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

Internship 2024 on Quantum Materials for Neuromorphic applications H/F

Job title: Internship (possibly leading to a PhD)
Title: Quantum Materials for Neuromorphic Applications (QuaMaNA project)
Location: Institut d'Electronique, de Microélectronique et de Nanotechnologies (IEMN-CNRS), Lille, France
Duration: 6 months
Closing date: Position should be between Jan 2024 and Sept 2024. The applications are evaluated on the fly. Seeking will continue until the position is filled.
Contact: Pascale Diener. Email: pascale.diener@junia.com Tel.: +33 3 20 30 40 52
Gross living allowance: Around 300 euros/month after taxes (to be confirmed)

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 or synapse is composed of thousands of transistors. The use of Quantum Materials, such as Mott materials which have fascinating non-linear properties, could significantly reduce the complexity of the circuit, reducing the number of components per neuron and synapse to one.

This project focus on layered, two-dimensional Mott materials, such as TaS_2, $TaSe_2$ and V_2O_3 and their property to switch between a semiconducting and a metallic state under specific voltage pulses. The microscopic mechanism at the origin of the switching is related to a local out-of-equilibrium phase transition under electric field in the material, is not well understood yet. This resistive switching can be either volatile or non volatile and is proposed for the realization of artificial neurons and synapses components.

The goal of the internship is to experimentally study the characteristic time necessary for the resistive switching in a series of chosen samples of different Mott materials and geometries, using advanced electric characterization devices. The second part of the internship is to explore the possibility of inducing the resistive switching at the nanoscale using an AFM (atomic force microscop) equipped with a metallic polarized tip.

The internship could lead to a PhD on the fundamental properties of the TaSe2 monolayers and their integration into resistive switching devices for neuromorphic applications.

Candidate profile :

The internship is intended for a student pursing a Master 2 in Physics or a related discipline, with a background in Solid State Physics. We are seeking for a enthusiastic, high-skilled F/M candidate with excellent analytical skills. Knowledge in one of the following items will be an advantage: quantum materials, near field microscopy, Mott or other strongly correlated electronic systems, Implementation of electronic devices, neuromorphic systems.

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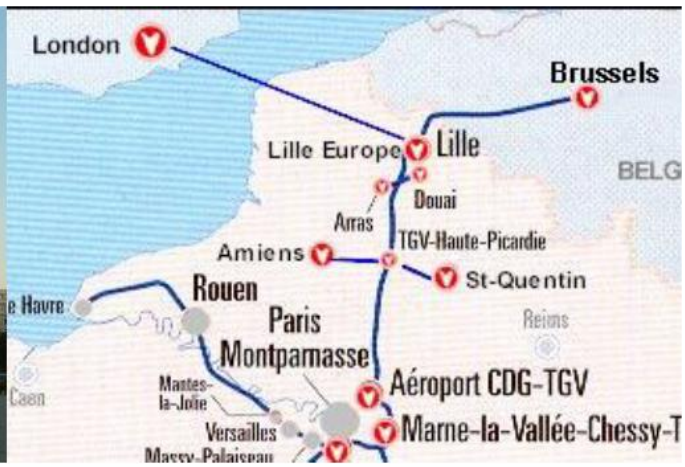
Context

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 7 permanent researchers, 3 postdocs and 5 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.

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

The City of Lille



Lille offers an attractive living and cultural environment, and sits at the crossroad of three capital cities of Europe (Paris, London and Brussels being reachable within an hour train ride).

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