

Development and adaptation of imaging tools for probing the small bodies of the solar system

Although different missions have targeted the small bodies (asteroid and comet) of the solar system, little is known about the interior of these structures. Knowledge of their internal structure would, however, be an important source of information for understanding our primitive solar system and its evolution. Radar is one of the most mature techniques capable of probing this internal structure. The first instrument of this nature, designed to probe the internal structure of a comet, is the CONSERT instrument. This instrument was on board the European Space Agency's Rosetta mission which reached comet 67P/Churyumov-Gerasimenko in November 2014. This instrument explored the comet nucleus using electromagnetic waves in the radiofrequency domain using a bistatic configuration. One of CONSERT's scientific objectives is to contribute to a better knowledge of the composition of cometary nuclei and their internal structure. The first measurements were made immediately after the "landing" of the Philae module on the comet and they have already shown the interest of electromagnetic waves for comet exploration and currently, several space mission projects include a radar to obtain information on the internal structure of asteroids or comets. In this configuration an electromagnetic wave is sent to the structure and the field after interaction is measured. As the physical features of an unknown target are contained in its scattered field, it is theoretically possible to retrieve its structural and electromagnetic characteristics thanks to the resolution of an inverse scattering problem. For this specific issue, the main difficulties are due to the very large size of the structure and the limited amount of data.

In this internship, the student will adapt (existing) imaging procedures to the study case. In particular, he/she will work on the introduction of realistic information into imaging algorithms, which will be selected in collaboration with planetologists.

Mots Clefs : Comet analog - Electromagnetic scattering - Imaging - Small solar bodies - Microwave - Polarisation

Profil du candidat : The applicant must have good knowledge in physics and in particular in electromagnetism. Skills in the microwave regime specificities and in hyperfrequency electronics will be appreciated.

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Références :

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