

Research Topic for the ParisTech/CSC PhD Program

***Field:** Chemistry, Physical Chemistry and Chemical Engineering

Subfield: Chemistry

Title: Synthesis and magnetic studies of organolanthanide complexes with slow magnetic relaxation

ParisTech School: Ecole polytechnique

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Short description of possible research topics for a PhD:

The use of molecules as **Single Molecules Magnets** is extremely relevant for the design of quantum computers. On the last 20 years this field has moved very rapidly and the temperature at which the molecules start to behave as a magnet increased to reach 60 K, which is very close to the 77 K of the liquid nitrogen. Closing the gap would be really beneficial for applications. The rare earth metal complexes have largely contributed to the fast increase on the field with their natural large magnetic anisotropy and high magnetic susceptibility. Recently, **organolanthanide complexes** have proven to be extremely useful in this area as well since the metal – carbon bonds enhance the magnetic slow relaxation *via* multiple vibronic coupling. The group has long experience on the difficult synthesis of organolanthanide complexes with trivalent but also divalent metal ions of the rare earths. For example, we have recently developed a very original ligand, specifically designed for divalent organolanthanide chemistry (Figure). Therefore, the research we propose within this project will be devoted to **the synthesis of original organolanthanide complexes with this new ligand in order to study their slow magnetic relaxation** and approach the targeted 77 K.

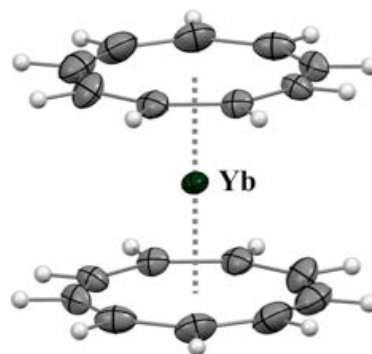


Figure. Structure of the new sandwich complex of Yb(Cnt)₂.

Required background of the student: Chemistry student with good knowledge of synthetic chemistry. The knowledge of the specific techniques of inert atmosphere synthesis or magnetism is best but not mandatory.

Representative publications of the group: (Related to the research topic)

- Xémard, M., Zimmer, S., Cordier, M., Goudy, V., Ricard, L., Clavaguéra, C., and **Nocton G.*** *J. Am. Chem. Soc.*, Accepted Manuscript
- Goudy, V., Jaoul A., Cordier M., Clavaguéra, C., **Nocton G.***, *J. Am. Chem. Soc.*, **2017**, 139, 10633-10636
- Xémard, M., Jaoul, A., Cordier, M., Molton, F., Cador, O., Le Guennic, B., Duboc, C., Maury, O., Clavaguéra, C., **Nocton, G.***, *Angew. Chem. Int. Ed.*, **2017**, 56, 4266-4271 (back cover)
- **Nocton G.***, Ricard L., *Chem. Commun.*, **2015**, 51, 3578-3581.
- **Nocton G.***, Lukens W. W., Booth C. H., Rozenel S. S., Medling S. A., Maron L. and Andersen R. A., *J. Am. Chem. Soc.*, **2014**, 136, 8626-8641.