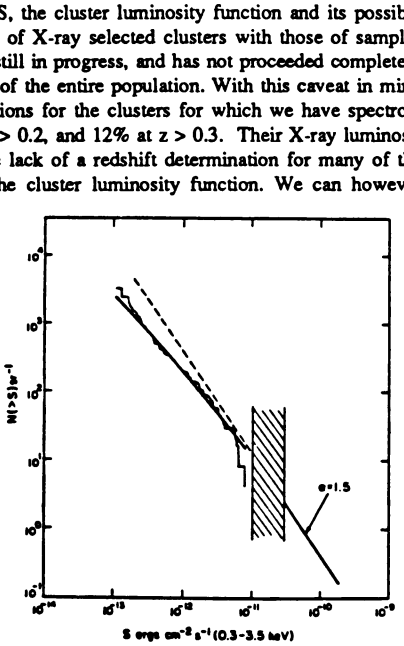
X-ray selected clusters of galaxies

Isabella M. Gioia[1,*], *T. Maccacaro*[1,*], *S. L. Morris*[2], *R. E. Schild*[1], *J. T. Stocke*[3] *and A. Wolter*[1].

1) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA
2) Steward Observatory, University of Arizona, Tucson, AZ
3) Center for Astrophysics and Space Astronomy, University of Colorado, Boulder, CO
*) On leave of absence from Istituto di Radioastronomia del CNR, Bologna, Italy

Studies of the evolution of X-ray emission from clusters of galaxies have so far used optically discovered distant clusters then observed at X-ray wavelengths. A different approach to the study of cluster evolution is to use clusters selected directly by their X-ray emission since X-ray selection is extremely successful at discovering high redshift clusters (up to z = 0.5). The Extension of the Medium Sensitivity Survey (Gioia, Maccacaro and Wolter, 1987), a flux limited sample of serendipitous X-ray sources discovered with the Einstein IPC, has been used to select 68 optically identified clusters and 66 possible candidates (using X-ray isointensity maps and optical POSS and ESO prints). Their X-ray fluxes are in the range 10^{-13}- 10^{-12} ergs cm^{-2} s^{-1} in the 0.3-3.5 keV energy band. Few misidentifications are expected, thus the results presented here have to be considered as preliminary. This sample can be used to study the X-ray logN-logS, the cluster luminosity function and its possible evolution with cosmic time, and also to compare the properties of X-ray selected clusters with those of samples selected by other techniques. Since the identification process is still in progress, and has not proceeded completely at random, the subset of identified sources is not representative of the entire population. With this caveat in mind we have constructed the redshift and X-ray luminosity distributions for the clusters for which we have spectroscopic observations. 68% of the clusters are at z > 0.1, 34% at z > 0.2, and 12% at z > 0.3. Their X-ray luminosities range from about 3 x 10^{42} to 10^{45} ergs s^{-1}. At present the lack of a redshift determination for many of the cluster candidates in our sample prevents us from studying the cluster luminosity function. We can however derive their logN(>S)-logS relation.

We have fitted the data with a function which allows for a flattening (or steepening) to occur below a critical value of the flux which is determined by the fitting procedure. Clusters of galaxies are described by the Euclidean slope at very high fluxes (> 10^{-11}) in agreement with the findings of Piccinotti et al. 1982 for the clusters in the HEAO1-A2 all sky survey. Their logN-logS deviates from the 1.5 slope for fluxes in the EMSS range where a moderate negative curvature is obtained (see figure). Is the departure from the "Euclidean" slope only a cosmological distance-volume effect, or is it the signature of some kind of evolution? These results are very preliminary; to answer this question we have to wait to complete the optical identification of the sources in the EMSS survey and to determine the redshift for all the clusters in order to address the study of the evolution phenomena.



I. M. Gioia acknowledges financial support from the Smithsonian Institution under the "Research Opportunities Fund" program. Partial financial support for this work has come from the Smithsonian Scholarly Studies Program Grant SS48-8-84, from NASA grant NAG8-575 and from NASA contract NAS8-30751.

References

Gioia, I.M., Maccacaro, T. and Wolter, A., 1987, Proceedings of the IAU 124, Observational Cosmology", Beijing, China, in press.

Piccinotti, G., Mushotzky, R.F., Boldt, E.A., Holt, S.S., Marshall, F.E., Serlemitsos, P.J., and Shafer, R.A., 1982, Ap. J., 253, 485.

J. Audouze et al. (eds.), Large Scale Structures of the Universe, 542.