

# Project

The successful applicant will work at DIFA within the stimulating environment of the Navile Campus in Bologna, the largest cluster of institutes for astrophysical research in Italy (DIFA, INAF-OAS, INAF-IRA, ALMA Regional Center, and the headquarters of the Cherenkov Telescope Array).

The research activity will be done under the supervision of Dr. M. Talia, Dr. O. Cucciati and Prof. F. Pozzi.

Large galaxy associations are an excellent laboratory for investigating astrophysical phenomena. The most massive associations, galaxy clusters and galaxy superclusters, i.e., clusters of clusters, while rare, are the regions of the universe where galaxy maturation occurs most rapidly likely as a result of the diverse transformative processes a galaxy experiences during cluster assembly.

The role that environment plays in galaxy evolution is, however, still unclear.

The research project will focus on this issue, through the exploitation of multiwavelength data (e.g. ALMA, NOEMA, KECK, HST) and/or simulations and theoretical models.

The main goals of the project will be:

- (i) contribute to the collection of spectroscopic and photometric data of the proto-clusters identified in the COSMOS field;
- (ii) characterize (total mass, shape, 3D distribution) the proto-clusters, with a special focus on Hyperion, a super-proto-cluster at  $z \sim 2.5$ , that is an ideal laboratory to study the efficiency of star formation as a function of density and of the dynamical evolution of individual proto-groups;
- (iii) analyse galaxy properties (SFR, stellar mass, gas content, spectral features, presence of AGN...) as a function of the environment;
- (iv) infer the evolution path of the proto-clusters with simulations and theoretical models, and find candidate “descendants” in the literature.

Moreover, the postdoctoral fellow will be involved in the forecasts on environmental studies for the EUCLID mission, where DIFA and OAS are involved with roles of top-level scientific and management responsibilities.

This project will allow us to build a comprehensive picture of the environmental processes regulating the star formation and stellar mass assembly. The exploitation of multi-wavelength datasets will be essential for the success of these studies.

The development of this research project will allow the research fellow to achieve an extended experience in the most modern methods of cosmological and astrophysical investigation. Moreover, the combination of both observational and theoretical aspects will allow the research fellow to grow the scientific expertise in a complete way, thus opening several opportunities for a successful career in cosmology and astrophysics research.