Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Matériaux et Phénomènes Quantiques
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Thesis possibility after internship: YES
Funding: YES Type of funding: ANR, Doctoral contract

Magnetic chirality at ferromagnet/molecule interfaces

Up to now, chiral magnetic textures such as skyrmions have been obtained through the symmetry breaking induced by the spin-orbit coupling, generally at the interface between a heavy metal and a ferromagnetic metal. In this internship, we want to explore the possibility to stabilize chiral magnetic structures by using structurally chiral interfaces.

Among the possible routes to obtain chiral interfaces, we will first work on the use of chiral molecules (helicenes) that we will deposit on standard ferromagnetic films (Fe, Co, Ni). It is already known that chiral molecules can induce some electronic spin polarization (the so-called Chiral Induced Spin Selectivity) that can be used to reduce by several order of magnitude the threshold current density required to switch the magnetization by spin-transfer torque [1]. However, little is known on the magnetic structures of such interfaces. We propose to grow in situ (ultra-high vacuum chamber) ultrathin films of ferromagnets with a vanishingly small magnetic anisotropy and to cover them with a single molecular layer of different molecules (coronene, helicene right, helicene left) to observe by magneto-optical Kerr effect how the magnetic cycles are evolving. This will allow to determine how the magnetic anisotropy is modified by the molecule/ferromagnet hybridization [2] and to measure by ex-situ methods if any asymmetric magnetic exchange is induced at such interfaces.

[1] O.B. Dor, Nat. Comm. 2017, 8, 14567
[2] K. Bairagi et al., Phys. Rev. Lett. 2015, 114, 247203; K. Bairagi et al., Phys. Rev. B 2018, 98, 85432

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