

Planck intermediate results: III. the relation between galaxy cluster mass and Sunyaev-Zeldovich signal

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Abstract

We examine the relation between the galaxy cluster mass M and Sunyaev-Zeldovich (SZ) effect signal $DA 2 Y500$ for a sample of 19 objects for which weak lensing (WL) mass measurements obtained from Subaru Telescope data are available in the literature. Hydrostatic X-ray masses are derived from XMM-Newton archive data, and the SZ effect signal is measured from Planck all-sky survey data. We find an $MWL-D A 2 Y500$ relation that is consistent in slope and normalisation with previous determinations using weak lensing masses; however, there is a normalisation offset with respect to previous measures based on hydrostatic X-ray mass-proxy relations. We verify that our SZ effect measurements are in excellent agreement with previous determinations from Planck data. For the present sample, the hydrostatic X-ray masses at $R500$ are on average ~ 20 percent larger than the corresponding weak lensing masses, which is contrary to expectations. We show that the mass discrepancy is driven by a difference in mass concentration as measured by the two methods and, for the present sample, that the mass discrepancy and difference in mass concentration are especially large for disturbed systems. The mass discrepancy is also linked to the offset in centres used by the X-ray and weak lensing analyses, which again is most important in disturbed systems. We outline several approaches that are needed to help achieve convergence in cluster mass measurement with X-ray and weak lensing observations. © ESO, 2013.

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Keywords

Cosmology: observations, Galaxies: clusters: general, Galaxies: clusters: intracluster medium, X-rays: galaxies: clusters