INTERNSHIP PROPOSAL

(One page maximum)

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Thesis possibility after internship: YES
Funding: YES/NO If YES, which type of funding:

Properties of chiral molecule / metallic interfaces

Chiral molecules are present in the form of two non-superimposable enantiomers due to the absence of inversion center (figure 1). They then offer the unique possibility of being able to create spin selectivity at the interface with a metal. This effect, known as the CISS (chiral induced spin-selectivity) effect, was demonstrated in the early 2000s on monolayers of lysine molecules, long carbon chains, adsorbed on Au [1]. But, the origin of this effect is still widely debated [2]. Experimentally, the CISS effect brings together all the phenomena for which the chirality of molecular species influences the spin selectivity of various electronic processes, whether for transmitted electrons [3,4], for transport measurements [5] or even during chemical reactions. To illustrate this last point, studies have been able to demonstrate enantio-selectivity during the adsorption of chiral molecules on magnetic substrates: depending on the orientation of the magnetization, an enantiomer is preferentially adsorbed [6].

In this context, the internship will focus on the interfaces between chiral molecules and metallic or ferromagnetic substrates in order to understand their properties. For this, measurements by scanning tunneling microscopy (STM) will be carried out. For the structural properties, it will be important to understand how chiral molecules adsorb on different metallic substrates. Furthermore, tunneling spectroscopy will provide access to the electronic properties of molecules and it will then be interesting to understand how the CISS effect translates into transport through molecular orbitals, before testing the spin selectivity.

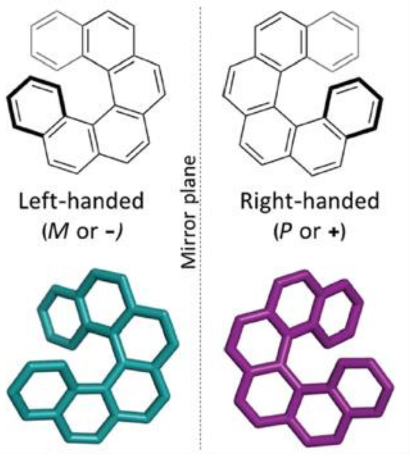

Figure 1 Scheme of [6]-helicene molecules

[1] Ray et al., Science 283, 814-816 (1999).
[2] Evers el al., Advanced Materials, 2106629 (2022).
[3] Göhler et al., Science 331, 894-897 (2011).
[4] Kettner et al., The Journal of Physical Chemistry Letters 9, 2025-2030 (2018).
[5] Rodríguez et al., J. Am. Chem. Soc. 144, 24 (2022).
[6] Banerjee-Ghosh et al., Science 360, 1331-1334 (2018).

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