



Observatoire
de la CÔTE d'AZUR



ARTEMIS Laboratory UMR 7250 (UCA/OCA/CNRS), Nice

**2021 Internship (3rd year Engineer or Master 2)
Avril – September 2021, followed by a 3 years PhD thesis**

Study of Photodiodes under proton irradiation for the LISA space mission

General context of the internship:

The internship focuses on the study of photodiodes dedicated to the LISA (Laser Interferometer Space Antenna) space mission:

<https://www.elisascience.org/articles/lisa-mission/lisa-mission-gravitational-universe>

In the LISA instrument, the optical interference signal ($\lambda = 1064$ nm) is transformed into an electrical signal by a quadrant photodiode (QPD) in InGaAs technology, connected to a front-end electronics (FEE), the assembly carrying the name of "Photoreceiver". The performance of the PR in terms of detection efficiency, bandwidth, noise, power dissipation, are essential to ensure the accuracy required for measuring gravitational wave signals in the LISA instrument.

During the mission, estimated at 12 years, the photoreceiver will be subjected to the irradiation of solar energetic particles that can affect its proper functioning, or even lead to its destruction. The radiation harness and qualification of photoreceptors in a space environment represent therefore a major technological challenge for a space mission like LISA, based on high precision interferometric optical measurements.

Internship subject:

The internship will take place within the framework of an interdisciplinary collaboration between the ARTEMIS laboratory, the National Office for Aerospace Studies and Research (ONERA) in Toulouse and the Antoine Lacassagne Proton-Therapy Center (CAL) in Nice.

The internship offers the study of the electrical parameters of quadrant photodiodes (ex: dark current and capacitance) in the space environment, particularly under proton irradiation. The photodiodes intended for the study are devices specifically developed for the LISA mission.

In this context, the student will contribute to the construction of the experimental system necessary for the irradiations and the tests of the photodiodes on the CAL site, as well as the analysis of the experimental data.

Requested knowledge and competences:

Semiconductor physics; Sensors and detection systems; Instrumentation associated with the characterization of photo-detectors; Electronics associated with photo-detectors; Radiation / matter interaction; Homodyne and heterodyne interferometry; Photonics / lasers; Analog and digital signal processing; Interfacing of experimental set-ups

Profile of the candidate :

Future graduate of Engineering School in Aeronautics and Space or Masters in Instrumentation, Sensors, Measurement and Metrology, general knowledge in signal processing and analysis, passion and enthusiasm for measurements and precision, strong attraction for instrumentation and electronics, at the same time autonomous, imaginative, perseverant and able to take a step back on the results. To pursue a thesis, a perfect knowledge of oral English is essential: almost all of the documents are in English.

Internship responsible:

Nicoleta Dinu-Jaeger, ARTEMIS laboratory, Nice

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<https://www.oca.eu/fr/accueil-artemis>