EVOLUTION OF THE CLUSTER X-RAY LUMINOSITY FUNCTION

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ABSTRACT

I predict the evolution of the X-ray luminosity function of clusters of galaxies. Predominantly, I treat the assumption that galaxies form first, then cluster purely due to gravitation. I show that the richness distribution of Abell clusters favors this scenario, rather than the protocluster hypothesis. The luminosity function is produced by combining a generalized (for all Ω) Press-Schechter evolutionary mass function for clusters (derived herein) with a power law X-ray luminosity-mass relation; a power law relation is supported by observations of low-redshift clusters.

I find very steep evolution in the luminosity function, and thus in the source counts, for large Ω, and moderate evolution for small Ω. For a variety of models for the gas supply rate to the intracluster medium, the evolution of the luminosity function does not vary greatly. Thus it appears that the Ω dependence will dominate and that number counts of X-ray clusters will yield cosmological information. The power of a test of Ω with an evolving luminosity function is considerably enhanced relative to a test which involves solely global cosmological effects on a non-evolving population. This occurs because of the well-known result that, at late times, clustering tends to proceed slowly for universes of small Ω and rapidly for large Ω.

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