Laboratory: Equipe Chimie Inorganique (ECI), Institut de Chimie Moléculaire et des Matériaux d'Orsay (ICMMO), Université Paris Saclay
Adress: Bâtiment Henri Moissan, 19 avenue des Sciences, 91400 Orsay cedex
Contact: Nathalie Bridonneau nathalie.bridonneau@universite-paris-saclay.fr

# Redox-active lanthanide complexes

Key words: coordination chemistry, lanthanide, molecular magnetism, electrochemistry

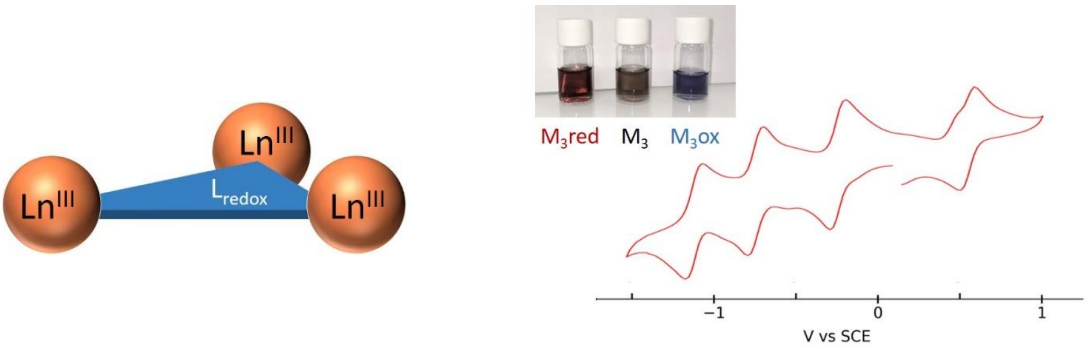
Lanthanide chemistry is rich and bears an interest is various fields, such as magnetism (single-molecule magnets, quantum bits) and luminescence. But the precise control of the magnetic properties is still highly challenging and relies on a critical design of molecular materials suitable for potential applications. To switch the magnetic properties of lanthanide compounds, a wide variety of external stimuli can be employed such as electro-activity, solvents, protonation, magnetic and electric fields, and light. In this project, **we propose to build redox-active lanthanide complexes**, that can be of interest for the development of applications such as sensors, information storage, or electronic devices.

In the recent years, we have developed transition metal-based complexes with the purpose of controlling the interaction between three metallic ions by using a redox active central ligand. We use a central ligand that bears three positions available for complexation, all of which can switch between different redox states. The aim of this internship is to extend our systems to the study of lanthanide ions.

This internship will consist in synthesizing and characterizing the redox-active lanthanide molecules. To do so, the M2 student will first be in charge of the **organic synthesis** of different ligands for which basic organic chemistry knowledge is required. Then, most of the part of the M2 internship will be devoted to **coordination chemistry**, as the student will synthesize first the mononuclear Ln(III) complexes and then the more challenging syntheses of the [Ln3] assemblies. The study of the obtained [Ln3] complexes will focus on the **magnetic and electrochemical properties**, as well as **UV-vis spectroscopy** (spectro-electrochemistry) for which the student will learn to work in autonomy. All these characterizations will be performed in the lab.

The subject requires strong knowledge in **inorganic chemistry** (synthesis, characterization of compounds), basic knowledge in magnetic materials would be a plus.

Techniques used: NMR, IR, UV-visible, electrochemistry, SQUID magnetometry, EPR spectroscopy, data simulations




**Left: Design of the targeted [Ln3] redox-active molecular assembly; Right: Example of the redox behavior of similar complexes based on transition metal ions**