iemn
Institut d'Electronique, de Microélectronique et de Nanotechnologie
UMR CNRS 8520

Master thesis position

Title Development of packaging for a TeraHertz spectroscopy system

Where ? IEMN, Villeneuve d'Ascq **Duration:** 6 months **Allowance:** 600€/month
Level of study required: Engineering school (final year) or equivalent Bac+5 in progress (MASTER2)
Key words: Packaging, Spectroscopy, TeraHertz
Contact details Dr Romain Peretti: romain.peretti@cnrs.fr and Dr Flavie Braud: flavie.braud@iemn.fr

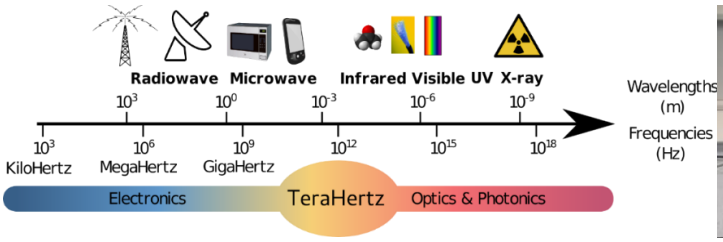
Environment

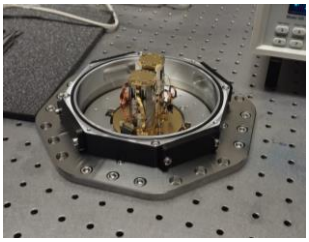
The student will be supervised by the experienced THz-Photonics group at IEMN and the packaging manager of the CMNF team. Our team has a long-standing history in THz optoelectronic devices and possesses three state-of-the-art THz-TDS setups (100 dB dynamic range, 1 GHz spectral resolution) and two closed-cycle cryostats. IEMN also features a 1600 m² clean-room for advanced fabrication.

Context and objectives

The Terahertz (THz) range (0.1–10 THz) uniquely bridges electronics and photonics. Technological advances have expanded its applications, with THz spectroscopy emerging as a non-invasive method for probing the structure and dynamics of biological molecules. This technique is particularly suited to studying proteins, where THz vibrations relate directly to their biological functions.

At the Institute of Electronics, Microelectronics, and Nanotechnologies (IEMN), we have a cutting-edge THz time-domain spectroscopy (THz-TDS) setup, capable of analyzing solid, liquid, and gas samples. One challenge in biological studies, however, is the behavior of liquid water in the THz range. The trainee will have to integrate the spectroscopy system into a cryostat, ensuring that it is as small as possible and compatible with micro-fluidics.





This internship is part of a project supported by an ERC grant, the main aim of which is to improve understanding of the spectral properties of aqueous solutions in the THz range, particularly in relation to proteins.

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Mission:

The trainee will become an expert user in the integration and packaging of THz-TDS systems for the analysis of biological samples. After being able to reproduce the experimental bench, the trainee will have to integrate it into a cryostat while ensuring temperature variations and micro-controls of the device. Starting with experiments on pure water, deuterated water, ionic solutions, and buffers, the student will progress to analyzing stabilized lysozyme samples. The goal is to achieve reliable and repeatable results for in-depth analysis, which will be discussed within the group and with biological collaborators.

The work will be mainly experimental: creating devices suitable for TeraHertz spectroscopy, such as PMMA lenses, using a CNC machine, involving sample preparation, stabilized (<0.1 K) THz measurements, data analysis, and interpretation. The student may also engage with our theoretical collaborators, who are developing models for the dielectric properties of aqueous solutions in the THz range. The specific responsibilities will be adapted to the student's skills, preferences, and motivation.

Profile

We are looking for a physics or engineering master's student or equivalent. Having one of the following skills would greatly increase the chance of success of any application:

- Experimental optics
- Spectroscopy
- 3D design using CAO software
- Mechanic

In addition, your autonomy, thoroughness and ability to solve problems will be great for this internship, which could lead to a contract within the laboratory.

How to apply

Please email Romain Peretti and Flavie Braud for an informal discussion before sending your application. We will be happy to answer any questions you may have about the internship or research project. Your formal application will include your CV and a covering letter detailing your interest in the subject and will be emailed to both contacts by the end of November.

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