

## Master 2: *International Centre for Fundamental Physics*

### INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Matériaux et Phénomènes Quantiques  
CNRS identification code: UMR 7162  
Internship director's surname: Bellec Amandine / Garreau Yves  
e-mail: [amandine.bellec@u-paris.fr](mailto:amandine.bellec@u-paris.fr) / [yves.garreau@u-paris.fr](mailto:yves.garreau@u-paris.fr)  
Phone number: 01-57-27-62-90  
Web page: [www.mpq.univ-paris-diderot.fr](http://www.mpq.univ-paris-diderot.fr)  
Internship location:  
Université de Paris – Laboratoire MPQ - 10 rue A. Domon et L. Duquet 75013 Paris  
Synchrotron SOLEIL – Ligne SixS - L'Orme des Merisiers Saint Aubin.  
Thesis possibility after internship: YES  
Funding: YES Type of funding: Doctoral contract

#### **Symmetry and epitaxial constrain on molecular magnetic switching**

Spin crossover complexes present the amazing property to switch between two spin states by external stimuli such as light, pressure or temperature. This makes them promising molecules for development of new and innovative spintronic devices. Their incorporation in actual devices needs a deep understanding of the spin crossover property of molecules once adsorbed on metallic surfaces and down to the single molecular level. Indeed, surprisingly, we demonstrate that once on a metallic substrate both molecular spin states can co-exist in contrast to the bulk behavior [BAI16]. For the photo-excitation, the nature of the substrate is playing a fundamental role in the underling mechanism [ZHA20].

The objective of this internship, that can be followed by a PhD, will be to control the self-assembly of spin crossover molecules along with their spin state by the substrate symmetry (use of Cu(110) or Cu(001) substrates) or by using vicinal substrates that act as a template for the molecular growth (e.g. Cu(322)). For this purpose, two complementary technics will be used. By scanning tunneling microscopy (STM), the self-assembly, the electronic properties and the light excitation of the molecules will be investigated at the molecular level. For their part, grazing incidence x-ray diffraction measurements will enable to determine the epitaxial relationship between the molecular layer and the substrate.

[BAI16] K. Bairagi et al., Nat. Commun., 7, 12212 (2016)

[ZHA20] L. Zhang et al., Angew. Chemie Int. Ed., 59, 13341 (2020)

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