Post-doctoral 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 **I**nformation and **C**ommunication **T**echnology (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 overall project is to ***investigate the interaction between electrons, photons and phonons, and the available degrees of freedom in the nano-opto-electro-mechanical systems (NOEMS)*** in order 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. She/he will be designing and modelling optomechanical cavities for 5G and SATCOM applications, operating between 3 – 6 GHz and 8 – 12 GHz, respectively. The design will be mainly based on phononic/photonic crystals, metamaterials and metasurfaces for in- and out-coupling and enhanced capability of electro-opto-mechanical interaction. The optimization of the unit cell (its architecture, size, aspect ratio, etc.) and of the total length of the finite structure will be performed. Afterwards, the efficiency of the conversion will be estimated as a function of the electric power input versus the energy in the mechanical modes in the designed nanobeam. An alternative approach (consisting in using bulk acoustic wave resonators) to excite the mechanical modes in the opto-mechanical cavity will also be explored.
The project will be carried out in 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 national and international conferences/meetings.

Required qualifications: The ideal candidate is required to hold a PhD in engineering, physics, or similar disciplines with experience in numerical modelling of elastic surface and bulk waves with a solid background in structural mechanics and wave propagation in periodic media. 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: January 1st, 2023 (12 mois, renewable).
Funding: This contract is supported by the HORIZON-CL4-2022-RESILIENCE-01-10 project MAGNIFIC, concerning « Materials for a next-generation (nano-)opto-electro-mechanical systems ».
Contacts: Further information could be required at Dr. Marco Miniaci (marco.miniaci@gmail.com, marco.miniaci@univ-lille.fr) and Prof. Yan Pennec (yan.pennec@univ-lille.fr).