THERMODYNAMICAL PROPERTIES OF WEAK-LENSING SELECTED CLUSTERS

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Galaxy clusters are fundamental for both astrophysics and cosmology. The various components present in a cluster, dark matter, intracluster medium, and galaxies, are deeply interconnected: galaxy formation and evolution depend on the large scale environment in which the live, and on the physical and chemical properties of the intergalactic gas from which they form; this gas in turn is affected by galaxy feedback.

The baryons in the intracluster medium offer us the unique opportunity of determining the dynamical status of clusters, their formation and evolution, through thermodynamic radial profiles (electron density, temperature, pressure, and entropy). However, our current knowledge of them comes primarily from detailed studies of systems selected by their minority component (hot baryons and stars), used to identify them (through X-ray, SZ, or optical/IR surveys). It is now generally recognized that X-ray selection yields a biased view of the cluster population (Pacaud et al. 2007; Stanek et al. 2006; Pratt et al. 2006; Andreon, Trinchieri & Pizzolato 2011; Andreon & Moretti 2012; Eckert et al. 2011; *Planck* Collaboration 2011, 2012; Maughan et al. 2012; Andreon et al. 2015) because at a given mass, brighter-than-average clusters are easier to select and be included in a sample. Considerable efforts have been made to correct for this effect, but the results are not definitive because the correction depends heavily on assumptions about the unseen population (Vikhlinin et al. 2009; Andreon et al. 2011, 2016, 2017). SZ-selection offers a less biased view and indeed samples a broader population (e.g., in gas content) than X-ray selection (e.g., *Planck* Collaboration 2011, 2012). However, an X-ray unbiased sample unveils the existence of an even larger variety of clusters at a given mass (Andreon et al. 2016, 2017).

Ideally, selection by total mass (i.e. weak-lensing) should provide a bias-free sample, and is preferable to a selection that relies on indirect signals triggered by baryons in hot gas and stars, linked to total mass through models. The release of the first catalog (Miyazaki et al 2018) of high signal-to-noise shear detections in the Hyper Suprime-Cam Subaru Survey (Aihara et al. 2018) allows us to select clusters independently of their baryon content and to investigate, for the first time, the bias of the baryon selection. The thesis uses X-ray and SZ data acquired by our group to measure thermodynamic profiles of these weak-lensing selected clusters and, from them, the whole spread of the population properties and the bias present in samples studied so far.

References: Aihara, H. et al. 2018, PASJ, 70, 4 • Andreon et al. 2009, A&A, 507, 147 • Andreon, S. & Moretti A. 2012, A&A, 536, A37 • Andreon, S., Trinchieri G. & Pizzolato F. 2011, MNRAS 412, 2391 • Andreon et al. 2014, A&A, 565, A120• Andreon, S. et al. 2015, A&A, 582, 100 • Andreon, S. et al. 2016, A&A, 585, A147 • Andreon, S. et al. 2017, A&A, 606, A24 • Eckert, D. et al. 2011, A&A 526, 79 • Maughan, B. et al. 2012, MNRAS, 421, 1583 • Miyazaki, S. et al. 2018, PASJ, 70, 27 • Pacaud, F. et al. 2007, MNRAS 382, 1289 • Planck Collaboration 2011, A&A, 536, A9 • Planck Collaboration 2012, A&A, 543, A102 • Pratt, G. W. et al. 2006, A&A, 446, 429 • Stanek, R. et al. 2006, ApJ 648, 956 • Vikhlinin, A. et al. 2009, ApJ 692, 1060

True colour ($z'JK$) image of the cluster at the highest redshift known, JKCS 041 (Andreon et al. 2009, 2014). The smooth, blue emission is the X-ray emission detected by Chandra. North is up and East is to the left, the field of view is 5×5 arcmin.