THE XMM-2DF CLUSTER SURVEY

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Abstract
We present the results from a shallow (2-10 ksec) XMM/2dF survey. Our survey covers 18 XMM fields (∼5deg²) previously spectroscopically followed up with the Anglo-Australian telescope 2-degree field facility. About half of the fields are also covered by the Sloan Digital Sky Survey (SDSS). We are searching for extended sources using the XMM SAS maximum likelihood algorithm in the 0.3-2 keV band and we have detected 14 candidate clusters down to a flux of ∼2×10⁻¹⁴ cgs. Our preliminary results show that: i) the redshift distribution peaks at relatively high redshifts (∼0.4) as expected from the Rosati et al. Φ(L), ii) some of our X-ray clusters appear to have optical counterparts.

Keywords: Surveys: galaxies: clusters; large–scale structure of Universe; Surveys

1.1 Cluster Detection in the XMM fields and Results
We have analyzed 18 XMM-fields located near the South Galactic Pole (SGP; Ra = 00h 57min, Dec = −28° 00'; total of 9 fields) and in the North Galactic Pole (NGP; Ra = 13h 41min, Dec = 00° 00'; total of 9 fields), covering an area of ∼5deg² and with exposure time between 2 and 10 ksec. We have excluded 4 southern fields and 1 northern field because of the high particle background.

In order to detect extended emission we use the wavelet-based XMM-SAS source detection task EWAWELET, with a detection threshold of 5σ, in combination with the EMLDETECT task with an extension probability >0.995. We detect: i) 5 candidate southern clusters in the MOS1 and MOS2 mosaic and 3 extended sources in the PN (out of which 3 overlap with the MOS detections) and ii) 6 candidate northern clusters in the MOS1 and MOS2 mosaic, 1
Figure 1. In the above figures the optical DSS image (for the Northern cluster at the left) and the SDSS image (for the southern cluster at the right) is overlaid with the X-ray contours in MOS1 only and 5 extended sources in the PN (out of which 3 overlap with the MOS detections). The faintest extended source has a flux of $\sim 2 \times 10^{-14}$ cgs, as estimated by the EMLDETECT task. Visual inspection suggests that the small overlap between the PN and the MOS detected cluster candidates can be attributed to (i) the presence of gaps in the PN and (ii) the elevated particle background of this detector.

For the NGP cluster candidates we compare the photometric redshift distribution (from SDSS) within a circular region of $1'-3'$ centered on the X-ray position with that of the field. This preliminary analysis suggests an overdensity of optical galaxies at photometric redshifts $z \sim 0.4$ in excess to the expectations from the Rosati et al 2002 luminosity function.

In the figures we present the XMM EPIC (mosaic of MOS1 and MOS2) contours of 2 of the candidate clusters, overlaid on the optical images, using the DSS and the SDSS for the southern and northern fields respectively.

We fitted to each cluster a King profile using fixed values for the $\beta$ parameter ($\beta = 0.7$ and $\beta = 1.0$). We then estimated the flux of each cluster by integrating their King profile to infinity and we found that the lower cluster luminosity is $\sim 10^{42}$ cgs. Varying the $\beta$ parameter between 0.7 - 1 translates to a $\sim 30\%$ change in $R_{core}$. We also found that the range of the cluster temperatures is between 1-3 keV.

To test the reliability of our procedure we have performed simulations of the expected cluster detection on XMM EPIC, using the Rosati et al (2002) $\Phi(L)$ and the SAS simulator (SciSim). We find that we should expect roughly $\sim 1.5$ clusters per field with $f > 2 \times 10^{-14}$ cgs, which is in rough agreement with our number of detected clusters.

References
Rosati, P. et al (2002), Annual Review of Astronomy and Astrophysics, vol.40, p.539 - 577.
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