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*:	Poizat	Prénom/ *first name* :	Jean-Philippe
Tél :	04 56 38 70 44	Fax :	
Courriel / *mail*:	Jean-philippe.poizat@grenoble.cnrs.fr		

Nom du Laboratoire / *laboratory name*: Institut Néel

Code d'identification : UPR2940 Organisme : CNRS

Site Internet / *web site*: www.neel.cnrs.fr/

Adresse / *address:* 25, avenue des Martyrs, 38042 Grenoble

Lieu du stage / *internship place*: Institut Néel, Grenoble

Titre du stage / *internship title*:

Giant nonlinearities and optomechanical experiments with a single quantum dot in a photonic wire

Résumé / *summary*

Coupling a single light emitter to a single spatial mode of a propagating electromagnetic field is a key requirement to produce quantum states of light with high efficiency and to implement giant nonlinearities at the single photon level. Systems featuring this property are known as "one-dimensional atom". They are toy models with many possibilities in quantum optics, and possible applications in ultralow power photonics and quantum information [1].

A photonic wire containing a semi-conducting quantum dot has been developed recently at CEA/INAC within our joint team "Nanophysics and semiconductors" to realize the most efficient single photon source so far [2] (see fig). This object is a quasi-ideal "one-dimensional atom".

The internship will be devoted to quantum optical experiments with this device. A key property of these photonic wires is their broadband behaviour. This will enable us to address two different transitions of the quantum dot to realize two-mode giant non-linearity at the single photon level. This will be the first step towards a new type of single photon transistor, wherein the property of a single control photon can change the transmission of a signal photon. We will also prepare the quantum dot in an inverted population state and investigate the stimulated emission at the single photon level [3].

Preliminary experimental results show that this object offers also outstanding optomechanical properties through strain-mediated coupling between photonic wire oscillation and excitonic quantum dot energy. This novel hybrid system couples the degrees of freedom of two radically different systems: a nanomechanical oscillator and a single quantum object [4]. A second goal of this PhD will be to investigate the very original possibility of controlling the motion of the wire with light.

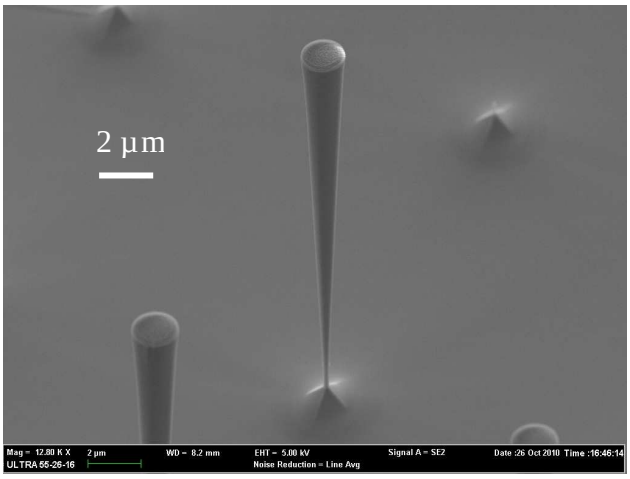

***Fig**. Scanning electronic microscope image of a photonic wire with a new design (CEA/INAC). Top diameter is 2 µm.*

[1] A. Auffèves et al, Phys. Rev. A **75**, 053823 (2007)

[2] J. Claudon et al, Nature Photonics **4**, 174 (2010)

[3] D. Valente et al, Phys. Rev. A **85**, 023811 (2012)

[4] O. Arcizet et al, Nature Phys. **7**, 879 (2011)

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***:** Application for a regional scholarship

Lasers et matière	**x**	Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie	**x**	Plasmas : de l'espace au laboratoire	