# Spécialité de Master « Optique, Matière, Paris »

*Stage de recherche (4 mois minimum, à partir de début mars)*

## Proposition de stage

*Date de la proposition : 24/10/2017*


| **Responsable du stage** / *internship supervisor*: | | | |
|---|---|---|---|
| Nom / *name*: | JACQUES | Prénom/ *first name* : | Vincent |
| Tél : | 0467149923 | Fax : | |
| Courriel / *mail*: | vincent.jacques@umontpellier.fr | | |
| **Nom du Laboratoire** / *laboratory name*: Laboratoire Charles Coulomb | | | |
| Code d'identification :UMR5221 | Organisme : CNRS – Université de Montpellier | | |
| Site Internet / *web site*: https://www.coulomb.univ-montp2.fr/ | | | |
| Adresse / *address:* place Eugène Bataillon – 34000 Montpellier | | | |
| Lieu du stage / *internship place*: Montpellier | | | |


**Titre du stage** / *internship title*: **Exploring condensed matter physics with a quantum magnetometer**

Detecting and imaging magnetic fields with high sensitivity and nanoscale resolution is a topic of crucial importance for a wealth of research domains, from material science, to mesoscopic physics, and life sciences. This is also a key requirement for fundamental studies in nanomagnetism and the design of innovative magnetic materials with tailored properties for applications in spintronics. Although a remarkable number of magnetic microscopy techniques have been developed over the last decades, imaging magnetism at the nanoscale still remains a challenging task.

It was recently realized that the experimental methods allowing for the detection of single spins in the solid-state, which were initially developed for quantum information science, open new avenues for high sensitivity magnetometry at the nanoscale. In that spirit, we make use of the electronic spin of a single nitrogen-vacancy (NV) defect in diamond as a nanoscale quantum sensor for scanning probe magnetometry [Fig. 1]. This approach promises significant advances in magnetic imaging since it provides non-invasive, quantitative and vectorial magnetic field measurements, with an unprecedented combination of spatial resolution and magnetic sensitivity [1].

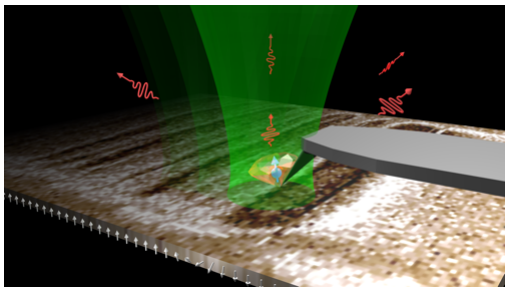

Figure 1 : Schematic representation of a scanning-NV magnetometer mapping the magnetic field distribution over domain walls in an ultrathin ferromagnet.

The objective of the internship is to exploit the unique performances of scanning-NV magnetometry to image and control exotic magnetic order in ultrathin antiferromagnet, such as spin cycloids and magnetic skyrmions, which are currently attracting tremendous interest for the design of innovative spintronic devices [2]. We will first study the physics of antiferromagnetic domains in insulating oxides and then manipulate these domains in order to design artificial spin textures on-demand.

A PhD could follow the internship, with funding from the Agence Nationale de la Recherche (ANR - PIAF). This project will be conducted in collaboration with the Oxytronics group at the CNRS/Thales laboratory, located within Thales Research and Technology in Palaiseau.


[1] L. Rondin et al., Rep. Prog. Phys. 77, 056503 (2014)
[2] P. Wadley et al., Science 351, 587 (2016).


Recent publications of the host group (http://www.solidstatequantumtech-l2c.fr)


I. Gross et al., Nature 549, 252 (2017).
A. Hrabec et al., Nature Communications 8, 15765 (2017)
J.-P. Tetienne et al., Nature Communications 6, 6733 (2015).
J.-P. Tetienne et al., Science 344, 1366 (2014).


**Ce stage pourra-t-il se prolonger en thèse ?** *Possibility of a PhD* **? : Yes**

**Si oui, financement de thèse envisagé/** *financial support for the PhD***: ANR PIAF**

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| Lumière, Matière, Interactions | x | Lasers, Optique, Matière | x |