PhD project: molecular switches for optomagnetic control of functionalized nanoparticles

The PEPR LUMA project "CLAMP" is a national collaborative program involving six laboratories with diverse expertise, ranging from theoretical physics to photophysics and synthetic chemistry. This project is dedicated to the study of rapid transitions in magneto-optic systems. Indeed, magnetic and optical sensitive systems can be independently activated with an external trigger. The main target here is to analyse the crossed responses of both magnetic particles and optical molecules in interactions while magnetic or optical excitation is promoted. To reach this objective, we need magnetic nanoparticles, decorated with different molecules that can be controlled either thermally or optically. To this end, we are looking for a motivated Ph.D. student that will be involved in this project, together with four other Ph.D. students and postdoctoral researcher.

The candidate will join two laboratories in Sorbonne University to work on this project. At the IPCM, the ERMMES group investigates magnetic molecular materials. At PHENIX, the Inorganic Colloids team gathered experts in magnetic nanostructured systems for environmental and health applications. Within these two groups, the candidate will work on the synthesis and the functionalization of magnetic nanoparticles, able to produce heat when subjected to an alternative magnetic field (magnetic hyperthermia), with ligands and complexes that are responsive to both light and heat.

The goal is to design, synthesize, and graft switchable ligands and complexes onto the surface of nanoparticles, making them sensitive to these two stimuli. These molecular "switches" will play a dual and essential role:

- Triggering changes in the nanoparticles' properties when exposed to light,
- Probing the local temperature generated by magnetic hyperthermia at the nanoparticle surface.

Three main families of ligands and coordination complexes will be targeted for this innovative approach:

- Dendrons with a fluorescent probe at its apex,
- Valence tautomeric cobalt(II/III) complexes,
- Spin-crossover iron(II/III) complexes.

We are therefore looking for a highly motivated student with a Master degree in Chemistry (molecular inorganic or materials chemistry). The candidates should:

(i) master basic synthetic and characterization techniques (inorganic, organic, UV-Vis, IR, NMR,…),
(ii) be willing to learn new and advanced physico-chemical analysis techniques (electronic microscopies, EPR, magnetic measurements, SC-XRD, XAS, XMCD…)
(iii) be willing to understand physical phenomena (magnetism, photophysics) occurring in the hybrids.

For more information and to express interest in applying, please contact:

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