Gas Mass Fractions from XMM-Newton

Della Monica Ferreira, Desiree; Pedersen, K.; Werner, N.; Allen, S. W.

Publication date: 2011

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
1. Introduction

We present a study where the gas mass fraction of seven clusters of galaxies observed with XMM-Newton is measured. The selected clusters are fairly hot, dynamically relaxed and span the redshift range $z=0.14$ to $0.89$. The cluster masses are derived under the assumption of spherical symmetry and hydrostatic equilibrium, and the effects of assumptions on the spacial distributions of the gas temperature, gas density and total gravitating mass are investigated. A model independent approach is adopted to compute the final mass results from spectral fitting alone. Due to the good angular resolution of Chandra and its well-constrained background, previous studies of the gas mass fraction for constraining cosmology are largely based on Chandra observations. This work presents a complementary and independent study of galaxy clusters, where the gas mass fraction is obtained by using XMM-Newton data only. Background and PSF effects were both carefully considered. In order to check for consistency and biases, the results from this analysis are compared with previous X-rays studies from Chandra and XMM-Newton observations.

2. Data Reduction and Analysis

- **Data set**
  - Cluster redshift 
    - $<T_{\text{peak}}>$ (keV)
    - G.T.I.*
  - A1413 0.143 7.94 ± 0.09 63 ks
  - A963 0.206 6.09 ± 0.15 23 ks
  - A2390 0.230 9.11 ± 0.45 10 ks
  - A1835 0.252 7.44 ± 0.08 71 ks
  - MS2137 0.313 4.18 ± 0.10 11 ks
  - RXJ0344 0.686 7.73 ± 0.42 63 ks
  - CL1226 0.892 12.36 ± 0.94 65 ks

- **Filtering**
  - Soft protons contamination.
  - CCDs in anomalous states.
  - Point sources.

- **Spectra**
  - Concentric annuli centered at the peak of emission.

- **Background**
  - Quiescent particle background (QPB)
  - Fluorescent X-rays (FX)
  - Soft protons
  - Cosmic X-ray background model (CXB)

- **Analysis**
  - Absorbed thermal model
  - CXB model
  - PSF correction
  - Deprojection
  - Model independent

Main references:

Ferreira, D. M. 2011, PhD thesis, Gas mass fractions from XMM-Newton, Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen.


