

# IGOSat Project

Internship Proposal – Spring 2020

## Development of the Radio-occultation Payload for the IGOSat mission: operations preparation and development of the flight software

**Skills, Keywords:** Scientific instrumentation, aerospace engineering, data treatment, functional tests, GPS occultation, embedded software, c language, critical software development, ARM micro controller, fundamental algorithmic, basics in electronics.

**Desired level :** 4th year, master degree **Duration :** 4 to 6 months **Stipend :** > 500 € / moth

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### Project Description :

The Laboratory of Excellence (LabEx) UnivEarthS, set up by laboratories AIM (Astrophysique et Interactions Multi-Echelles), APC (AstroParticule et Cosmologie) and IPGP (Institut de Physique du Globe de Paris) from Paris Diderot University, is carrying carrying transverse projects between those 3 laboratories.

Using the strong involvement of those laboratories in numerous space experiments and instrumentation, an educational nanosatellite project has begun in 2013, with the financial and technical support from CNES (Centre National d'Etudes Spatiales) and the Space Campus of Paris Diderot University.

More specifically, the project is to develop a scientific 3U CubeSat, and launch it in 2021. The satellite will carry 2 payloads, one to study the Ionosphere and one to study the radiation belt.

### Internship Description :

The purpose of the internship is to iterate the flight software design of a radio-occultation payload that will fly within a 3 units CubeSat. The student will study data transmission chain, from the antenna, through the onboard data processing, to the ground station. The quality of the scientific data will be investigated too. As every space project related work, some documentation will have to be produced, and reviewed in front of experts from the French Space Agency (CNES) may have to be performed.

This payload includes an L-Band GNSS antenna and a dual-frequencies GPS receiver operated through the onboard computer. Raw data recorded by the receiver have to be processed onboard to select the occultation data of interest for the mission.

A test bench is already in place, currently being integrated in a « flat-satellite ». The student will have to go one step further and work on the integration to the Engineering Model of the satellite (basically the flat-satellite integrated in a « flight-model » shape, with relevant functions and performance).

The main goal of this internship is to continue and finish the GPS payload software. This latter will be integrated within the main software in the On-Board Computer. The future intern must be autonomous and familiar with C language. Knowledge about Real Time Operating Systems and microcontrollers are an asset. Development and tests are done under a Linux development tool chain, basics about Linux environment would be appreciated but not necessary.

On another hand, measurements with the GPS antenna will have to be performed to validate the software and study the results.

Within a team of students, engineers and scientists, the student need to be able to work autonomously as well as part of a team, have a sense of rigor especially in writing presentation, and already a global vision of information transmission.

This internship is a good opportunity to address numerous points of space engineering, scientific instrumentation and embedded software development.

**Website:** <http://www.igosat.fr>

**reference:** Jakowski, N., V. Wilken, and C. Mayer (2007), Space weather monitoring by GPS measurements on board CHAMP, Space Weather, 5, S08006.