

Project title: Absorption spectroscopy from 1D to 3D: cold gas in galaxies over cosmic history

Supervisors

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Area Tematica: Galassie e cosmologia

This PhD thesis focuses on the study of the connection between the denser absorbers in the Intergalactic Medium (IGM), and the atomic and molecular hydrogen content of galaxies.

The study of these absorbers allows us to study:

- the cosmic evolution of neutral hydrogen;
- the distribution of diffuse gas and the gas cycle in galaxies;
- the evolution of galaxy metallicity

The study requires an in depth comparison between data obtained with latest generation spectrographs (e.g. ESPRESSO, MUSE, X-shooter, UVES) and state-of-the-art semi-analytical models (e.g. GAEA) and simulations (e.g. Illustris TNG, EAGLE, THESAN), with varying prescriptions for the physical processes at play (e.g. partitioning of the cold gas phase, inflows/outflows, dust, AGN feedback, chemical

enrichment). The proposed project will allow the candidate student to obtain a detailed characterization of the observational properties of the denser IGM absorbers, and to interpret these in the framework of cosmological models of structure formation.

The student is also expected to contribute to the design of future experiments with current and upcoming instrumentation (e.g. the CUBES and ANDES spectrographs).

Project keywords: NewIGM, ESPRESSO, CUBES, GAEA

References:

"Damped Ly α absorbers and atomic hydrogen in galaxies: the view of the GAEA model", Di Gioia, S., Cristiani, S., De Lucia, G., et al., 2020, MNRAS, 497, 2469

"ESPRESSO at VLT. On-sky performance and first results", Pepe, F., Cristiani, S., Rebolo, R., et al., 2021, A&A, 645, A96