



SZ/X-ray Scaling Relations from Bolocam and Chandra

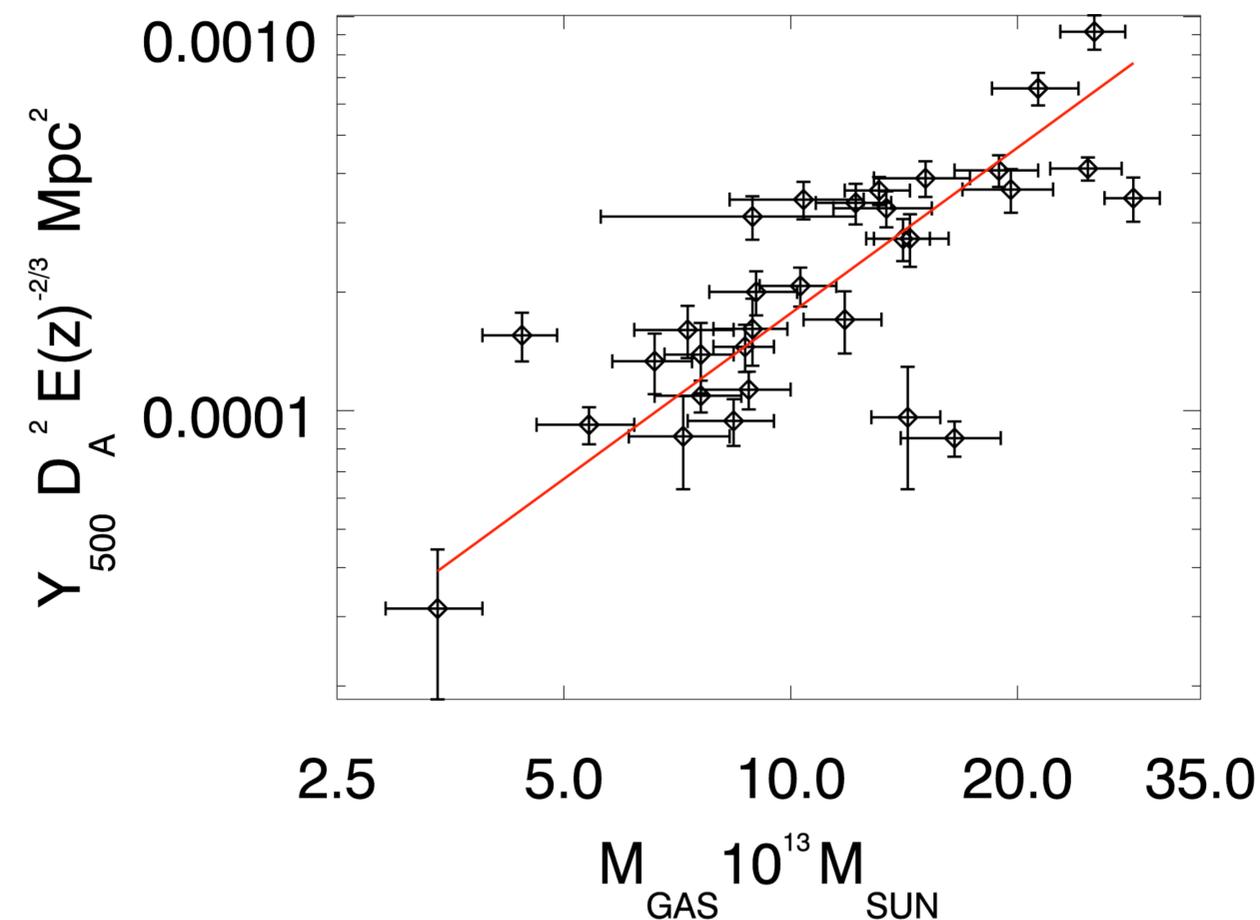
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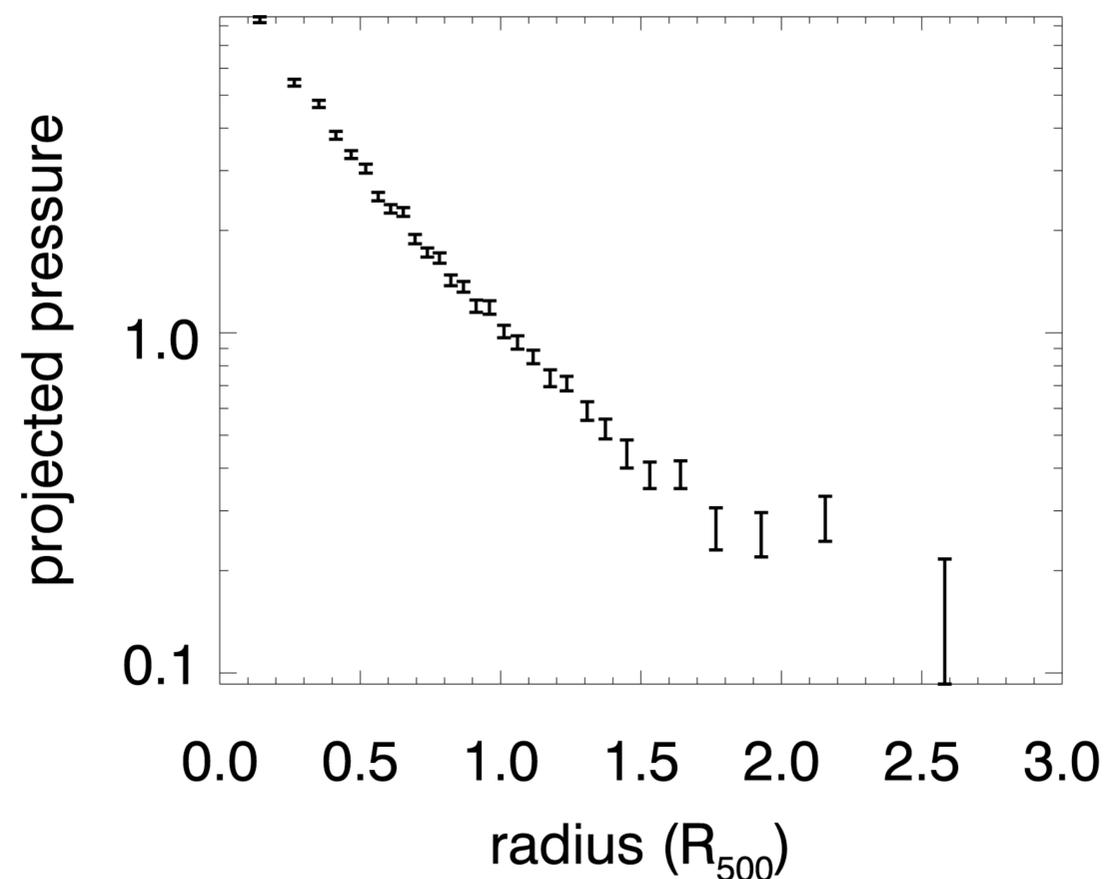


Abstract

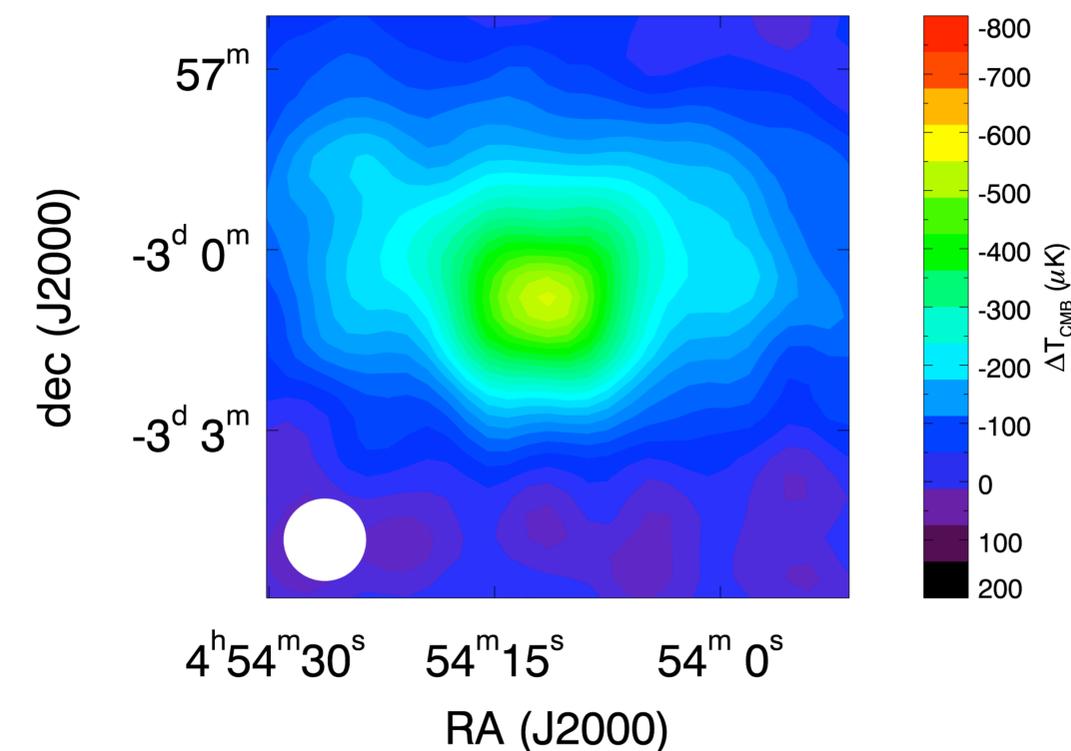
We provide an update on our SZ/X-ray scaling relation analysis using Bolocam and Chandra observations of ~ 35 massive galaxy clusters. These clusters span the mass range $3 \times 10^{14} M_{\text{sun}} < M_{500} < 25 \times 10^{14} M_{\text{sun}}$ and the redshift range $0.15 < z < 0.89$ with $\langle z \rangle = 0.44$. The Bolocam data are of sufficient quality to obtain model-independent $\sim 10\%$ estimates of Y_{500} , the integrated SZ signal within a cylindrical aperture of R_{500} . Other than defining R_{500} , the X-ray data are not used in the SZ analysis. The Chandra data are of sufficient quality to obtain $\sim 10\%$ estimates of several X-ray observables, including the gas mass ($M_{\text{gas},500}$), temperature ($T_{X,500}$), luminosity ($L_{X,500}$), and center-excised luminosity ($L_{Xce,500}$). These data will allow us to search for subtle deviations from self-similarity and to tightly constrain the intrinsic scatter of the SZ/X-ray scaling relations. We also provide an update on our analysis of the average cluster pressure profile at extremely large radius using Bolocam SZ data. By stacking our data, we are able to measure an average pressure profile in 30 radial bins between $0.15R_{500} < R < 2.5R_{500}$.



The scaling between Y_{500} and $M_{\text{gas},500}$ for 31 of the clusters in our sample. We compute Y_{500} in a model-independent and X-ray-independent way. We expect to constrain the logarithmic slope and intercept of the scaling relation to within ~ 0.1 using these data.



Peak-normalized, stacked pressure profile for 31 clusters observed with Bolocam. Note that this profile includes artifacts from our finite-width PSF over a wide range of scales because the angular size of R_{500} varies by a factor of 5 over our cluster sample.



Left: Bolocam SZ image of MS 0451.6, a massive galaxy cluster at $z=0.55$ that is representative of our sample.

Right: Binned radial SZ profile of the same cluster (black points). Note that, to obtain unbiased SZ images we deconvolve the high-pass filter that is applied to the data for atmospheric noise subtraction. The filtered (un-deconvolved) SZ profile is shown as red points.

