Research project and development plan

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 (Department of Physics and Astronomy DIFA, Istituto Nazionale di Astrofisica - Osservatorio di Astrofisica e Scienza dello Spazio di Bologna INAF OAS, Istituto Nazionale di Astrofisica - Istituto di Radioastronomia INAF-IRA, ALMA Regional Center, and the headquarters of the Cherenkov Telescope Array).

The research project is based on the MIUR PRIN 2022 project "*Optimizing the extraction of cosmological information from Large Scale Structure analysis in view of the next large spectroscopic surveys*" (PI: M. Moresco) and will be focused on developing new methods to best exploit spectroscopic galaxy redshift surveys, with particular attention on systematic errors that can introduce significant biases in the cosmological results.

The main goals of the project will be agreed with the successful applicant among the following:
- exploit for the first time at the BAO scale the constraining power of the combination of lower- and higher-order correlation functions, that encode additional information on BAO and structure formation that is not fully accessed by current analysis methods;
- measure clustering statistics with a joint analysis of 2PCF and 3PCF up to r~120 Mpc/h, and estimate cosmological parameters, assessing the gain in constraining power compared to other approaches such as reconstruction;
- explore mitigation strategies at the likelihood level (but not only) to take into account the impact of systematic effects in the clustering analyses.

Taking advantage of the position of the PI and CoIs in international collaborations (Euclid, VIPERS), the applicant will consider both the latest and largest real data available in which a cosmological analysis of 2PCF+3PCF has not been performed (eBOSS emission-line galaxies, luminous red galaxies, and quasars, VIPERS), but also make use of the state-of-art simulated data to forecast the performance in future cosmological surveys, including Roman.

People with a background either in galaxy clustering analysis or cosmology are encouraged to apply. Preferential requirements for the candidate will be:
- knowledge in the field of observational cosmology;
- knowledge of numerical methods and programming languages as Python and/or C++;
- knowledge of the Bayesian inference method;
- experience in galaxy clustering analysis techniques;
- experience in real or simulated analysis from multi-tracer spectroscopic surveys.

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.

The contract has a duration of 12 months, but it may be renewed and/or extended for up to additional 12 months.