

# Master II Internship proposal at CPT, year 2021

Research team: Cosmology

Supervisor: Ch. Marinoni

e-mail: marinoni@cpt.univ-mrs.fr

**Project title: Horizon effects on the linear power spectrum of cosmic structures**

## **Description:**

Theoretical and observational advances in cosmology offer a unique opportunity to explore subtle relativistic properties hidden in the folds of the cosmic web. In the coming years, big data will allow small effects to be measured and, in turn, the most minute details will be of utmost importance to gain insights into, and perhaps solve, great cosmological puzzles such as the physical nature of those still elusive cosmic components called dark matter and dark energy.

With this proposal we intend to develop analytical approaches to study the linear evolution of cosmological perturbations in non-Newtonian regimes, *i.e.* on spatial and temporal scales where general relativistic corrections are no longer negligible. According to the standard picture, each perturbation mode in the matter distribution enters the 'cosmic horizon' (its physical length becomes shorter than Hubble's length) and begins to grow in amplitude. We expect this transition to introduce fine structure corrections to the Newtonian scenario, such as, for example, scale-dependent modulations in the growth of linear perturbations of matter, and in general, deviations from simple predictions obtained using quasi-static approximation, which are valid only in regimes where the temporal derivatives of perturbations are negligible compared to spatial ones.

The aim is to investigate the potential existence of tricky relativistic effects, emerging on large cosmological scales, which may allow to solve a long-standing issue in observational cosmology: the discrepancy between the measurement of the amplitudes of dark matter fluctuations made in our local outskirts with those made in the early universe, when cosmic structures were much younger.

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