INTERNSHIP PROPOSAL

Laboratory name: Institute for Planetology and Astrophysics in Grenoble (IPAG)
CNRS identification code: UMR 5274
Internship director'surname: Fabien MALBET
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Internship location: Grenoble

Thesis possibility after internship: NO
Funding: YES If YES, which type of funding: 680€/month

Title: Inverse Problem Solving for the Search for Earth-like Exoplanets in the Context of Space Mission Projects

Scientific Background

The search for Earth-like exoplanets orbiting stars near the Sun is a pioneering area of contemporary astrophysics. It aims to identify potentially habitable worl, i.e. planets comparable in size to Earth, located within their star's habitable zone, and likely to possess conditions favorable to the emergence of life. Among the various techniques for detecting exoplanets, astrometry plays an important role. This method, which relies on extremely precise measurements of the positions of stars in the sky, makes it possible to detect tiny wobbles in their apparent motion caused by the gravitational influence of orbiting exoplanets.
Astrometry is particularly well-suited for identifying planets located at an intermediate distance from their star, where the habitable zone is often found. It also offers the advantage of better characterizing planetary systems around nearby stars, complementing techniques such as transits or radial velocities. Space missions such as Gaia (ESA) and future projects such as Theia or HWO are focusing on this approach to broaden our understanding of exoplanetary systems. These initiatives could lead to the discovery of the first true Earth-like planets around nearby stars, paving the way for detailed analyses of their atmospheres and habitability.

Internship Description

The internship will take place at the Institute for Planetology and Astrophysics in Grenoble (IPAG), within the CHARM team, in collaboration with the Exoplanets team. It is part of the preparatory studies for space-based astrometry projects funded by CNES, LabEx FOCUS, and the RETINA project under PEPR Origins, and is also part of international collaborations with NASA for the future HWO (Habitable World Observatory) space telescope, the successor to the Hubble, James Webb, and Roman telescopes.
The main objective of the internship will be to analyze experimental data obtained in the laboratory to test and refine inversion algorithms. These algorithms will enable the characterization of the focal plane of the THEIA mission using approaches based on interferometric calibration methods and the inverse problem technique (also called forward modeling). Depending on the progress of the laboratory measurement campaigns, the work may include:
- Improving algorithms for correcting image distortions by utilizing information from stars detected in the target field.
- Particular attention will also be paid to evaluating the potential applications of the methods developed for the HWO space telescope.

Qualifications

We are looking for a motivated student with a strong interest in astrophysics research and a solid command of programming tools. Scientific curiosity and the ability to work as part of a team are essential.
The student will join a project team consisting of an experienced researcher, a doctoral student, two postdoctoral researchers, and an engineer, with regular interactions within national and international networks. This immersive experience at the heart of a dynamic scientific collaboration will offer an excellent training opportunity within the framework of an ambitious and innovative research project.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: NO Theoretical Physics: NO