CENTRE DE RECHERCHE ASTROPHYSIQUE DE LYON

Centre de Recherche Astrophysique de Lyon
UMR 5574

Master 2 Research internship offer
Academic year 2024 – 2025

Internship supervisor: Nicolas Bouché & Jonathan Freundlich

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Address/Workplace: CRAL **-** site Charles André : 9 avenue C. André, St Genis Laval
Alternative: Observatoire de Strasbourg

Hosting research team: Galpac

Internship title: Using rotation curves to test dark-matter models

Summary of proposed work:

The morphology of galaxies (spirals vs ellipticals) is thought to be determined by the dark matter content of galaxies and by their amount of rotation. This invisible dark matter reveals itself from the rotation curves of galaxies. However, it is particularly difficult to study the rotation curves in the outer parts of galaxies where the galaxy light fades very quickly. To tackle this difficulty, we have developed an advanced algorithm (GalPak3D) to extract the rotation curves using simplistic parametric functions.

The aim of this internship is to modify the algorithm to allow it to model dark matter models beyond the Cold Dark Matter standard model such as MOdified Newtian Dynamics (MOND), Cotton gravity, fuzzy, or self-interacting dark matter. Then, the student will test the reliability of the method on test data, and finally apply the algorithm on a sample of recent observations with the MUSE instrument on the VLT. This will allow us to confront the various dark matter models against observations, as part of the ANR DARK.

This internship will introduce several new concepts on the physics of dark matter, on galaxy formation, and on 3D spectroscopy at a time when the field is undergoing very rapid developments thanks to numerous innovative 3D projects (such as MUSE, built by CRAL). Indeed CRAL is leading or co-leading several next-generation instruments such as BlueMUSE/VLT, Harmoni/ELT.

This internship will benefit any student who wants to improve his/her programming skills, and who would like to be knowledgeable in the next generation of integral field spectrographs.

Deadline: 15 November 2024

Prequisite: A keen interest in galaxy formation. Programming experience with python. Experience with git a plus.

Duration: 4months

Nature of the financial support for the internship: ANR

Potential for a follow-up as a PhD thesis: Yes