INTERNSHIP PROPOSAL

(One page maximum)

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Thesis possibility after internship: **YES**
Funding: **SECURED** If YES, which type of funding: **Institut Quantique Occitan**

Emergent properties of altermagnets and non-collinear antiferromagnets

Historically, magnets have been classified in two categories: ferromagnets and antiferromagnets (AFM). While typical AFM host 2 oppositely oriented magnetic sublattices, non-collinear AFM like Mn_3Sn or $Co_{1/3}TaS_2$ possess a more complicated magnetic texture with more sublattices, which can lead to the emergence of new phenomena like orbital magnetization or anomalous Hall effect. Besides these exotic AFM, another class of magnets has recently been introduced: altermagnets. They have the magnetic order of collinear AFM, but also exhibit large magneto-optic or Hall effects, as if they had a significant net magnetization, and seem therefore very promising for applications in spintronics.
Up to now, most of the knowledge about these materials comes from macroscopic characterization. The goal of the proposed project is to investigate them at the nanoscale with the help of a very sensitive scanning probe technique: scanning NV center magnetometry. This method employs a single nitrogen-vacancy (NV) defect in diamond as a quantum sensor and provides non-invasive and quantitative stray field measurements, with an unprecedented combination of spatial resolution (~50 nm) and magnetic sensitivity (~$\mu T.Hz^{-1/2}$). We will in particular examine domain walls, as their internal structure should give us insight about the balance of magnetic interactions in these systems.

Related publications of the group:
- A. Finco et al., Physical Review Letters 128, 187201 (2022)
- A. Finco and V. Jacques, APL Materials 11, 100901 (2023)

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

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