Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / *internship supervisor*:			
Nom / *name*:	Dubin	Prénom/ *first name* :	François
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Nom du Laboratoire / *laboratory name*: Institut des NanoSciences de Paris			
Code d'identification :UMR-7588		Organisme :CNRS - UPMC	
Site Internet / *web site*: www.insp.jussieu.fr			
Adresse / *address:* 4 place Jussieu, 75 005 Paris			
Lieu du stage / *internship place*: INSP			

Titre du stage / *internship title*: Quantum Optical Manipulation of Single Indirect Excitons

Résumé / *summary*

Among the possible realisations of semiconductor excitons, spatially indirect excitons are very attractive since they exhibit unique properties to explore quantum optical scenarios, notably in the context of quantum information science and processing. Spatially indirect excitons are engineered by enforcing a spatial separation between their electron and hole constituents. Thus, indirect excitons have a radiative lifetime that ranges from hundreds of nanoseconds to even microseconds. At the same time, the indirect excitons magnetic levels have long relaxation and coherence times which paves the way towards quantum logical operations in order to coherently control a single exciton spin-qubit.

Here, we propose an internship that aims at demonstrating artificial trapping potentials to confine single indirect excitons. Such traps rely on the dipolar interaction between the large electric dipole of indirect excitons and a spatially inhomogeneous electric field. More precisely, the Master student will study field-effect devices where a coupled quantum well is embedded. On the surface of such device a nano-structured pattern of gate electrodes will serve to control the spatial profile of the electric field applied perpendicular to the coupled quantum well. Thus, electrons and holes have minimum energy states in each quantum well resulting in the formation of indirect excitons. At the same time, the spatial profile of the excitons confinement is controlled by the surface electrode structure in this "all-in-one" architecture.

The aim of the internship is to demonstrate that starting from a dilute exciton gas in a trap, exciton evaporation can be demonstrated to enter the regime where a single exciton remains confined in the trap. For that purpose, the strength of the confinement will be vary in-situ and dynamically using pulse sequencing techniques. More generally, experiments will be realised in a fully operation laboratory that allows to optically study indirect excitons at temperatures as low as 300 mK with a He3/He4 cryostat.

Through this internship, the student will acquire the techniques to perform optical microscopy in a cryogenic environment, as well as computational tools to simulate exciton traps and thus optimise their performances.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

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 ED**

Lasers, Optique, Matière		Lumière, Matière, Interactions	
Plasmas : de l'espace au laboratoire			

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