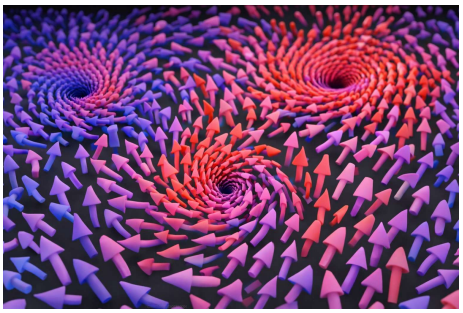
PhD position in Nanomagnetism



Research on magnetic nanoparticles and nanostructures is largely motivated by their potential and existing applications in medicine, biology, chemistry, and nanotechnology. A key question in this field is whether assembling individual nanoparticles into macroscopic systems (e.g., ordered arrays of nanoparticles) preserves their unique nanoscale properties. Addressing this challenge requires a thorough understanding of the interplay between the intrinsic properties of nanoparticles such as size, shape, and defect structure and their interactions within complex assemblies. From a fundamental standpoint, advancing our knowledge of nanoscale behavior necessitates sophisticated tools to probe, measure, and model these systems. Utilizing polarized magnetic neutron scattering, particularly small-angle neutron scattering (SANS), we have recently developed a theoretical framework that combines analytical and numerical approaches to quantitatively investigate the spin structures and surface anisotropy of nanoparticles. SANS is particularly sensitive to mesoscale variations (approximately 1−1000 nm) in the magnitude and orientation of the static magnetization vector field. These efforts, which form the foundation of the present project, have significantly advanced our understanding of the magnetic structures of nanoparticles and their distinctive signatures in experimental neutron scattering data. This primarily theoretical project aims to explore the relationship between intrinsic and collective magnetic properties in ordered and disordered nanoparticle assemblies, addressing both their equilibrium and dynamic behavior, with a focus on their representation in the SANS cross section and correlation function. Beyond studying static spin structures, we will also compute the dynamic (time-dependent) magnetization response, where the intermediate scattering function serves as the key neutron scattering observable. More broadly, this work will help establish a solid foundation for future studies on the coupling between thermal transport and magnetization dynamics in nanostructures, as well as on the impact of magnetism on the electrical, thermal, and magnetooptical properties of arrays of nanomagnets deposited, for example, on metallic or semiconducting substrates.

We are looking for a **motivated researcher at the PhD student level**. This theory project will comprise both analytical calculations as well as numerical simulations of classical spin systems. The PhD candidate should have a MS degree in physics or materials science, ideally with a specialization in condensed-matter physics and magnetism.

The project will be carried out in the group of Professor Andreas Michels at the University of Luxembourg in collaboration with the group of Professor Hamid Kachkachi at the University of Perpignan. The PhD position (for up to four years) includes travel funds for visiting schools and conferences, and possible extended research stays abroad.

Review of applications will start immediately, and the position will remain open until filled. Interested candidates should submit a one-page cover letter, a two-page curriculum vitae, copies of BS and MS certificates, as well as the contact addresses of up to three possible referees (all in one single pdf document). Shortlisted candidates will be interviewed remotely and/or in Luxembourg and will be invited to give a seminar presentation about a research project of their choice.

In case of further questions, please send emails to andreas.michels@uni.lu and/or hamid.kachkachi@univ-perp.fr.