

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 06-11-2018

Responsable du stage / internship supervisor:			
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Nom du Laboratoire / laboratory name: Laboratoire Micro et Nano Physique			
Code d'identification :	LMNP	Organisme :	Thales Research & Technology (TRT)
Site Internet / web site:	www.thalesgroup.com		
Adresse / address:	1 avenue Augustin Fresnel, 91767 Palaiseau Cedex		
Lieu du stage / internship place:	TRT		

Titre du stage / internship title: NV centers for high sensitivity quantum sensing
Résumé / summary <p>Thales Research & Technology (TRT) is the corporate research laboratory of Thales group and it performs applied research in fields that are promising for future Thales products. One main line of research consists in developing quantum sensors based on NV centers in diamond.</p> <p>The NV center in diamond consists of a nitrogen atom inserted in the diamond carbon lattice coupled to a vacancy. It behaves as an atom-like system in the solid-state and is a promising technology in view of future applications. NV centers are quantum sensors that exploit quantum coherence to achieve ultimate performances. In particular, they are widely studied as a magnetic field sensor with high sensitivity and nanometer scale spatial resolution. We are developing several applications, among them a wide-field magnetic imager used to image electronic circuits and a large bandwidth radio-frequency spectrum analyzer with instantaneous response. Our main objective is to improve those sensors in term of sensitivity, spectral resolution, dynamics, spectral range, etc. This requires a deep understanding of the NV properties on the theoretical aspects and experimental aspects as well. In particular, most of our sensors involve ensembles of NV centers and therefore, understanding their mutual coupling and collective behavior is essential.</p> <p>A first objective of the internship is to better understand NV centers and how they are coupled to optical fields and magnetic field. This will require investigating the available literature and also bringing original contribution when necessary. A particular aspect will be to investigate the advantage of operating the NV center in pulsed regime (optical and microwave) as compared to the continuous regime used so far. This would result in overall improved sensing performances.</p> <p>A second objective will then be to apply this in-depth understanding to the various applications we are pursuing and for which NV centers either bring new solutions or bring a significant improvement to existing ones. Direct imaging of the microwave field produced by complex antennas is possible, which allows a detailed characterization of their performances. Coupling NV centers to resonant optical cavities allows enhancing their optical signal, which results in an improved magnetic sensitivity. Operating our spectrum analyzer in optimized configuration will greatly improve its sensitivity and spectral resolution. Depending on the progress at the time of the internship, one or several of those applications will be investigated.</p> <p>This work is performed in a strong collaborative framework. We have a common laboratory with CNRS which is located in our premises, which makes possible a day to day interaction. Furthermore TRT is coordinating two recently notified European projects, MICROSENS and ASTERIQS (Quantum Flagship), thus ensuring a strong collaboration with the most prominent European laboratories in the field.</p>

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : PhD propositions will be available at TRT			
Si oui, financement de thèse envisagé/ financial support for the PhD: bourse CIFRE			
Lumière, Matière, Interactions	oui	Lasers, Optique, Matière	oui

Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>