

Informations sur le stage

Catégories

Cosmologie, Univers primordial, origine et évolution des grandes structures de l'Univers et des galaxies
Formation, structure et évolution des étoiles

Sujet du stage

Probing the nature of dark matter with globular clusters via cosmological simulations and orbital integration methods

Description

The relics of galaxy formation and assembly are now observed in halos across the local Universe, yet a comprehensive picture of the Milky Way (MW) formation history is still missing. Globular clusters (GCs), gravitationally bound stellar systems orbiting massive galaxies, represent powerful tracers of this hierarchical assembly process. We have recently developed a novel framework that combines cosmological simulations with orbital integration techniques to investigate the assembly of GC populations in the MW (<https://arxiv.org/abs/2506.13254>). This model captures the growth and evolution of GCs in different galactic environments, including the effects of dynamical friction and mass loss. The objective of this internship is to improve the formation component of our GC model by incorporating high-redshift constraints from JWST (<https://arxiv.org/abs/2410.10974>) together with present-day constraints from Gaia (<https://arxiv.org/abs/2102.09568>). The goal is to increase the physical realism of the model by enabling GC tagging across all redshifts, using a formation efficiency parameter derived from local gas and stellar properties resolved in cosmological simulations. The intern will gain hands-on experience in the analysis of cosmological simulations (<https://www.tng-project.org/>), the use of Galpy (<https://docs.galpy.org/en/v1.11.0/>) for orbital integrations, and the exploitation of data from major space missions (Gaia and JWST). A further motivation for building robust GC models lies in their potential as probes of dark matter, by exploring their dynamics under alternative dark matter scenarios (<https://arxiv.org/abs/2510.00927>). Depending on the progress of the project, this aspect may also be explored during the internship.

Plus d'informations

<https://www.iap.fr/useriap/boldrini/>

Nature du travail demandé

Simulations numériques
Modélisation

Pré-requis

cient in Python, good background in general physics, and knowledge of classical statistical methods

Informations complémentaires

Le stage se déroulera au LIRA, Observatoire de Paris - site de Meudon (5 Pl. Jules Janssen 92190 Meudon)
Pôle Etoile-Galaxie

Laboratoire

UMR-8254 LIRA
Laboratoire d'Instrumentation et de Recherche en Astrophysique
61 avenue de l'Observatoire de Paris
75014 Paris

Calendrier prévisionnel

Date initiale estimée : 2026-04-05
Durée proposée : 4-5 mois

Encadrant

Pierre Boldrini (Chercheur en contrat post-doctoral)
boldrini@iap.fr

Co-encadrant

Paola Di Matteo
paola.dimatteo@obspm.fr

Gratification

Acquise