

Scientific Area	Quantum sensing, Spintronics, Nanomagnetism
Topic title	Precise spin detection and manipulation of a single molecule magnet
Main host institution	Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS), CNRS/Université de Strasbourg, www.ipcms.fr
Supervisor/institution	Laurent LIMOT, CNRS director of research https://www.ipcms.fr/en/laurent-limot-2
Co-Supervisor/institution	Jelena Klinovaja / University of Basel: https://physik.unibas.ch/en/persons/jelena-klinovaja/
Mentor¹/institution	TBC
Secondment institution	TBC
Topic description	
<p>Precise spin detection and manipulation of a single molecule magnet</p> <p>Spin qubits can take different forms, such as quantum dots, dopants in semiconductors, and single-molecule magnets (SMMs). The TbPc₂ molecule serves as a notable example of an SMM and will be the focal point of this proposed thesis. Single TbPc₂ molecules will be studied using electron spin resonance (ESR) within a low-temperature scanning tunneling microscope (STM). The approach involves depositing the molecules on double layers of salt grown on Cu(100) and organizing them through tip-assisted manipulation to form 2D magnetic arrays of various shapes. The objectives are to develop and employ ESR-STM for precise spin detection at the millitesla level and to manipulate the TbPc₂ spin through reversible, current-induced changes in the molecular structure, thereby simulating a read/write device. Additionally, we aim to unravel magnetic interactions between molecules and investigate how structural or spin changes within a molecule impact neighboring molecules. This research, positioned at the intersection of spintronics and quantum information processing, holds promise for encoding information at the single-molecule level.</p>	
Recommended applicant's profile	
<p>The applicant will lead experiments using a low-temperature scanning tunneling microscope (STM) to manipulate and magnetically characterize single SMMs. Specifically, the research will involve working with a low-temperature STM (1.4 K, ultra-high vacuum) equipped with a 5 T perpendicular magnetic field, located in a low-noise building. The work will be conducted within the STM team (https://www-ipcms.u-strasbg.fr/stmipcms/) of the Surfaces and Interfaces Department of IPCMS, with internal theoretical support at the Institute (O. Bengone, C. Ghoyhenex) and external collaborations with R. Robles and N. Lorente (CFM, San Sebastián). The applicant will optimize the ESR-STM technique to enable quantum magnetometry and precisely map the spin textures of the molecular network. The applicant must hold a recently obtained Master's degree in Physics, specializing in materials science or a related field. Basic experience in surface physics and scanning tunneling microscopy (STM), preferably at low temperatures, is highly desirable. The ability to work independently while effectively collaborating within a multidisciplinary team is essential. Proficiency in written and oral communication in English is strongly desirable, with fluency in French being a valued asset. This position offers an opportunity to specialize in cutting-edge research within a collaborative environment at IPCMS.</p>	

¹ Mentor: The primary role of the mentors will be to identify and facilitate specific training objectives, advise on any problems faced by the DC, including career matters with an external perspective and provide mediation in the case of disputes.