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*:	PHILIP	Prénom/ *first name* :	Isabelle
Tél :	04 76 14 99 23	Fax :	
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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*: http://www.solidstatequantumtech-l2c.fr/home
Adresse / *address:* place Eugène Bataillon, Montpellier, France
Lieu du stage / *internship place*: Laboratoire Charles Coulomb

Titre du stage / *internship title*: Thermal quantum sensing at nanoscale

Résumé / *summary*

In recent years, quantum sensing has attracted increasing attention thanks to its unprecedented combination of nanoscale mapping and non-invasively probing of very weak signals such as magnetic field or temperature. Such ability, out of reach with conventional sensors, has strong implications for fundamental physics in a wide range of fields, such as quantum mechanics, nanomagnetism, life science..., but also for industrial-scale applications like microelectronics.

One major breakthrough in this field has been the recent development of diamond-based quantum sensors as highly sensitive magnetic field sensors with nanometric spatial resolution [2-4]. Such probes exploit the quantum manipulation and read-out of the single spin state of a single atomic impurity in diamond: the nitrogen-vacancy center (NV center).

In addition to magnetic field imaging, the NV center-based probes also offer the potential for extraordinarily precise resolution of temperature with high spatial resolution [1]. The objective of the internship is to address this prospect, by implementing a novel sensing tool based on individual quantum defects in diamond for nanoscale thermal imaging. The first task will be to assess the performances of the single solid-state spins to measure nanoscale local temperature gradients. This quantum sensor will then be applied to investigate novel thermal effects in plasmonic structures made of nanoscale gold assemblies, down to the single nanoparticle level.

This intership can be followed by a PhD work, on the enhancement of the sensor's performance, based on a hybrid architecture capitalizing on the ultimate sensitivity of the spins to magnetic field and an efficient conversion of temperature gradient to magnetic fields by ferrimagnetic layers.

[1] G. Kucsko, et al., Nature 500, 54–58 (2013)

Relevant publications of the group :

[2] J.-P. Tetienne et al., Science 344, 1366 (2014)
[3] I. Gross et al., Nature 549, 252 (2017)
[4] I. Gross et al., Phys. Rev. Materials 2, 024406 (2018)

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 (THESEUS)**

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