Witnessing the Formation of a Brightest Cluster Galaxy

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What Are Brightest Cluster Galaxies?

BCGs:

- Most luminous + massive galaxies in Universe
- Contain substantial fraction of all cluster light
- Often at center of host cluster (peak of X-ray emission)
And Why Are They Interesting?

BCGs:

- Properties linked to those of host cluster
- Regulate central properties of intracluster medium
- Formed at (very?) high $z$
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XI Groups Survey:
Multi-λ survey of 25 statistically representative galaxy groups at z=0.06 (Rasmussen+ 06)

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$\Delta r \sim 20$ kpc, $\Delta v \sim 35$ km/s
Chandra Observations of MZ 10451

0.3-2 keV (80 ks):

200 kpc
Impact on the Intracluster Medium

Cool core retained...

...but strong central Fe excess present.
Impact on ICM: 2-D “Spectral” Mapping

Temperature:
\[ T \sim HR = 1-2/0.5-1 \text{ keV} \]

Entropy:
\[ S = \frac{T}{n^{2/3}} \sim \frac{HR}{I_e^{1/3}} \]

Pressure:
\[ P \sim nT \sim HR^{1/2} \]
The Nature of the Central Merger
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![Image of a galaxy with labeled regions A and B, showing near-UV and 24μm emissions, and a graph of photons/arcsec² vs. distance (r) in the 0.3-2 keV band, with labels ACIS PSF, Galaxy B, and a highlighted region marked X.]

**GALEX**

**Spitzer**
Implications for BCG Formation

BCGs: built up hierarchically by mergers near cluster cores.

Progenitors: Galaxies infalling along accreting filaments (De Lucia+ 07)
BCG major merger: No large-scale impact on ICM
Cool core remains - but metals injected in core
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Merger may not be dissipationless ("dry")
Evidence for cold + hot gas in progenitors
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BCGs form through mergers in cluster cores
by galaxies infalling along “feeder” filaments