Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 24/10/2016

Responsable du stage / *internship supervisor*:
Nom / *name*: DREAU   Prénom/ *first name* : Anais
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Nom du Laboratoire / *laboratory name*:
Code d'identification :UMR5221 (CMRS/UM)   Organisme : Laboratoire Charles Coulomb
Site Internet / *web site*: http://www.coulomb.univ-montp2.fr/?lang=en
Adresse / *address:* place Eugène Bataillon - 34000 Montpellier
Lieu du stage / *internship place*: Montpellier

Titre du stage / *internship title*: **Identifying spin qubit defects in wide-bandgap semiconductors**

Electronic spins associated with point-like defects in wide-bandgap materials are at the heart of a broad range of emerging technologies, from quantum information science, to the development of highly sensitive quantum sensors. The most prominent of these solid-state artificial atoms is currently the nitrogen-vacancy (NV) center in diamond, whose electronic spin can be optically polarized and readout, as well as coherently manipulated with long coherence times, even under ambient conditions. Recent achievements with this quantum system include the first generation of kilometre-scale entanglement with solid-state qubits [1] and the realization of nanomagnetometers with high sensitivity [3]. In addition to diamond, similar defects do exist in other semiconductors, as demonstrated by the recent detection of individual long-lived electron spins [2] in silicon carbide (SiC) and of single emitters in hexagonal boron nitride (hBN) [6].

This internship aims at identifying new optically active centers in wide bandgap semiconductors, such as SiC or hBN, which can be used as solid-state spin qubits. The fluorescence properties of such defects will be investigated at the single level using photon correlation measurements. 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.

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., *Nat. Mater.* **14**, 160-163 (2015) & Widmann et al., *Nat. Mater.* **14**, 164-168 (2015)

Recent related publications of the host group

[3] J.-P. Tetienne *et al., Science* **344**, 1366 (2014).
[4] A. Dréau *et al., Phys. Rev. Lett.* **110**, 060502 (2013),
[5] A. Dréau *et al., Phys. Rev. Lett.* **113**, 137601 (2014).
[6] P. Jamonneau *et al., Phys. Rev. Lett.* **116**, 043603 (2016).
[7] L. J. Martinez et al., *Phys. Rev. B* **94**, 121405(R) (2016)

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: bourse doctorale**

Lumière, Matière, Interactions	**Oui**	Lasers, Optique, Matière	**Oui**