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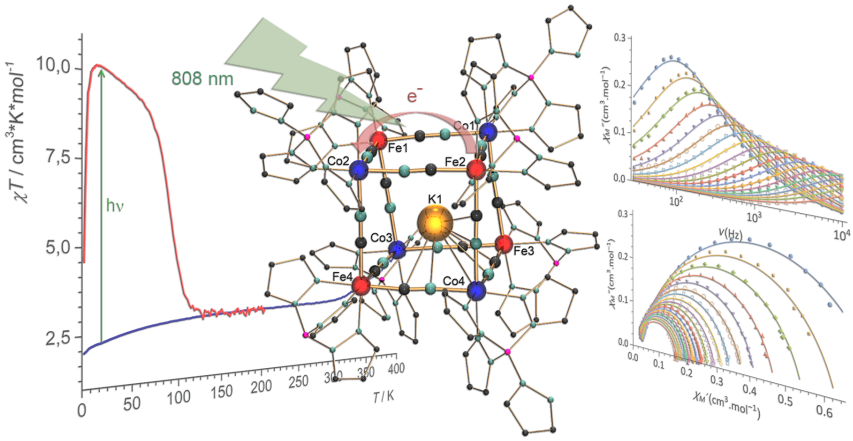
Functional (porous) Materials based on Switchable Molecular Units

In the last years we have focused our research on the design of cyanide-based switchable complexes showing reversible electron transfer and/or spin crossover. In particular, we recently developed a series of A⊂[Fe_4Co_4] molecular cages (A is a cation) showing interesting magnetic and optical properties.[1] *In this family, the diamagnetic [$Fe^{II}_{LS}Co^{III}_{LS}$] pairs can be reversibly switched into paramagnetic [$Fe^{III}_{LS}Co^{II}_{HS}$] pairs upon light irradiation or under temperature change. These responsive molecules show promises in different emerging fields such as molecular electronics or spintronics.*



Interestingly, these cubic molecules also show high redox versatility with up to eight accessible redox states. This remarkable electronic flexibility makes these molecules appealing for other applications such as catalysis (CO_2 reduction), ions intercalation, charge storage, etc.

In this project, we intend to assemble these switchable cubic molecules into three-dimensional coordination networks by using tailored organic linkers. Our goal is to obtain functional coordination polymers with controllable porosity and architecture. Such responsive materials can be used in as sensors, but also offer potentialities as ions storage devices (cathode material) or as heterogeneous catalysts. These properties will be explored in collaboration with other research teams.

This multidisciplinary project will permit the PhD. student to explore different domains of chemistry: the organic synthesis for the preparation of tailored ligands and linkers, the inorganic synthesis for the preparation of the switchable nodes, and the assembling of these molecular systems into functionalized hybrid 2D- 3D-networks. At each step, all products will be fully characterized by different techniques available in the institute; mainly liquid and solid (paramagnetic) NMR, FT-IR, UV-visible spectroscopies, cyclic voltammetry, mass spectrometry, thermal gravimetric analysis, (powder) X-ray diffraction, magnetometry, photomagnetic measurements, EPR.

[1] D. Garnier et al., *Chemical Science, 7,* **2016**, *4825.*

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