CASPEN Visitor Program Report

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August 22, 2024

Motivation

Questions we want to answer:

(1) Is there intracluster light in the infall region of protoclusters in different cosmic times? (2) Where were ICL particles in the past? (3) How ICL particles formed and assembled? Were they ejected due to galaxies' interactions or is there a significant fraction of in situ formation?

Motivation for these figures: different environments mean different physical processes of ICL formation and assembly. For example, if we find ICL in groups, it means that pre-processing is important. If we find ICL outside groups, it might mean that stars 1) were formed in clouds outside galaxies (also called in situ formation) or 2) they were ejected from galaxies outside groups or 3) dwarf disruption can be happening. There are also other possibilities.

Main outcomes of visit

I stayed as a visitor at CCA - Flatiron from 7th to 26th of May. During this time we:

- Spent some time setting everything up. This includes access to the cluster, installation of useful python packages, learning how to use ytree and gizmo.
- We use gizmo to identify galaxies in the simulation and classify them in different environemnts: clusters and infall. We also excluded galaxies outside $3 \times R_{200}$ at redshift 2, since the simulations are not reliable outside this region.
- We checked the number of galaxies in these different environments and how they change with galaxies' masses.
- Estimated the number of particles in the total environment and decreased by the number of particles in galaxies, with that we found the number of stellar particles in the intracluster light. This can be seen in the figure on the left. These results show that there is a considerable amount of intracluster light in the infall region.
- We selected all ICL particles in the main halo at redshift 2. Main halo particle is defined as a particle inside R200 of the cluster at redshift 2 that is outside galaxies. We track all ICL particles and check where they were in the past at $2.0 < z < 8.0$. Each particle is classified in 5 different environments that are shown in the middle figure.
- We have done the previous steps for all snapshots.The right figure shows the fraction of particles in different environments in different redshifts. The particle fraction increases with time in the main halo, which is expected by models. Some particles are in groups in the infall region, which is also expected considering the hierarchical structure formation. The fraction of particles in the infall outside group and outside galaxy is very high for high redshifts, the reason for that is currently being investigated.
- We created an overleaf file with all figures and results we have until now. The figures are not included here because this report would be longer than a page.
- The next steps are to test different ICL formation and assembly.(1) Redo the fraction figure in terms of mass and divided by total ICL mass at z2 (2) Check if in-situ formation is relevant: check star particles that have never been in a galaxy (3) ICL particles coming from galaxies outside groups: check star particles that were in the slist of the galaxies not in groups and do an intersection with all ParticleIDs at z=2 (4) Check dwarf disruption: take galaxies at a redshift $z > 2$ check if all of the particles in those galaxies are NOT in a galaxy at z=2 but are in the ICL.

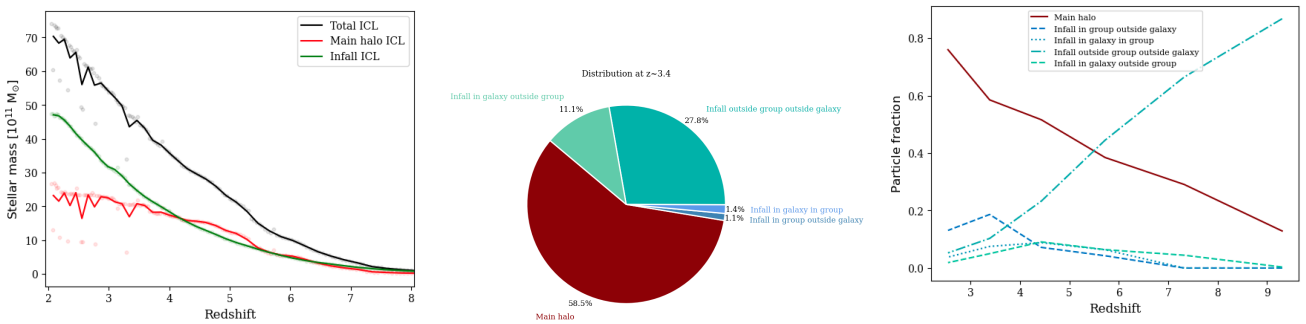

Figure 1: Left: how stellar mass changes with redshift for different environments. Middle: where ICL particles were at z∼3.4. Right: particle fraction as a function of redshift for different environments.

This work was supported by collaborative visits funded by the Cosmology and Astroparticle Student and Postdoc Exchange Network (CASPEN).