Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : Octobre 2018

Responsable du stage */ internship supervisor*:

Nom / *name*:	CASSABOIS	Prénom/ *first name* :	Guillaume
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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/index.php?page=pageperso&nom=CASSABOIS&prenom=Guillaume*

Adresse / *address:* place Eugène Bataillon, Montpellier, France

Lieu du stage / *internship place*: Laboratoire Charles Coulomb

Titre du stage / *internship title*: **Optically-addressable spin qubits in silicon 28**

Résumé / *summary*

Like its classical counterpart, the field of **quantum technologies** is highly demanding in scalable and low-cost solutions for device fabrication. Silicon, as leader material of the semiconductor industry, constitutes a highly promising platform for developing quantum devices. This interest is strengthened by the possibility of producing high-grade **isotopically enriched silicon-28 wafers** that provides a vacuum-like environment for quantum systems, guaranteeing their long-lived quantum properties [1].

One challenge for Si-based quantum systems is to interface them with optical photons, in order to enable opportunities for **quantum communications**. In this context, **G-center defects in silicon** have recently attracted interest due to their infrared emission, matching the important optical telecommunications wavelength O-band spreading between 1260-1360 nm [2]. This internship aims at exploring their potential for applications in quantum technologies. The first goal is to investigate individual G-centers in nanophotonic structures based on isotopically purified ^{28}Si samples, as a means of developing integrated single photon sources emitting in the telecommunications wavelength range. The second step will be to assess the potential of G-center defects for storing quantum information.

The project will be developed in strong collaborations with the two other partners of the *OCTOPUS* ANR project: CEA-Grenoble ant IM2NP-Marseille.

[1] M. Steger et al., "Quantum information storage for over 180s using donor spins in a ^{28}Si "semiconductor vacuum"", Science 336, 1280 (2012).

[2] C. Beaufils, W. Redjem, E. Rousseau, **V. Jacques**, A. Yu. Kuznetsov, C. Raynaud, C. Voisin, A. Benali, T. Herzig, S. Pezzagna, J. Meijer, M. Abbarchi, and **G. Cassabois**, "Optical properties of an ensemble of G-centers in silicon", Phys. Rev. B 97, 035303 (2018).

Relevant publications of the group (G. Cassabois, A. Dréau, V. Jacques) :

[3] B. Hensen, H. Bernien, **A. Dréau**, et al., "Loophole-free Bell inequality violation using electron spins separated by 1.3 kilometres", Nature 526, 682 (2015).

[4] **A. Dréau**, P. Jamonneau, O. Gazzano, S. Kosen, J.-F. Roch, J.R. Maze, and **V. Jacques**, "Probing the Dynamics of a Nuclear Spin Bath in Diamond through Time-Resolved Central Spin Magnetometry" Phys. Rev. Lett. 113, 137601 (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 project (OCTOPUS)**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**