of Biotechnology, Eukaryotic Molecular Cell Biology, U.S. Department of Energy, University of Manchester
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Publication date: 23 Jan 2018
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Scopus rating (2016): CiteScore 8.56 SJR 6.321 SNIP 2.629
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.767 SNIP 2.682 CiteScore 8.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.853 SNIP 2.725 CiteScore 8.86
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 6.989 SNIP 2.73 CiteScore 9.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 6.792 SNIP 2.682 CiteScore 9.49
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 6.771 SNIP 2.636 CiteScore 9.31
ISI indexed (2011): ISI indexed yes
Fast and stable gratings inscription in POFs made of different materials with pulsed 248 nm KrF laser

This paper presents fiber Bragg grating (FBG) inscription with a pulsed 248 nm UV KrF laser in polymer optical fibers (POFs) made of different polymers, namely polymethyl methacrylate (PMMA), cyclic-olefin polymer and co-polymer, and Polycarbonate. The inscribed gratings and the corresponding inscription parameters are compared with grating inscribed in POFs made of the aforementioned materials but with the hitherto most used laser for inscription, which is a continuous wave 325 nm UV HeCd laser. Results show a reduction of the inscription time of at least 16 times. The maximum time reduction is more than 130 times. In addition, a reflectivity and a bandwidth close to or higher than the ones with the 325 nm laser were obtained. The polymer optical fiber Bragg gratings (POFBGs) inscribed with the 248 nm laser setup present high stability with small variations in their central wavelength, bandwidth, and reflectivity after 40 days.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Manufacturing Engineering, Universidad Politecnica de Valencia, University of Espirito Santo, Universidade de Aveiro
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Main Research Area: Technical/natural sciences

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Journal: Optics Express
Volume: 26
Formalization of the Resolution Calculus for First-Order Logic

I present a formalization in Isabelle/HOL of the resolution calculus for first-order logic with formal soundness and completeness proofs. To prove the calculus sound, I use the substitution lemma, and to prove it complete, I use Herbrand interpretations and semantic trees. The correspondence between unsatisfiable sets of clauses and finite semantic trees is formalized in Herbrand’s theorem. I discuss the difficulties that I had formalizing proofs of the lifting lemma found in the literature, and I formalize a correct proof. The completeness proof is by induction on the size of a finite semantic tree. Throughout the paper I emphasize details that are often glossed over in paper proofs. I give a thorough overview of formalizations of first-order logic found in the literature. The formalization of resolution is part of the IsaFoL project, which is an effort to formalize logics in Isabelle/HOL.

Radiative MRI Coil Design Using Parasitic Scatterers: MRI Yagi

Conventionally, radiofrequency (RF) coils used for magnetic resonance imaging (MRI) are electrically small and designed for nearfield operation. Therefore, existing antenna design techniques are mostly irrelevant for RF coils. However, the use of higher frequencies in ultrahigh field (UHF) MRI allows for antenna design techniques to be adapted to RF coil designs. This study proposes the use of parasitic scatterers to improve the performance of an existing 7T MRI coil called the single-sided adapted dipole (SSAD) antenna. The results reveal that scatterers arranged in a Yagi fashion can be applied to reduce local specific absorption rate (SAR) maxima of a reference SSAD by 40% with only a 6% decrease in the propagated B1 + field at the tissue depth of 15 cm. The higher directivity of the proposed design also decreasing the coupling with additional elements, making this antenna suitable for use in high density arrays. These findings show the potential of parasitic scatterers as an effective method to improve the performance of existing radiative MRI coils.
Approximation of ruin probabilities via Erlangized scale mixtures

In this paper, we extend an existing scheme for numerically calculating the probability of ruin of a classical Cramér–Lundberg reserve process having absolutely continuous but otherwise general claim size distributions. We employ a dense class of distributions that we denominate Erlangized scale mixtures (ESM) that correspond to nonnegative and absolutely continuous distributions which can be written as a Mellin–Stieltjes convolution $\Pi \ast G$ of a nonnegative distribution $\Pi$ with an Erlang distribution $G$. A distinctive feature of such a class is that it contains heavy-tailed distributions. We suggest a simple methodology for constructing a sequence of distributions having the form $\Pi \ast G$ with the purpose of approximating the integrated tail distribution of the claim sizes. Then we adapt a recent result which delivers an explicit expression for the probability of ruin in the case that the claim size distribution is modeled as an Erlangized scale mixture. We provide simplified expressions for the approximation of the probability of ruin and construct explicit bounds for the error of approximation. We complement our results with a classical example where the claim sizes are heavy-tailed.

General information

State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, University of Liverpool, University of Queensland
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Pages: 136-156
Publication date: 1 Jan 2018
Main Research Area: Technical/natural sciences
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- Scopus rating (2011): CiteScore 1.67
Original language: English
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Source: Scopus
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Selecting of a cytochrome P450$_{cam}$ SeSaM library with 3-chloroindole and endosulfan – Identification of mutants that dehalogenate 3-chloroindole

Cytochrome P450$_{cam}$ (a camphor hydroxylase) from the soil bacterium Pseudomonas putida shows potential importance in environmental applications such as the degradation of chlorinated organic pollutants. Seven P450$_{cam}$ mutants generated from Sequence Saturation Mutagenesis (SeSaM) and isolated by selection on minimal media with either 3-chloroindole or the insecticide endosulfan were studied for their ability to oxidize 3-chloroindole to isatin. The wild-type enzyme did not accept 3-chloroindole as a substrate. Mutant (E156G/V247F/V253G/F256S) had the highest maximal velocity in the conversion of 3-chloroindole to isatin, whereas mutants (T56A/N116H/D297N) and (G60S/Y75H) had highest k$_{cat}$/K$_{M}$ values. Six of the mutants had more than one mutation, and within this set, mutation of residues 297 and 179 was observed twice. Docking simulations were performed on models of the mutant enzymes; the wild-type did not accommodate 3-chloroindole in the active site, whereas all the mutants did. We propose two potential reaction pathways for dechlorination of 3-chloroindole. This article is part of a Special Issue entitled: Cytochrome P450 biodiversity and biotechnology, edited by Erika Plettner, Gianfranco Gilardi, Luet Wong, Vlada Urlacher, Jared Goldstone.
Latency and bit-error-rate evaluation for radio-over-ethernet in optical fiber front-haul networks

Nowadays several research projects are under progress to manage a soft migration toward the 5th generation networks. Radio over Ethernet (RoE) is one of recent topics that try to have a cost efficient and independent front-haul network. In this paper, we discuss the requirements of the 5G networks and analyze the conditions for the implementation of a RoE protocol. For this purpose we digitalize radio frames that are taken from BBU or RRH and create RoE basic frames considering all the requirements of protocol. We then encapsulate RoE basic frames into an Ethernet packet and finally experimentally evaluate this Ethernet packet as a case of study for RoE applications. The packet is transmitted through different fiber spans, measuring the BER and latency on each case. The system achieves BER values below the FEC limit and a manageable latency. These results serve as a guideline and proof of concept for applications on RoE, showing the viability of its implementation as part of the next generation of front-haul networks.

General information
State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Electromagnetic Systems, Technical University of Denmark
Authors: Sayadi, M. (Ekstern), Rodríguez, S. (Intern), Olmos, J. J. V. (Intern), Tafur Monroy, I. (Intern)
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Main Research Area: Technical/natural sciences

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Scopus rating (2015): SJR 0.334 SNIP 0.722 CiteScore 1.33
Scopus rating (2014): SJR 0.314 SNIP 0.839 CiteScore 1.39
Scopus rating (2013): SJR 0.342 SNIP 0.736 CiteScore 1.36
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.459 SNIP 1.146 CiteScore 1.28
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 0.365 SNIP 1.064 CiteScore 1.43
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.331 SNIP 0.914
Scopus rating (2009): SJR 0.324 SNIP 0.958
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.339 SNIP 0.799
Scopus rating (2007): SJR 0.361 SNIP 0.903
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Effect of process parameters on flow length and flash formation in injection moulding of high aspect ratio polymeric micro features

This paper reports an investigation of the effects of process parameters on the quality characteristics of polymeric parts produced by micro injection moulding (µIM) with two different materials. Four injection moulding process parameters (injection velocity, holding pressure, melt temperature and mould temperature) were investigated using Polypropylene (PP) and Acrylonitrile Butadiene Styrene (ABS). Three key characteristics of the mouldings were evaluated with respect to process settings and the material employed: part mass, flow length and flash formation. The experimentation employs a test part with four micro fingers with different aspect ratios (from 21 up to 150) and was carried out according to the Design of Experiments (DOE) statistical technique. The results show that holding pressure and injection velocity are the most influential parameters on part mass with a direct effect for both materials. Both parameters have a similar effect on flow length for both PP and ABS at all aspect ratios and have higher effects as the feature thickness decreased below 300 µm. The study shows that for the investigated materials the injection speed and packing pressure were the most influential parameters for increasing the amount of flash formation, with relative effects consistent for both materials. Higher melt and mould temperatures settings were less influential parameters for increasing the flash amount when moulding with both materials. Of the two investigated materials, PP was the one exhibiting more flash formation as compared with ABS, when corresponding injection moulding parameters settings for both materials were considered.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Mansoura University
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Number of pages: 19
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Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.438 SNIP 0.931 CiteScore 1.78
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.638 SNIP 1.384 CiteScore 2.1
Scopus rating (2013): SJR 0.479 SNIP 1.151 CiteScore 1.73
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.477 SNIP 1.34 CiteScore 1.28
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.226 SNIP 0.892
ISI indexed (2011): ISI indexed no
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Source-ID: 2396033779
Publication: Research - peer-review › Journal article – Annual report year: 2018
A new method for estimating transmission rates of mastitis-causing pathogens

General information
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Organisations: National Veterinary Institute, Epidemiology, Department of Applied Mathematics and Computer Science
Authors: Kirkeby, C. (Intern), Halasa, T. (Intern), Gussmann, M. K. (Intern), Græsbøll, K. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences
Electronic versions:
NMC_2018_poster_v5.pdf
Source: PublicationPreSubmission
Source-ID: 143856174
Publication: Research - peer-review › Poster – Annual report year: 2018

Influence of Adsorption and Capillary Pressure on Phase Equilibria Inside Shale Reservoirs
Due to the small pore sizes and organic content of shale, capillary pressure and adsorption are two effects that should be taken into account in the study of phase equilibrium inside shale. The inclusion of both effects in the phase equilibrium modeling can shed light on how bulk phase composition inside the porous media changes with temperature and pressure, and how the phase equilibrium changes accordingly. In the long run, such a model can be used in reservoir simulation for more complicated analysis. In this study, we present a calculation method that can effectively include adsorption and capillarity. We propose to introduce an excess adsorbed phase and treat the remaining substance inside the pores as a bulk phase (gas, liquid, or both) in order to make the mass balance formulation simpler. The adsorbed phase is modeled by the Multicomponent Langmuir (ML) equation for its simplicity and computational efficiency. A more theoretical adsorption model, the multicomponent potential theory of adsorption (MPTA), is used to determine the parameters of the simpler ML equation. The liquid and gas phases are described by the Peng-Robinson equation of state and the capillary pressure across their interface is taken into account. A flash algorithm by alternately updating the adsorbed phase amount and the fugacities in the bulk phases has been developed. The flash algorithm is used to analyze some representative systems (from binary, ternary to low-GOR and high-GOR model reservoir fluid systems) for the phase equilibrium inside porous media. The results show that adsorption and capillary pressure can significantly change the bulk phase composition and thus its corresponding phase envelope. Since the adsorption varies at different temperature and pressure conditions, the extent of change in the phase envelope is different. In general, a much shrunk phase envelope with a shifted critical point is observed. The heavier components are preferentially adsorbed in the whole pressure and temperature range studied here. At high pressure and low temperature, the selectivity towards heavier components is moderate in comparison to the that at low pressure and high temperature. The adsorption effects are stronger for the gas bulk phase region, leading to bigger changes in the gas phase composition and the shift of the dew point curve. PVT simulations of two model reservoir fluid systems show significant change in the results when capillary pressure and adsorption are included.

General information
State: Accepted/In press
Organisations: Department of Chemistry, Department of Chemical and Biochemical Engineering, CERE – Center for Energy Resources Engineering, Center for Energy Resources Engineering
Authors: Sandoval, D. R. (Intern), Yan, W. (Intern), Michelsen, M. L. (Intern), Stenby, E. H. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.49
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.34
Effects of Lifestyle on Muscle Strength in a Healthy Danish Population

Background: Life style is expected to influence muscle strength. This study aimed at assessing a possible relationship between smoking, alcohol intake and physical activity, and muscle strength in a healthy Danish population aged 20-79 years. Population study based on data collected from The Copenhagen City Heart Study (CCHS) and measurements of isokinetic muscle strength from a sub-study of randomly selected healthy participants from CCHS.

Methods: 126 women and 63 men were studied. All participants completed a questionnaire regarding their lifestyle, including physical activity, alcohol intake and smoking habits. Isokinetic muscle strength was measured over the upper extremities (UE), trunk, and lower extremities (LE). Multivariate analyses including all of the variables were carried out.

Results: The level of daily physical activity during leisure was positively correlated to muscle strength in the lower extremities (p = 0.03) for women, and lower extremities (p = 0.03) and trunk (p = 0.007) for men. Alcohol Intake was in general not correlated to muscle strength. No clear effect of smoking was seen on muscle strength. Conclusions: Our results show that physical activity during leisure is associated with a positive effect on muscle strength in both sexes. When keeping alcohol intake within the recommended limits, alcohol does not seem to affect muscle strength negatively. No effect of smoking on muscle strength was found in our group of healthy subjects. The findings are of importance when considering recommendation on life style when wishing to keeping fit with age to be able to carry out daily activities.

General information

State: Accepted/In press
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Copenhagen University Hospital, University of Copenhagen, Frederiksborg Hospital
Authors: Bartels, E. M. (Ekstern), Robertson, S. (Ekstern), Danneskiold-Samsøe, B. (Ekstern), Appleyard, M. (Ekstern), Stockmarr, A. (Intern)
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 gray 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.
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
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.
Redirection of lipid flux toward phospholipids in yeast increases fatty acid turnover and secretion

Bio-based production of fatty acids and fatty acid-derived products can enable sustainable substitution of petroleum-derived fuels and chemicals. However, developing new microbial cell factories for producing high levels of fatty acids requires extensive engineering of lipid metabolism, a complex and tightly regulated metabolic network. Here we generated a Saccharomyces cerevisiae platform strain with a simplified lipid metabolism network with high-level production of free fatty acids (FFAs) due to redirected fatty acid metabolism and reduced feedback regulation. Deletion of the main fatty acid activation genes (the first step in s-oxidation), main storage lipid formation genes, and phosphatidate phosphatase genes resulted in a constrained lipid metabolic network in which fatty acid flux was directed to a large extent toward phospholipids. This resulted in simultaneous increases of phospholipids by up to 2.8-fold and of FFAs by up to 40-fold compared with wild-type levels. Further deletion of phospholipase genes PLB1 and PLB2 resulted in a 46% decrease in FFA levels and 105% increase in phospholipid levels, suggesting that phospholipid hydrolysis plays an important role in FFA production when phospholipid levels are increased. The multiple deletion mutant generated allowed for a study of fatty acid dynamics in lipid metabolism and represents a platform strain with interesting properties that provide insight into the future development of lipid-related cell factories.

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A comprehensive and quantitative comparison of text-mining in 15 million full-text articles versus their corresponding abstracts

Across academia and industry, text mining has become a popular strategy for keeping up with the rapid growth of the scientific literature. Text mining of the scientific literature has mostly been carried out on collections of abstracts, due to their availability. Here we present an analysis of 15 million English scientific full-text articles published during the period 1823-2016. We describe the development in article length and publication sub-topics during these nearly 250 years. We showcase the potential of text mining by extracting published protein-protein, disease-gene, and protein subcellular associations using a named entity recognition system, and quantitatively report on their accuracy using gold standard benchmark data sets. We subsequently compare the findings to corresponding results obtained on 16.5 million abstracts included in MEDLINE and show that text mining of full-text articles consistently outperforms using abstracts only.
Filling the Gaps in the Kirromycin Biosynthesis: Deciphering the Role of Genes Involved in Ethylmalonyl-CoA Supply and Tailoring Reactions

Kirromycin is the main product of the soil-dwelling Streptomyces collinus Tü 365. The elucidation of the biosynthetic pathway revealed that the antibiotic is synthesised via a unique combination of trans-/cis-AT type I polyketide synthases and non-ribosomal peptide synthetases (PKS I/NRPS). This was the first example of an assembly line integrating the three biosynthetic principles in one pathway. However, information about other enzymes involved in kirromycin biosynthesis remained scarce. In this study, genes encoding tailoring enzymes KirM, KirHVI, KirOI, and KirOII, and the putative crotonyl-CoA reductase/carboxylase KirN were deleted, complemented, and the emerged products analysed by HPLC-HRMS and MS/MS. Derivatives were identified in mutants ΔkirM, ΔkirHVI, ΔkirOI, and ΔkirOII. The products of ΔkirOI, ΔkirOII, and kirHVI were subjected to 2D-NMR for structure elucidation. Our results enabled functional assignment of those enzymes, demonstrating their involvement in kirromycin tailoring. In the ΔkirN mutant, the production of kirromycin was significantly decreased. The obtained data enabled us to clarify the putative roles of the studied enzymes, ultimately allowing us to fill many of the missing gaps in the biosynthesis of the complex antibiotic. Furthermore, this collection of mutants can serve as a toolbox for generation of new kirromycins.

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