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Unlocking the potential of the XMM Serendipitous Survey via multi-colour broad band imaging

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1. XMM Serendipitous Survey and the follow-up imaging programme

The XMM-Newton Serendipitous Survey has been detecting X-ray sources at a rate of ∼50,000 per year. As part of the XMM serendipitous source identification programme (XID) of the XMM Science Survey Center (Watson et al. 2001), we have been obtaining optical multi-colour CCD imaging data for a large number of XMM fields. The multi-colour CCD imaging data for high Galactic latitude fields is currently being obtained with the wide field CCD mosaic cameras at the 2.5m Isaac Newton Telescope in La Palma and the 2.2m MPG/ESO Telescope in Chile. The scientific goals are: to provide optical/IR counterparts for the need of the XID spectroscopic identification programme (e.g. Barcons et al. 2002) and photometric identification of XMM sources for which spectroscopic data are not available; to explore in a statistical manner various topics such as hard X-ray sources, the CXB, objects at high redshifts, and AGN evolution.

2. Current status

So far we have obtained multi-colour optical CCD data for about 150 XMM fields with the 2.5m Isaac Newton Telescope in the u, g', r', i', z bands, with median 5σ limiting magnitudes reaching $\sim$ 23.1 for i' and $\sim$ 23.3 for r'-band. We are now at a stage of finalising the photometric calibration and other data quality control work. A pilot study has been started using a subsample of 35 XMM fields. We have compiled a statistically complete sample of hard X-ray sources with hardness ratio $HR2$[1]>-0.2 and $f_{0.5-7.5\mathrm{keV}} > 5\times10^{-15}\,\mathrm{erg\,cm^{-2}\,s^{-1}}$, for which the source number counts are shown in Fig. 1. These objects sample the bright part of the CXB source population, complementary to the faint part as revealed in the deepest Chandra and XMM surveys (e.g. Brandt et al. 2001, Giacconi et al. 2001, Hasinger et al. 2001), and are thus of great importance in understanding the nature and evolution of the CXB source population.

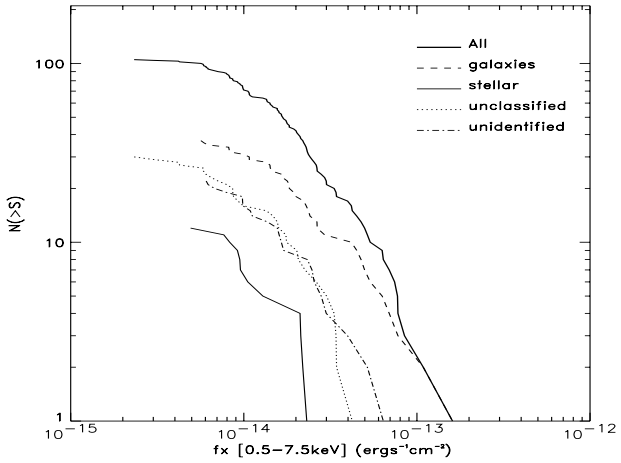

Fig. 1. Number counts of the hard X-ray sources from a subsample showing that the dominant population ($> 40\%$) are classified as galaxies, while stellar-like objects (e.g. QSOs) contribute a smaller fraction (∼10%); about 30% are too faint to be reliably classified and ∼20% remain unidentified down to the general limiting magnitudes of i∼ 23 mag.

The ongoing work is to perform photometric redshift measurement and classification combined with follow-up spectroscopy of sub-sets. The optical imaging data and photometric identification results are becoming public (see *http://www.ast.cam.ac.uk/˜xmmssc*).

References

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[1] $HR2$= ($\mathrm{cr}_{2-4.5\mathrm{keV}}$-$\mathrm{cr}_{0.5-2\mathrm{keV}}$)/($\mathrm{cr}_{2-4.5\mathrm{keV}}$+$\mathrm{cr}_{0.5-2\mathrm{keV}}$)

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