A06a Interactions Between the Hot Plasmas and Galaxies in Clusters II

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To verify our conjecture described in the previous talk, we studied "optical-light vs. ICM-mass ratio" profile for a sample of 34 clusters with $z = 0.1 - 0.9$. They were selected to have similar ICM temperatures, and relaxed X-ray and optical morphology. Using their optical data obtained with the UH88 telescope (PI: Inada), we derived radially-integrated I-band 2D optical luminosity profile $L(r)$, and determined its background level $L_{\rm b}$ by an offset observation. Their 2D ICM mass profiles, $M(r)$, were derived by analyzing archival ¥it XMM-Newton and ¥it Chandra data. Then, we calculated the ratio $D(r) = [L(r) - L_{\rm b}]/M(r)$, and normalized each $D(r)$ to its value at the innermost regions. When the 34 clusters are divided into three subsamples with $z = 0.1 - 0.2$, 0.2–0.4, and 0.4–0.9, we found that $D(r)$ drops more steeply outwards in lower-redshift subsamples. According to a K-S test, this evolution in the light-to-ICM ratio profile is significant at >99¥

The result is of course subject to various errors in, e.g., $L_{\rm b}$ (due to cosmic variance) and the virial radius determinations. There must also be various redshift-dependent systematic biases, e.g., different rest-frame optical bands, optical and X-ray sensitivities, intracluster light, and evolution of radius-dependent star formation rate. By assessing each of these errors and biases, we found none of them is significant against the observed $D(r)$ evolution. Furthermore, other astrophysical effects, e.g., dynamical friction, are estimated to be insufficient to explain the observation. This result provides important support for our view of galaxy-plasma interaction.