2D-iron based Materials: a platform for exotic spin states, spin-clusters and domains and their dynamics.

This PhD project is part of a three-year collaboration between the University of Lille and the Institut Laue Langevin. The candidate will be based in each institution for a period of 1.5 years and will be attached to the Doctoral School - 104 of the University of Lille (*Ecole Doctorale-104, Sciences de la Matière du Rayonnement et de l'Environnement*).

During the 3 years of this project, the PhD student will be responsible for sample preparation using solid state and solvothermal techniques, and physical characterisation of the sample using laboratory techniques (powder and single crystal X-ray diffraction, electron microscopy, magnetometry measurements and surface analysis among others) as well as advanced techniques such as magnetic force microscopy, unpolarised and polarised neutron diffraction (powder and single crystal), synchrotron measurements and inelastic neutron measurements. Measurements using neutron techniques will be carried out mainly at the ILL, while others will be developed at other large facilities in Europe or in collaborating laboratories. The ultimate goal is to have an in-depth knowledge of the interplay between crystal structure and magnetic and magnetoelectric properties of 2D iron-based compounds.

The chemical tailoring of the proposed 2D platform will allow us to set new paradigms on exotic magnetic states/excitations/dynamics of spins/clusters/magnetic domains. For this PhD project, we have selected three promising series of layered Fe-based materials ($BaFe_2(PO_4)_2$, Fe-based mica compounds and Fe-based Aurivillius oxyfluorides). Preliminary studies on these systems have been developed at the UCCS (Univ. Lille) and show great potential in terms of magnetic (-electric) behaviour.

From a chemical point of view, these systems offer different degrees of freedom and chemical/lattice/redox flexibility towards tuneable magnetic components (direct exchange, spin, anisotropy or correlation lengths). The academic supervisors have a strong background in sample preparation, so most of the synthetic work will be carried out during the time at the University of Lille.

The PhD student will start the project (1 year) in Olivier Mentre's group (UCCS, Lille) where the inorganic synthesis, crystallographic studies and physical characterisation will be carried out. During this period, the student will also be introduced to the basics of diffraction and first-principles theoretical methods. Short stays to receive specific training necessary for the development of the PhD will also be carried out during this period. In addition, the candidate should attend some doctoral courses at the University of Lille. During the next 1.5 years, the PhD student will be based at the ILL (Grenoble) and will focus on neutron diffraction experiments and data treatment. For the last 6 months of the project, the PhD student will return to the UCCS to complete the writing of the thesis and the PhD defence.

We are looking for a highly motivated candidate with a degree in physics, chemistry or materials science. The candidate must hold an MSc degree in an affine field and meet the requirements to be enrolled in the Doctoral School of the University of Lille.

How to apply: email to Olivier Mentré/Angel Arevalo-Lopez + Oscar Fabello/Clemens Ritter (olivier.mentre@univ-lille.fr; angel.arevalo-lopez@univ-lille.fr; fabelo@ill.fr; ritter@ill.fr)
with the subject "Thesis-MAG-2023_17-your name". Attach a CV, a brief motivation letter and the contact person for a reference.
For additional details about the specific conditions for the PhD and the application procedure, please consult the following link: https://www.ill.eu/careers/all-our-vacancies/phd-recruitment/open-phd-position