ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

DIPARTIMENTO DI FISICA E ASTRONOMIA
Department of Physics and Astronomy - DIFA

Constraining galaxy evolution through the optimal exploitation of Euclid spectroscopic data

Euclid is an ESA space telescope launched in July 2023, designed to understand the nature of dark energy and dark matter. To achieve this, Euclid is observing over a third of the sky with high resolution imaging and spectroscopy, which will establish "the" reference map of the extra-galactic celestial sphere for decades to come. The giant archive produced will be a goldmine to study the history of the formation and growth of galaxies over the age of the Universe, driving answers to many fundamental science questions on the co-evolution of galaxies and supermassive black holes, the interaction between stars, gas, and galactic nuclei in galaxies at cosmic noon, and excelling in the discovery of rare objects including gravitational lenses.

The research project will focus on the optimal exploitation of the Euclid spectroscopic galaxy surveys, in the framework of galaxy evolution studies. The successful applicant will help the spectroscopic group in Bologna with the exploration, validation and analysis of the Euclid dataset. Previous experience with spectroscopic data (not necessarily related to Euclid) is highly recommended. Researchers with experience in machine learning techniques applied to spectroscopic analysis are also encouraged to apply.

The main scientific goals of the project will be agreed upon with the successful applicant. A not exhaustive list of topics is the following:
(i) study of scaling relations (e.g. SFR-Mass, mass-metallicity…) as a function of redshift, morphology, and environment, also by means of stacking techniques;
(ii) explore the feasibility of combining Euclid spectroscopic and photometric data to extract a wide range of physical parameters, including star formation history, dust extinction, and metallicity, providing a complete understanding of the physical and chemical properties of the galaxies observed by Euclid;
(iii) compare different SFR estimators and study the evolution of the obscured vs. unobscured SFR;
(iv) compare the results to state-of-the-art theoretical models, in order to put them into the broader context of galaxy evolution.
Applicants are encouraged to submit their own project plan and discuss it during the interview.

In pursuing their scientific goal, the successful applicant is expected also to contribute to the development and testing of advanced spectroscopic analysis tools, and to participate in the activities of the Euclid Legacy Science Advanced Analysis Tools (ELSA) program, an HORIZON-EU funded project (PI: M. Talia) aimed at exploring new methodologies and creating cutting-edge pipelines, tools and algorithms in order to maximally exploit the legacy value of Euclid spectroscopic data for galaxy evolution studies. ELSA membership will give access to reserved computational resources of the cluster inside the Open Physics Hub (OPH) at DiFA.

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.