A BAYESIAN APPROACH TO DETECT BCGs AT PHOTOMETRIC SURVEYS

Vicentin, M; Araya-Araya, P.; Sodré Jr., Laerte

INTRODUÇÃO

Galaxy clusters ($M_{200} > 10^{14} M_\odot$) trace the densest regions of the universe, where the first perturbations in the primordial field collapsed;

The mass distribution of galaxy clusters across different redshifts and the fraction of gas are important tools to constrain cosmological parameters (Fig 1);

Also, they are unique laboratories to understand astrophysical processes associated with the galaxies and the hot intracluster medium (ICM);

The first galaxy formed in a cluster is the Brightest Cluster Galaxy (BCG). BCGs show distinctive properties of luminosity, color, and mass (Fig 2);

In the last decades, a large volume of data became available due to photometric surveys (Fig 3), which made the systematic search for galaxy clusters possible

METHODS

Bayesian probabilistic model of a given galaxy being a BCG;

Candidates are selected by the following conditions:

1) $M_i > M_i^* \approx 10^{11} M_\odot$

2) Most massive within 2 cMpc radius

We use local density measurements as the likelihood, and the expected r-band magnitude and color as priors;

Figure X illustrates how the model works

To test the model, we use PCcones (Araya-Araya+2021) mock data

PRELIMINARY RESULTS

4 different types of galaxies: Field, Cluster member, BGG, and BCG

BGG stands for Brightest Group Galaxy: Defined as the most massive galaxy in a halo with $M < 10^{14} M_\odot$

Completeness = BCGs above a probability cut / all BCGs; Purity = BCGs above a probability cut / all types of galaxies above a probability cut

It is possible to select a sample of BCGs with ~75% of completeness and purity

For a sample with BCG completeness = 100%, the purity is ~28%, but most of the contamination is BGGs (58%)

PERSPECTIVES

After finding BCGs:

Additional probabilistic criteria to search for the others cluster members
Establish cluster properties
Construct a catalog and compare with others in the literature

REFERENCES

Araya-Araya et al. 2021
Bocquet et al. 2019
Trevisan & Mamon, 2017
Wang et al. 2018