INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Centre de Nanosciences et de Nanotechnologies
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Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: ANR

Magneto-ionic gating in magnetic tunnel junctions

Magneto-ionics is an emerging field that offers great potential for reducing power consumption in spintronics memory applications through non-volatile gate-control of magnetic properties. By combining the concept of voltage-controlled ionic motion from memristor technologies, typically used in neuromorphic applications, with spintronics, this field also provides a unique opportunity to create a new generation of neuromorphic computing functionalities based on spintronics devices. Our group has been at the forefront of investigating the magneto-ionic control of magnetic properties in various materials and nanodevice geometries. We have demonstrated large, reversible, and non-volatile gating effects on magnetic anisotropy and the Dzyaloshinskii–Moriya interaction and characterised in depth the interactions between the mobile ions and the magnetic atoms.

One major challenge remains ahead for the use of magneto-ionics in practical applications, its integration into magnetic tunnel junctions (MTJ), the building blocks of magnetic memory architectures. This will not only unlock the dynamic control of switching currents in magnetic tunnel junctions to reduce power consumption in memory technologies, but also allow for the modulation of stochastic magnetisation switching, which has important implications in probabilistic computing.

We are currently seeking a highly motivated candidate to join our team at C2N and work on an experimental research project focused on the implementation of magneto-ionic gating schemes in magnetic tunnel junctions. The ultimate goal of the project is to obtain reliable and non-volatile gate-control over magnetisation switching in three-terminal magnetic tunnel junctions. The project will greatly benefit from our team's collective expertise in magneto-ionics, neuromorphic computing architectures and nanofabrication; and the close collaboration with CEA-SPEC for the design of spintronics materials and MTJ devices.

Our technical means to carry out this project at C2N include simultaneous magneto-transport measurements and magneto-optical imaging, and all necessary nanofabrication tools in our cleanroom. CEA-SPEC will provide their long lasting expertise in spintronics materials deposition and MTJ fabrication.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO