LoCuSS: Dynamical Estimates of Mass and Substructure in a Survey of Galaxy Clusters at z~0.2

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CLJ2010+0628 @ IPMU
AIM: To understand the impact of recent hierarchical infall history of clusters on their baryonic content -- galaxies and hot intracluster gas.

- Observable cluster scaling relations show intrinsic scatter from cluster to cluster. How does this scatter relate to their recent assembly history?

- Transformation of infalling galaxies through different environments: field / filaments / groups / cluster cores.
Local Cluster Substructure Survey
(P.I. Graham Smith)

http://www.sr.bham.ac.uk/locuss/

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Morphologically unbiased sample:
- $0.15 < z < 0.3$, $-70 < \text{dec} < +70\,\text{deg}$, $n_H < 7 \times 10^{-20}\,\text{cm}^{-2}$
- ROSAT All Sky Survey catalogs: BCS, eBCS, REFLEX
- 165 clusters with $L_X > 2 \times 10^{44}\,\text{erg/s}$

Huge multi-wavelength effort (30-50% complete):

- Subaru, HST, Keck, VLT, Gemini, Chandra, XMM, SZA, Palomar, Spitzer (24um), GALEX, Herschel, MMT/Hectospec, KPNO, CTIO, UKIRT
Hectospec/MMT

1 degree FoV
MOS: 300 fibers

obtained ~500 spectra per cluster for subsample of 30 LoCuSS clusters
fibers assigned to galaxies selected in J-K color to be likely cluster members.
Spitzer 24um sources also prioritized regardless of optical, near IR colors.

- between 50-75% of targeted galaxies are confirmed cluster members.
- 270 lines/mm grating: resolution ~ 300km/s
Caustic mass estimates

Kaiser 1987
Diaferio & Geller 1997

\[ GM(< r) = \frac{1}{2} \int_0^r A^2(R) dR \]

mass estimate does not depend on the dynamical state of the cluster, or on a parametrization of the mass distribution

but does assume spherical symmetry

can obtain mass profiles well beyond the virial radius \( r_{\text{vir}} \sim 2-3 \) Mpc for this sample
Dynamical vs Weak Lensing Mass Estimates from Okabe+ 2010

\[ M(r < r_{500}) \]

\[ M(r < r_{110}) \]

Hardegree-Ullman + (in prep)

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Dynamical Substructure

Abell 1835

Lensing

X-ray

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Luminous infrared galaxies dynamically segregated from the cluster population
Infall regions of this massive relaxed cluster are extremely active!

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