Thesis subject

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Subject's title: Cosmology from the galaxy spatial distribution in the Euclid mission early data

Subject description:

Euclid is a major European space mission that will map the spatial distribution of galaxies and dark matter in a huge volume of the Universe, to constrain cosmology and answer today's major questions in cosmology: what is the origin of the accelerating expansion of the Universe and the nature of dark energy? The Euclid satellite will be launched in July 2023 and one of the two primary cosmological probes is the clustering of galaxies. The latter is mainly characterized by the two-point statistics of the observed spatial distribution of galaxies. The accuracy in measuring this observable has a crucial impact on the accuracy with which we will be able to determine cosmological parameters. A major challenge for Euclid is to control the level of systematic errors to an extremely low level, below the expected statistical error, which is of the order of the percent. Beyond observational aspects, the expected high precision also implies that associated theoretical models must be extremely accurate, which still has to be investigated.

This thesis project aims at developing methods and performing the first measurements of the clustering of spectroscopic emission-line galaxies in the early data of the Euclid mission. This includes working on both observational and theoretical modelling aspects, to obtain the highest level of accuracy on inferred cosmological parameters. The early Euclid data (data release 1) will arrive 18 months after launch and one expects to reach already with those data, a level of precision never achieved before. One of the major difficulties that this PhD project wants to tackle is the account of the selection function of the spectroscopic survey with the complexity of Euclid slitless spectroscopic observations (spectral contamination

effects, error in redshift measurements, inhomogeneous sampling etc.) and Euclid observational strategy. The successful candidate will work on the development of realistic simulations of the Euclid spectroscopic survey that include all known observational biases to quantify the observational bias and develop statistical methods to correct for them. On the theoretical aspects, the successful candidate will implement and validate the most advanced theoretical models describing redshift-space distortions and baryonic acoustic oscillations, which are the two characteristics of the two-point statistics of galaxies that we want to extract to constrain the cosmological model.

The PhD project work will be part of the developments carried out in the Euclid consortium within the scientific ground segment and galaxy clustering science working group. The successful candidate will benefit from the very diverse and rich environment of the Euclid consortium, which comprises more than a thousand of researchers, but also local LAM environment, where a lot of persons are involved on various aspects of the mission. This PhD project is very timely given that the launch of Euclid satellite is expected for July 2023. A lot of effort has been put in the preparation, leadership, and science ground segment development by the French community and this PhD represents a great opportunity to ensure a scientific return from the mission.

Bibliography:

https://www.euclid-ec.org/

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