Galaxy Populations & Intracluster Light in Local-Universe Clusters

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Summary

1. galaxies in clusters vs “galaxies” in halos

   good agreement between simple models and real universe

   • for local \((z < 0.3)\) there are now lots of solid measurements describing the cluster galaxy population (eg SDSS)

   • mock galaxy catalogs (eg ADDGALs) are now able to reproduce many of these trends using simple prescriptions for galaxy assignment

11. BCG + ICL profiles from SDSS [preliminary]

   starting to be able to examine color profiles
I. galaxies in clusters vs “galaxies” in halos
maxBCG Clusters in SDSS

red-sequence cluster finding

>13,000 clusters in 7300 deg$^2$ of ugriz data

$0.1 \leq z \leq 0.3$ with $\Delta z \sim 0.01$

mass proxy: $N_{200}$

Koester+07a,b; Becker+07; Sheldon+09a,b; Johnston+07; Rykoff+08; Hansen+09; Rozo+09a,b; Rozo+10

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ADDGALS Mock Catalogs

N-body simulations populated with galaxies having *global* properties matched to SDSS

- Luminosity-dependent correlation function sets r-band for most galaxies (Montera-Dorta & Prada 09; Zehavi et al DR7)
- BCGs need special treatment: use SDSS cluster results (Hansen et al 2009)

Busha & Wechsler
ADDGALS Catalogs

Colors added based on local environment:
\[ P(\text{SED} \mid M_r, \Delta_5) \] from SDSS

Except for centrals, galaxies do not know anything about the halos they happen to live in.

Busha & Wechsler
ADDGALS: Galaxy LFs in Halos

Most massive

Least massive

Solid lines are SDSS trends (Hansen et al 2009)

Data points are ADDGALS
ADDGALS: Halo Red Fractions

Colored lines with error bars are ADDGALS (as a function of halo mass)

Solid lines are SDSS trends (Hansen et al 2009)
11. BCG + ICL profiles from SDSS
Cluster Images

- maxBCG clusters from repeatedly observed region of SDSS
- $0.2 < z < 0.3$
- $\log M > 13.7$
- low-dust regions (based on SFD maps)
- coadded images with improved sky subtraction

PSFs measured for each coadd

Flat images to $>28\text{ mag arcsec}^{-2}$ in g,r
Example Cluster

$z = 0.23$

$N_{200} = 33$

$log_{10} M = 14.1$

calibrated & sky-subtracted

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Surface Brightness Profiles

g-band

r-band

semi-major axis [kpc]

surface brightness

semi-major axis [kpc]
BCG+ICL Profiles

$r$-band surface brightness vs. semi-major axis [kpc]

LogM = 14.3, z = 0.21
LogM = 13.7, z = 0.23
LogM = 13.7, z = 0.23
LogM = 14.3, z = 0.23

LogM = 14.2, z = 0.23
LogM = 14.1, z = 0.24
LogM = 14.2, z = 0.24
LogM = 13.9, z = 0.24

LogM = 14.2, z = 0.24
LogM = 14.3, z = 0.25
LogM = 14.2, z = 0.25
LogM = 14.1, z = 0.25

LogM = 14.5, z = 0.26
LogM = 14.4, z = 0.27
LogM = 14.1, z = 0.29
LogM = 14.4, z = 0.80
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II. BCG + ICL profiles from SDSS [preliminary]

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ADDGALS: Centrals/Satellites

Cluster Mass \([10^{14} M_\odot]\)

Solid lines are SDSS trends (Hansen et al 2009)

Data points are ADDGALS
Improved Sky Subtraction

Corrected frames, before sky subtraction:

SDSS sky estimate:

Mask to avoid known bright stars:

Sky model:
Improved Sky Subtraction

With SDSS sky subtraction

With improved sky estimate