

PhD Project in nanomaterials science

Job title: Doctoral Research Fellowship (PhD)

Title: Nanoneuron - Mott materials at the nanoscale for Neuromorphic systems

Location: Institut d'Electronique, de Microélectronique et de Nanotechnologies (IEMN-CNRS), Lille, France

Duration: 3 years

Closing date: May 10, 2020

Contact: Dr Pascale Diener, e-mail: pascale.diener@isen.iemn.univ-lille1.fr
Tel.: +33 3 20 30 40 52
Dr. Bruno Grandidier, e-mail: bruno.grandidier@isen.iemn.univ-lille1.fr
Tel.: +33 3 20 30 40 14

Gross living allowance: 1900 € gross per month + advantages

PhD Research project

Neuromorphic systems hold great promise for reducing power consumption and for creating new applications beyond the reach of conventional computers. To date, each artificial neuron is composed of thousands of transistors. The use of Mott insulators, a class of materials with fascinating non-linear properties, could significantly reduce the complexity of the circuit, reducing the number of components per neuron to one.

However, this property has only been reported in millimetre-sized single crystals. This thesis aims at performing a multi-scale analysis using a high end equipment present at IEMN, a multi-probe scanning tunneling microscope coupled to a time-resolved optical system, to determine the fundamental properties required for the development of a neuron at the nanoscale. The thesis topic also includes the fabrication and characterization of monoatomic layers of Mott insulators for future neural network implementations.

The fellowship is funded by Yncrea – FUPL and the Hauts-de-France region.

Context



The team Physics of Nanostructure Devices works on the electrical and optical properties of promising nanomaterials, with both fundamental and device-oriented approaches. We currently have 4 permanent researchers, 1 research engineer and 3 PhD students, working in strong connection with all the members of the Physics group.

IEMN is a research institute created by the National Centre for Scientific Research (CNRS), two universities and an engineer school of France northern region. IEMN is part of the RENATECH network and as such, the equipment for design, fabrication and characterization of micro/nano devices are at the best european level. The institute has a total staff of about 500 persons including 150 permanent researchers, 100 engineers and administrative agents, about 150 PhD students. The lab is very open to international collaborations; more than 100 foreigner scientists coming from 20 different countries are currently working at IEMN. The IEMN scientific activity covers a large domain going from the physics of materials and nanostructures to microwaves, telecommunications and acoustics instrumentation.

The City of Lille



Lille offers an attractive living environment while being a student city of more than a million inhabitants. Furthermore, it sits at the crossroad of three capital cities of Europe (Paris, London and Brussels being reachable within an hour train ride).

Website: <https://www.iemn.fr/la-recherche/les-groupes/physique/nanostructures-quantum>

Person Specification

The successful candidate must have:

- (1) An excellent academic record in Physics, Engineering, Material Sciences or related areas.
- (2) Demonstrate a keen interest in pursuing experimental research in nanoscience.
- (3) The ability to work independently, and as a member of a research team.
- (4) Excellent interpersonal and communication skills.
- (5) A good command of English language.

Any or combination of the following will be a clear advantage.

- A past record of experimental work with scanning probe microscopies or time-resolved optical probes.
- A basic knowledge of strongly correlated electronic systems
- A demonstrable ability to produce research published in peer-reviewed journals.
- Knowledge and willingness to learn the language of the host institution.