Exploring Galaxy Clusters at $z \sim 0.3$:

XMM-Newton observations of the REFLEX-DXL sample

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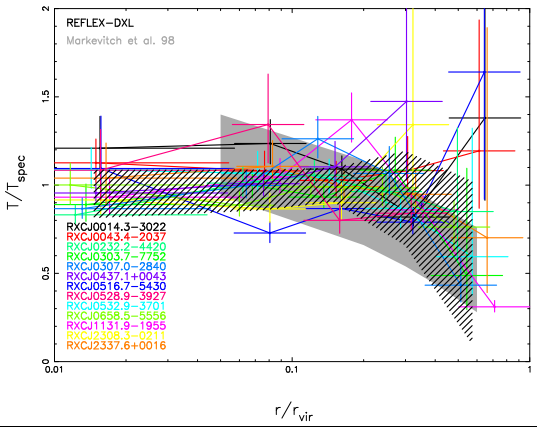
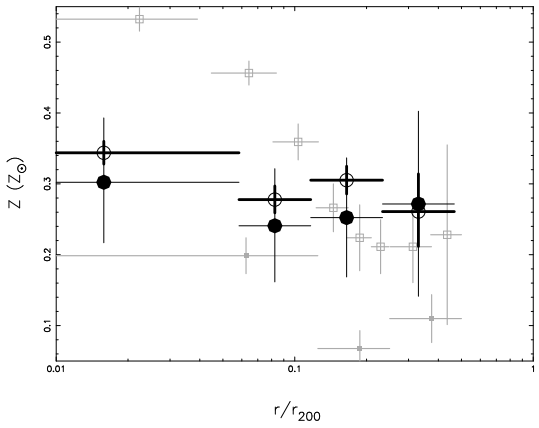
ABSTRACT: Using XMM-Newton, we observed a volume-limited sample of 13 distant X-ray luminous (DXL; $z \sim 0.3$) galaxy clusters selected from the REFLEX survey (REFLEX-DXL sample). We derived the X-ray properties of the REFLEX-DXL galaxy clusters. The robust cluster mass measurements have been used to study the X-ray galaxy cluster scaling relations and their intrinsic scatter. This is important for the use of clusters of galaxies as cosmological probes. We found that the X-ray properties of the REFLEX-DXL sample show a self-similar behavior at $r > 0.1 r_{\rm vir}$. This helps us to establish tight scaling relations and correlations, e.g. the M–T relation. Error bars correspond to the 68% confidence level. $\Omega_{\rm m} = 0.3$, $\Omega_\Lambda = 0.7$, and $H_0 = 70$ km s^{-1} Mpc^{-1}.

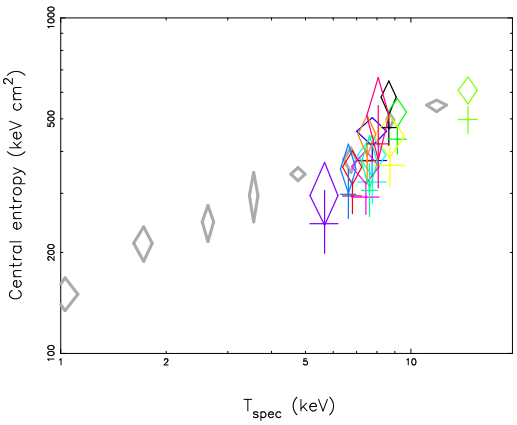
Scaled temperature profiles: The shadows show the average temperature profi le of the REFLEX-DXL clusters in Zhang et al. (2005b, hatched, astro-ph/0502197) and the temperature profi le range in Markevitch et al. (1998; fi lled).



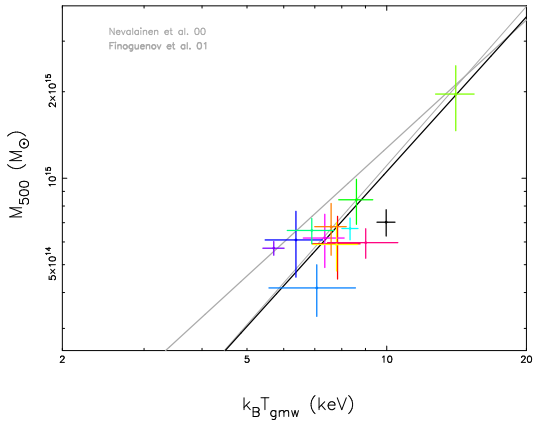
Metallicity profiles: The open (fi lled) symbols are shown for the cooling flow (non-cooling flow) clusters in the REFLEX-DXL sample (Zhang et al. in preparation) and in De Grandi et al. (2004, grey).



Central entropy vs. temperature: Redshift corrected (diamond, thin) and uncorrected (cross, thin) central entropy at $0.1 r_{200}$ are shown for the REFLEX-DXL clusters (Zhang et al. in preparation) and Nearby clusters in Ponman et al. (2003, diamond, thick).



M_{500}–T relation: The best fi t of the REFLEX-DXL sample is shown in black line. The gas mass weighted temperatures have been used (Zhang et al. in preparation).



CONCLUSION: X-ray luminous (massive) galaxy clusters are usually self-similar. We found a closely universal temperature profile with a constant central distribution for the NCCs, but with an increasing distribution for the CCs in the REFLEX-DXL sample. We observed a decreasing temperature profile at $r > 0.3 r_{\rm vir}$ for most REFLEX-DXL clusters. No significant cool gas was found in the cluster center. For the cooling flow clusters, the metallicity profile shows a higher metal concentration. The central entropy at $0.1 r_{200}$ is consistent with that of the nearby clusters in Ponman et al. (2003) after the redshift correction. We reproduced the ROSAT luminosities of the REFLEX-DXL clusters using the XMM-Newton data. The REFLEX-DXL sample can provide a tight constrain on the normalizations of the correlations, e.g. the M–T relation.

Reference: Böhringer, H., Schuecker, P., Guzzo, L., et al., 2001, A&A, 369, 826 Zhang, Y.-Y., Finoguenov, A., Böhringer, H., et al., 2004, A&A, 413, 49