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 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

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Redshift</th>
<th>$&lt;T_{gas}&gt;$(keV)</th>
<th>G.T.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1413</td>
<td>0.143</td>
<td>7.94 ± 0.09</td>
<td>63 ks</td>
</tr>
<tr>
<td>A983</td>
<td>0.206</td>
<td>6.09 ± 0.15</td>
<td>23 ks</td>
</tr>
<tr>
<td>A2390</td>
<td>0.230</td>
<td>9.11 ± 0.45</td>
<td>10 ks</td>
</tr>
<tr>
<td>A1835</td>
<td>0.252</td>
<td>7.44 ± 0.08</td>
<td>71 ks</td>
</tr>
<tr>
<td>MS2127</td>
<td>0.313</td>
<td>4.18 ± 0.10</td>
<td>11 ks</td>
</tr>
<tr>
<td>RXJ0744</td>
<td>0.392</td>
<td>2.74 ± 0.42</td>
<td>63 ks</td>
</tr>
<tr>
<td>CL1126</td>
<td>0.892</td>
<td>12.36 ± 0.94</td>
<td>65 ks</td>
</tr>
</tbody>
</table>

*G.T.I.* = Exposure time after filtering the data - MOS only.

- Filtering
  - Soft protons contamination.
  - CCs 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

3. Results

- Cluster mass ($M_c$)

$$M_c(<r) = \frac{k T r}{G m_p} \left(\frac{\ln T}{\ln r} + \frac{\ln T}{\ln r_j}ight)$$

- Gas mass ($\rho_{gas}$)

$$\rho_{gas}(r) = \sum_{i=1}^{4} \left(\frac{r_i - r_j}{r_i - r_j}ight) f_{gas}(r)$$

- Gas mass fraction ($f_{gas}$)

$$f_{gas}(r) = \frac{M_{gas}(r)}{M_c(<r)}$$

- Conclusions

The model independent measurements of the gas mass fractions from XMM-Newton observations are in overall agreement with the results from Chandra. The gas mass fractions from XMM-Newton, derived in this study, can be used to constrain cosmological parameters in consistence with the constraints by Allen et al. (2008) with Chandra data based on a much larger sample. The constraint on $\Omega_m$ is comparable to previous results and no significant constraint on dark energy was achieved. A larger sample of clusters from XMM-Newton would provide competitive constraints on $\Omega_m$. 

Main references:
Ferreira 2011, PhD thesis, Gas mass fractions from XMM-Newton, Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen.
Snowden et al. 2008, A catalog of galaxy clusters observed by XMM-Newton, ABA, 479, 615-658.

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**DTU Space**
National Space Institute

Desiree Della Monica Ferreira
Postdoc, DTU Space
Technical University of Denmark
desiree@space.dtu.dk