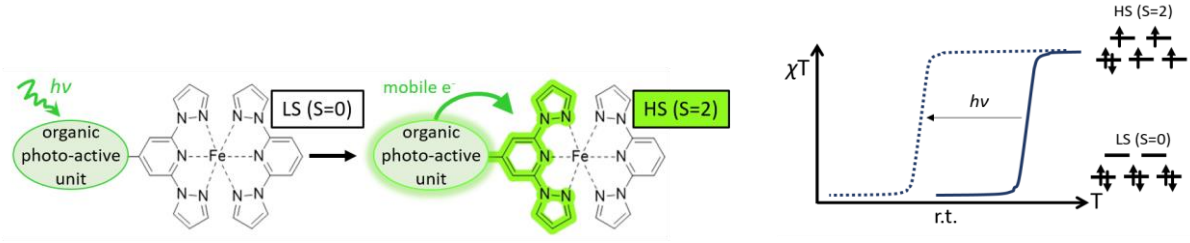
ANR-funded PhD position starting in October 2023 (or sooner)

Light-induced Electronic Control of Magnetic molecules

This research project aims at developing a molecular design that enables a Light-induced Electronic Control of MAgnetic molecules (LECMA project). To do so, we intend to use light to trigger a change between two electronic states leading to bistability at room temperature. The molecules will consist of organic photo-active parts linked to Fe(II) spin crossover (SCO) complexes. These magnetic complexes can reversibly switch from a diamagnetic low spin state (LS, S=0) to a paramagnetic high spin state (HS, S=2). The concept developed consists in using light to induce a dissymmetric electronic distribution on the Fe(II) ligands that would trigger the spin transition process. To date, it still remains a challenge to reversibly and synergistically manipulate the SCO process by light irradiation in the solid state at room temperature. To aim at a direct control of the spin state, we will use organic photo-switches as ligands in SCO complexes, providing a change of the electronic density distribution in the coordination sphere of the magnetic metallic ion, thus triggering the spin switch. Thus, the molecular systems developed in this project open the way to information storage at the single molecule level at room temperature, and will have high potential in molecular electronics for the development of many applications such as sensors or electronic devices.
The project consists in synthesizing and characterizing the photo-active spin crossover molecules. The PhD student will be in charge of the organic synthesis of different photo-active ligands for which basic organic chemistry knowledge is required. Then, the student will synthesize the Fe(II) complexes under controlled atmosphere (schlenk line, glovebox). The magnetic compounds will be obtained by crystallization techniques and characterized by IR and UV-vis spectroscopy and single crystal X-ray diffraction studies. The study of the photo-magnetic properties will be performed using SQUID magnetometry, for which the student will learn to adjust and simulate data using the appropriate softwares. The ICMMO laboratory, and especially the ECI team, has all the techniques required to synthesize and characterize the obtained compounds, from the syntheses to the full photo-magnetic characterizations.



Design of the Fe(II) SCO-photoswitch molecular assembly; expected switch in magnetic behavior

Profile and skills required:
We are looking for a young scientist holding a master degree in molecular chemistry with good skills in synthesis and characterization of molecular compounds. The PhD candidate must have strong knowledge in inorganic chemistry. The research project requires multistep organic and inorganic synthesis under inert atmosphere. Basic knowledge in magnetic materials would be a plus but are not mandatory.
The success of this project will depend on the PhD candidate ability to acquire knowledge in several different fields of research and to adapt to different learning environments.

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