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## PhD Opening in Nanoscience

# Entanglement of single molecule magnets via radical spins

**Position:** 3 year Ph.D. funding (France-German project).

**Place:** Université de Strasbourg, IPCMS and Karlsruhe Institut für Technologie, INT

**Deadline for applications:** July the 20<sup>th</sup> 2017.

Single molecule magnets (SMM), made of metal ions stabilized by appropriate ligands, participate in promising strategies of encoding information in single, all identical, units. In particular SMM are showing interesting quantum effects that makes them suitable candidates in supramolecular quantum computing and magnetic data storage [1,2]. The ability to assemble weakly interacting subsystems is a prerequisite for implementing quantum information processing through controlled entanglement. The mastering of such qubit interactions is achieved by means of the tip of a scanning tunneling microscope (STM) that allows manipulating individual molecules. In this project we would like to explore by scanning tunneling spectroscopy (STS) the technologically important situation of pi-orbital overlap in surface confined SMM. STS, due to its ability to map the Kondo physics in organic pi-radicals at every point in space is the dedicated tool to follow the magnetic behavior of organic molecules deposited on a surface.

A low temperature (LT-STM) equipped with a vector magnetic field is used to accurately map the local electronic properties of single molecules. Assemblies of single molecules are built by atomic manipulation with the tip of the STM. The measurements are carried out in ultrahigh vacuum to ensure a clean and reproducible experimental environment. Relevant work by some of the members of the consortium can be found in Refs. 2-4.

The candidate will participate in an ambitious multi-partner project. The molecules are synthesized in the group of Prof. M. Ruben (Karlsruhe Institute für Technologie). Theoretical support is provided by the team of Dr. K. Fink (INT Karlsruhe).

**Supervisors:** Prof. Jean-Pierre Bucher (Unistra), Prof. Mario Ruben (KIT, Karlsruhe)

**Keywords:** Nanotechnology, Molecular electronics, Scanning tunneling microscopy/spectroscopy.

[1] M.N. Leuenberger, D. Loss, *Nature*, 401, 789 (2001).

[2] M. Urdampilleta, S. Klyatskaya, J.-P. Cleuzio, M. Ruben, W. Wernsdorfer, *Nature Materials* **10**, 502 (2011).

[3] L. Vitali, S. Fabris, A. Mosca, S. Brink, M. Ruben et al. *Nano Letters* **8**, 3364 (2008).

[4] S. Kezilebieke, A. Amokrane, M. Abel, J.P. Bucher, *J. Phys. Chem. Lett.* **5**, 3175, (2014) & *Nano Research* **7**, 888 (2014).

**Candidate's profile:** The candidate should have a master degree in physics or chemical-physics. Experience in ultrahigh vacuum, scanning tunneling microscopy, magnetism, or material science is welcome. The candidate should be fluent in scientific English.

Interested candidates are invited to send a CV, a motivation letter, grades and ranking along with two supporting letters by email to: [jean-pierre.bucher@ipcms.unistra.fr](mailto:jean-pierre.bucher@ipcms.unistra.fr)

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