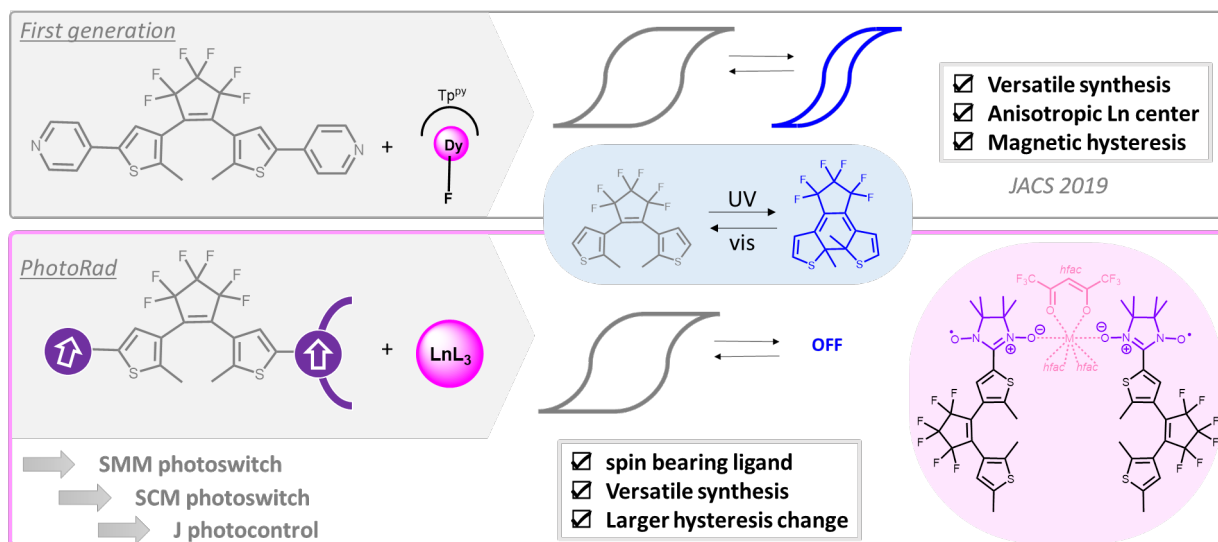


## PhD position

### Photoswitchable Radicals for Light-Control of Single Molecule Magnets

**Keywords :** Molecular materials, ligand synthesis, coordination chemistry, lanthanide complexes magnetism, photoactive molecules, magnetic anisotropy, cantilever torque magnetometry .

**Context :** Devices integrating molecular-scale components may ultimately allow the replacement of silicon-based electronics by high speed systems with low energy consumption. Because of the prominent use of magnetization-based information storage technologies in our daily life, Single-Molecule-Magnets (SMM), which are able to interconvert between two states with opposite magnetization directions receive a great deal of attention.<sup>1-2</sup> With this PhD project, we explore a new strategy to reversibly switch such molecular magnetic behavior with light using dithienylethene (DTE) ligands. We already have shown for the first time the synthesis of lanthanide complexes combining efficient light-switching abilities and excellent SMM properties,<sup>3</sup> and demonstrated the unique photomagnetic behavior of such species with photomodulation of magnetic hysteresis.<sup>4</sup> We now aim at maximizing the contrast in the magnetic response by using radical coordinating moieties as a magnetic relay of the electronic perturbation of the DTE ligands under light. .



Scheme 1: General strategy of the project

**Project description :** This is a molecular synthesis project embracing multistep organic synthesis and coordination chemistry. It targets the synthesis of new coordination complexes with photoactive ligands bearing nitronyl nitroxide radicals. It is expected that the development of the new radicals will require demanding multistep synthetic work. Then, coordination chemistry, photophysical studies and magnetometry will be performed according to the methodology already developed in our laboratory. During this 3 years project, the candidate will spend 2×4 months in the group of Dr. M. Perfetti, to study how the magnetic anisotropy of each complex is modified upon photoisomerization thanks to Cantilever Torque Magnetometry.<sup>5</sup> This state of the art technique has never been applied in the context of photoswitching of SMM and will greatly help us in finding the best strategy to

manipulate magnetic anisotropy upon the ligand isomerization. Our laboratory has been involved for many years in the development of switchable metal complexes<sup>6-7</sup> and magnetic systems.<sup>8-9</sup> In addition, the hired PhD student will count on a unique scientific environment gathering specific expertise on every single aspect of the project (ligand synthesis, coordination chemistry, SMM, advanced magnetometry) thanks to the involvement of several experts :

- Mauro Perfetti (LAMM, University of Firenze), expert in Torque Magnetometry
- Kevin Bernot (ISCR), expert in Single Molecule Magnets.
- Boris Le Guennic (ISCR), expert in ab initio investigations of SMM systems.

**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. A great deal of the work will concern multistep synthesis of metal complexes, eventually under controlled atmosphere. Previous experience in synthesis is required. The hired PhD student will also be involved in photophysical and magnetism studies, including advanced magnetometry that require a good background in physical chemistry. Experimental skills in these field would be appreciated 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 including the ones in which his/her academic background is less developed and to adapt to different learning environments.

In France, the candidate will be hosted in a friendly and multicultural group and must be ready and happy to participate in team duties. In Italy, the candidate will have a unique opportunity to broaden the scope of his/her experience in one of the leading group in molecular magnetism.

Finally, participation to national and international conferences are meant to be included in the training of the candidate as well as participation to summer schools.

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<https://iscr.univ-rennes1.fr/omc/dr-lucie-norel>

**Funding :** The PhD is funded by LUMOMAT grant. We will also apply to mobility grants to support the stays in Italy. See <https://www.lumomat.fr/>

**Application :** Please provide your resume (including your academic records), a statement of interest and the name and email of two references we can contact.

**Starting date of the contract :** September 2023

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