2 Results and Discussion

The 150 clusters have been determined independently from X-ray data. In this context of constraining a highly complete X-ray-luminous sample of

1 Introduction

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To Gravitational Masses in Wide Angle Surveys

Relating Galaxy Cluster X-Ray Luminosities
line is the self-similar relation (slope = 4/3) normalized by the simulations of Navarro, Frenk & White \cite{7}, the dashed line is the ‘pre-heated’ relation given by Evrard & Henry \cite{4} (slope = 11/6). The normalization given by Evrard & Henry, determined theoretically, agrees with the normalization found in the simulations of pre-heated clusters by Navarro, Frenk & White. The measured relations lie in between the relations with and without pre-heating. The physical implications will be discussed in Reiprich et al. (in prep.), here we emphasize that the plot shows measured and predicted $L_{\text{Bol}} - M_{200}$ relation to be in rough agreement. Using a bisector linear regression fit routine in log-log space which takes into account errors in both variables and allows for intrinsic scatter \cite{2}, the following best fit relations are found using 106 clusters: $L_{\text{Bol}} = 9.25 \times 10^{-23} M_{200}^{1.812 \pm 0.08}$ and for the luminosity in the ROSAT energy band $L_X(0.1 - 2.4 \text{keV}) = 1.47 \times 10^{-19} M_{200}^{1.57 \pm 0.08}$ ($L_X$ in units of $10^{40}$ erg/s and $M_{200}$ in solar masses). Note that different best fit values are obtained when errors in the variables are neglected and only one variable is treated as dependent e.g., for the latter relation then a slope of 1.33, in agreement with the slope of the preliminary $L_X - M_{500}$ relation quantified by Reiprich & Böhringer \cite{8}, is found instead of 1.57). The bisector method used here ensures that variables are treated symmetrically \cite{6}. The 1-$\sigma$ scatter in log-log space for the mass around the $L_{\text{Bol}} - M_{200}$ relation equals 0.19, corresponding to a relative mass error of $+55\%$ and $-35\%$ when converting $L_{\text{Bol}}$ to $M_{200}$. This error includes intrinsic and measurement scatter.

Fig. 1. Bolometric X-ray luminosity versus gravitational mass for 106 clusters.
Fig. 2. Number of cluster galaxies for 66 clusters (left) and galaxy velocity dispersion for 78 clusters (right) versus mass as compared to X-ray luminosity versus X-ray mass for the same clusters.

In Fig. 2 the measured number of cluster galaxies, $N_{\text{gal}}$, as taken from Abell, Corwin & Olowin [1] and the measured radial galaxy velocity dispersion, $\sigma$, as taken from Struble & Rood [10] are compared to $L_X$ as gravitational mass tracers. It is clear from the plot on the left that, assuming $M_{\text{halo}}$ to be a good estimate of the true cluster mass, solely taking the Abell richness to select clusters is not a very effective way to select clusters by their mass. From the plot on the right, one can see that the velocity dispersion correlates better with mass than the galaxy richness but also it confirms that careful analyses are required, e.g. [5], when determining the cluster mass from the velocity dispersion.

For further info and more comprehensive articles please check http://www.xray.mpe.mpg.de/~reiprich/

References

3. Böhringer, H. & Schuecker, P., these proceedings