

Master2 Internship proposal at CPT, year 2022-2023

Research team:

Cosmology

Supervisor:

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Project title:

Extract cosmological information from the clustering of matter in a spatially curved universe

Description:

“The Cosmic Microwave Background tells us that the universe is almost spatially flat” is a sentence that one often hears during lectures, conferences and seminars. However recently it has been shown by [1,2] that the CMB alone measures a small but statistically significant amount of curvature (its associated energy density) in the universe.

As a result, studying the clustering of dark matter in curved space appears to be of great scientific interest. Indeed, one must be careful in assessing whether the usual assumption about the flatness of the universe is not biasing the cosmological inference in large scale structure studies based on galaxy clustering. In addition, taking into account curvature properly allows to constrain it with current and future redshift surveys (see [2]).

We have shown in [2] that curvature effects are taking place on a scale for which one cannot adopt the usual “plane parallel approximation” to describe the observed galaxy clustering. Thus one expects some specific signatures that should be measurable in current redshift surveys. Therefore, the internship will consist in working on two principal aspects. The first one will be dedicated to understanding the theory and contributing to developing predictions taking into account curvature and dropping the plane parallel approximation. The second one will consist in estimating the level of clustering in the Sloan Digital Sky Survey in order to constrain the spatial curvature of the universe.

References:

[1]Di Valentino, Melchiorri, Silk, 2019, *Planck evidence for a closed Universe and a possible crisis for cosmology*

[2]Bel, Larena, Maartens, Marinoni, Perenon, 2022, *Constraining spatial curvature with large-scale structure*

Specify whether the internship project may naturally lead to a PhD thesis.

The internship project could potentially lead to a PhD thesis.