Project Title: Measuring the mass accretion rate of clusters of galaxies

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Project Description:

Clusters of galaxies form by gravitational accretion of galaxies and galaxy groups. They are the largest structures of the Universe in dynamical quasi-equilibrium, and for this reason they are the latest structures to complete their assembly. Understanding their history of assembly provides useful constraints on the cosmological model. Since they form late, it is possible to learn about their assembly history by studying relatively nearby clusters.

The proposed PhD project is focused on the determination of the mass accretion rate (MAR hereafter) of clusters in the redshift range z=0.04-0.50. There are two main publicly available data sets that can be investigated for this purpose: OmegaWINGS and CLASH. These two data sets contain, respectively, ~50 clusters at low-z and ~10 clusters at intermediate-z, with extensive spectroscopic and photometric data that allow to determine the cluster membership of galaxies in the cluster fields.

To determine the MAR of the OmegaWINGS and CLASH clusters, two probes can be used. One is the shape of the number density profile of cluster galaxies at large distances from the cluster center. Simulations indicate that this shape is correlated with the mass accretion rate. Another probe is the amount of infalling groups in the cluster outskirts. These groups can be detected by suitable algorithms of substructure identification. These two probes will be calibrated using cluster-size halos in cosmological simulations. Several suites of cosmological simulations are now freely accessible for this purpose, and a

collaboration can be established on this specific issue with other members of the local astrophysical Trieste community.

The measured cluster MAR will be compared with respect to the cluster redshifts, masses, mass distributions, and galaxy population contents. These comparisons will inform us on (1) the evolution of the cluster assembly, and (2) the evolution of the cluster galaxy population.