INTERNSHIP PROPOSAL

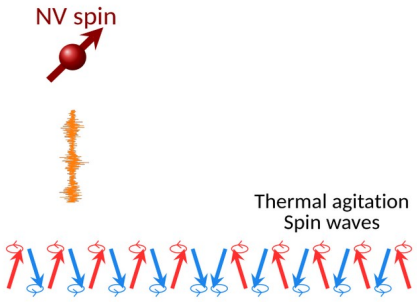
Laboratory name: Laboratoire Charles Coulomb (L2C)
CNRS identification code: UMR5221
Internship director'surname: FINCO
e-mail: aurore.finco@umontpellier.fr Phone number: 0467144820
Web page: https://solidstatequantumtech-l2c.fr/
Internship location: L2C - Montpellier

Thesis possibility after internship: YES
Funding: YES, Bourse Institut Quantique Occitan

Investigation of spin waves at the nanoscale with a quantum sensor

Quantum sensors take advantage of the extreme sensitivity of quantum systems to external perturbations to accurately measure a broad range of physical quantities such as acceleration, rotation, magnetic and electric fields, or temperature. Among a wide variety of quantum systems employed for sensing purposes, the **nitrogen-vacancy (NV) defect in diamond** has garnered considerable attention in the last decade for the development of a new generation of magnetometers providing an unprecedented combination of spatial resolution and magnetic sensitivity under ambient conditions. The host group at Laboratoire Charles Coulomb (Montpellier) has played a major role in the development of this innovative magnetometry technique, with a focus on its **applications in condensed matter physics**.

The goal of the present project is to combine the capability of scanning NV microscopy to image nanoscale magnetic textures with its sensitivity to the fluctuating magnetic stray field which is produced by thermally activated spin waves. This combination will offer us the possibility to **probe magnetic excitations which are confined inside domain walls**. We will first localise and characterise antiferromagnetic domain walls with NV center magnetometry, by measuring the Zeeman shift induced by the stray field of the domain wall on the spin sublevels of the NV center. Then, we will probe the spin waves by **monitoring the relaxation time of the NV** center, as this relaxation is accelerated in the presence of fluctuating magnetic field. This experiment will allow us to check predictions about the dispersion of **spin waves confined inside antiferromagnetic domain walls** and to explore the effect of the texture of the domain wall itself on these spin waves.



Principle of the experiment

Publications related to the project:
- A. Finco *et al.*, Nature Communications 12, 767 (2021)
- M. Rollo *et al.*, Physical Review B 103, 235418 (2021)

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO