UNIVERSITÉ SAVOIE MONT BLANC

IMEP-LAHC, CNRS, Chambéry, France

PhD open position in
Arbitrary THz waveforms generator for Quantum Electronics applications

Context: The most recent developments in 2D electron gas (2DEG) electronic circuits make it possible to consider the demonstration of quantum electronic experiments in which an electron would behave like a photon propagating in a quantum optical system [1]. However, since the coherence time of electrons is only a few tens of picoseconds (ps), it is necessary to be able to excite, control and detect electrons with a temporal precision of the order of ps. For this purpose, we use ultrafast optoelectronics as a technique to generate ps electrical pulses exciting quantum circuits. The use of femtosecond pulsed lasers associated with very short response time photodetectors is commonly used for the generation of ps or Terahertz signals [2]. However, it has never been successfully applied to the study of quantum properties of electronic circuits. In this research project, supported by national quantum investments (PEPR Quantique, ANR ...) we develop a new technological approach by integrating optoelectronic devices for the generation of ps electrical pulses into 2DEG circuits [3]. The precise control of the quantum state of the circuit also requires the ability to generate electronic signals of variable duration and amplitude: the design of an optoelectronic generator of arbitrary waveforms at the picosecond scale constitutes the core of this thesis proposal.

Objectives of the PhD work: The work will focus on the development and experimental characterization of optoelectronic solutions to generate electrical pulses with adjustable duration between 1 and 10 ps and variable shape (Lorentzian, rectangle etc. ...). This research will take advantage of the experience acquired by the team in the design of THz optoelectronic components and circuits. Two approaches will be considered: the shaping of electrical signals within the circuit or the prior shaping of the optical control pulses

Collaboration and networking: The research will be carried out within the PHOTO group at IMEP-LAHC, Université Savoie Mont-Blanc in Chambéry (http://imep-lahc.grenoble-inp.fr) in collaboration with the QuantECA group at the Neel Institute, CNRS in Grenoble (http://neel.cnrs.fr). Both groups benefit from equipment in high-frequency electronics, lasers, THz benches, cryogenic instrumentation, clean room and nanofabrication lab. This project is part of the PEPR Quantique : https://anr.fr/fr/detail/call/pepr-quantique-appel-a-projets-calcul-quantique-au-vol/

Profile sought: We are looking for a student with a background in physics, optics or electronics at Master or Engineer level. Electromagnetism, semiconductor physics and optics are at the heart of the proposed subject. A first research experience in one of these fields would be a plus. The candidate should have a strong interest in experimental research, instrumentation and collaborative work.

To apply for this thesis, please send your application (single PDF file). The application should include a cover letter with a brief description of your previous experiences, your CV, a copy of your grades and diplomas from Bac + 3 to Bac + 5.

Thesis start date: September 2023

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1] Bauerle et al. 2018 Rep. Prog. Phys. 81 056503 [2] Eusebe et al. 2005 JAP 98, 033711

3] Georgiou et al. ArXiV: 2001.01341

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