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*:	DREAU	Prénom/ *first name* :	Anaïs
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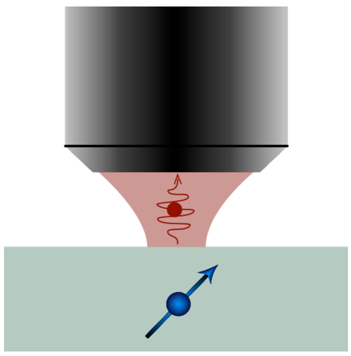
Courriel / *mail*:	anais.dreau@umontpellier.fr		
Nom du Laboratoire / *laboratory name*: Laboratoire Charles Coulomb			
Code d'identification :UMR5221	Organisme : CNRS – Université de Montpellier		
Site Internet / *web site*: https://www.coulomb.univ-montp2.fr/			
Adresse / *address:* place Eugène Bataillon – 34000 Montpellier			
Lieu du stage / *internship place*: Montpellier			

Titre du stage / *internship title*: **Identifying spin qubit defects in silicon-based material**

Among all the condensed-matter artificial atoms investigated up to now, electron spins associated with optically-active point-defects in semiconductors presently stand out for their capacity to maintain their quantum characteristics over outstanding long time, opening not only novel prospects in fundamental science but also new horizons in the growing field of quantum technologies (photon-mediated spin-spin entanglement [1], nanomagnetometers with high sensitivity [3] to name a few).

The most prominent of these solid-state artificial atoms is currently the nitrogen-vacancy (NV) centre in diamond. In addition to diamond, similar defects do exist in other semiconductors, in particular in technology-friendly semiconductors compatible with industrial standards. These defects, that combine the best attributes of atomic and condensed matter systems for quantum technologies, have recently been identified in silicon carbide (with the detection of individual long-lived electron spins [2]) and in silicon (with the detection of ensembles of point-defect emitters radiating in the NIR spectral range [4]).

This internship aims at tackling the spin and optical properties of these new optically active centers in SiC and Si, in order to assess their potential as solid-state spin qubits or as sources of single photons in the NIR fiber-compatible spectral range. Their fluorescence properties will be investigated at the single level. Then, the key element will be to demonstrate that their electron spin state can be measured optically and coherently controlled by use of microwave magnetic field. The final goal will be to assess the interest of these defects for quantum technologies, in particular through a complete analysis of their spin coherence properties and the study of their response to environmental modifications such as magnetic field or temperature variations.



Optical detection of single spins.

This internship can be followed by a PhD work.

[1] See for example, B. Hensen, H. Bernien, A. E. Dréau, et al., Nature 526, 682 (2015).
[2] Christle et al., Nature Materials 14, 160-163 (2015) & Widmann et al., Nature Materials 14, 164-168 (2015)

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

[3] L. Rondin, et al., Rep. Prog. Phys. 77, 056503 (2014).
[4] C. Beaufils et al., arXiv:1708.05238
[5] A. Dréau et al., Phys. Rev. Lett. 113, 137601 (2014).
[6] A. Dréau et al., Phys. Rev. Lett. 110, 060502 (2013)

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*: **ED**			
Lumière, Matière, Interactions	x	Lasers, Optique, Matière	x