

***PhD position in « metamaterials for (nano-)opto-electro-mechanical systems »
at the Institute of Electronic, Microelectronic and Nanotechnology (UMR CNRS 8520)
Laboratory of Acoustics, 41 Boulevard Vauban – Lille (FR)***

Project Context and objectives: Today's Information and Communication Technology (ICT) is essentially governed by (i) complementary metal–oxide–semiconductor (CMOS) microelectronics and (ii) distribution of information via optical telecom network. Introducing a third variable – phonons – could lead to additional degrees of freedom in ICT applications. In this context, the main objective of the PhD position is to ***investigate the interaction between electrons, photons and phonons, and the available degrees of freedom in the nano-opto-electro-mechanical systems (NOEMS)*** to advance the potential of low power information processing and transmitting ICT technology.

Main tasks and responsibilities: The candidate will work in the framework of the HORIZON-CL4-2022-RESILIENCE-01-10 project MAGNIFIC (« *Materials for a next-generation (nano-)opto-electro-mechanical systems* ») under the supervision of Dr. M. Miniaci.

After a thorough bibliography review on the current ICT technologies, she/he will be designing and modelling phononic/photonic crystals, metamaterials and metasurfaces for 5G and SATCOM applications (i.e., optomechanical cavities operating between 3 – 6 GHz and 8 – 12 GHz, respectively). The architecture of the unit cell, its size, its aspect ratio, etc. will then be optimized, as well as the finite structure using analytical, semi-analytical and numerical simulations. Alternative approaches to excite the mechanical modes in the opto-mechanical cavity will be explored (for instance, using bulk acoustic wave resonators).

The project will be carried out in strong collaboration with the “Theory group (Ephoni)” led by Prof. Y. Pennec and that has a long experience on the theoretical study of wave propagation in phononic, photonic, and plasmonic nanostructures/crystals. Collaborations with other groups of the project specialized in the fabrication and characterization of micro and nano systems is also foreseen.

The candidate is expected to contribute on the analysis and interpretation of data, manuscript preparation and dissemination of the results in the context of internal meetings as well as national and international conferences/workshops.

Required qualifications: The ideal candidate is required to hold a Master of Science in engineering, physics, or similar disciplines. Experience in numerical modelling of elastic surface/bulk waves and a solid background in structural mechanics and wave propagation in periodic media is also required. Good knowledge of electromagnetism, opto-mechanical coupling and / or topological protection will be evaluated as a plus.

Application: Applicants are asked to provide the following documents (**only the online applications – CNRS website – will be accepted**):

- 1) a motivation letter (approximately 1 page) explaining why they are applying for this position
- 2) a detailed CV
- 3) two to three reference letters.

Location: The Institute of Electronic, Microelectronic and Nanotechnology (UMR CNRS 8520 – <https://www.iemn.fr/en/>) is in Villeneuve D’Ascq, close to the city of Lille (France). With a total staff of over 500 persons, the institute has a broad area of research activity ranging from physics to materials science,

acoustics, micro- and nanotechnology. The laboratory of Acoustics (where the candidate will carry on her / his research and where she / he will have her / his office) is in the city center of Lille, at 41 Boulevard Vauban, within the « Junia » buildings.

Starting date and duration of the contract: March 1st, 2023 (36 months).

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