Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars 2012)

Proposition de stage pour l'année 2011-2012 (ne pas dépasser 1 page)

Date de la proposition : 23/10/2011

Responsable du stage / *internship supervisor*:

Nom / *name*: DUCCI — Prénom/ *first name* : Sara

Tél : 0157276225 — Fax :01 57276241

Courriel / *mail*:sara.ducci@univ-paris-diderot.fr

Nom du Laboratoire / *laboratory name*: Matériaux et Phénomènes Quantiques

Code d'identification : UMR 7162 — Organisme :Université Paris Diderot/CNRS

Site Internet / *web site*: http://www.mpq.univ-paris7.fr/

Adresse / *address:* 10 rue Domon et Duquet 75013 PARI

Lieu du stage / *internship place*: 10 rue Domon et Duquet 75013 PARI

Titre du stage / *internship title*: ***Semiconductor sources of quantum light at room temperature***

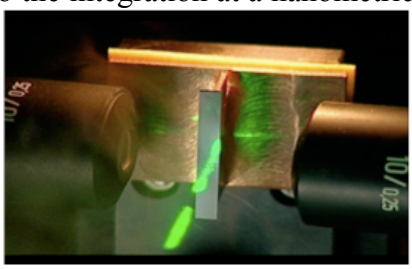
Parametric down-conversion is the most used physical process to produce photon pairs, one of the building blocks in quantum information and communication. The exploitation of this process in semiconductor waveguides allows realizing two-photon state sources at room temperature and at telecom wavelength, which are two key issues for applications. Moreover, 3-5 semiconductors exhibit a huge potential in terms of integration of novel optoelectronic devices.

This internship / PhD thesis is focused on two kinds of original devices developed by our team: a microcavity based on a counterpropagating phase matching and an active device based on modal phase matching.

In the first device, a pump beam impinging onto an AlGaAs waveguide produces photon pairs on two counterpropagating and orthogonally polarized modes. A first quantum optics experiment (Hong-Ou-Mandel interference)[1] has proven the indistiguishability of the emitted photons. The objective now is to go on with the quantum characterization of the photon pairs to demonstrate de generation of Bell states and the versatility in the control of frequency correlations via the spectral and spatial properties of the pump beam [2]; these are unique characteristics of this source.

In the second device the phase matching is obtained by playing with guided modes of different orders; this geometry allows the insertion of a quantum well within the heterostructure to realize an electrically pumped ultra compact source [3].

The demonstration of the quantum properties of the generated two-photon state opens the way to their application in more complex architectures of quantum communications and to the integration at a nanometric scale of quantum photonic functions. This work will benefit from national and international collaborations for the device fabrication and their application in quantum information.



*1) X. Caillet et al. "Two-photon interference with a semiconductor integrated source at room temperature," Opt. Express **18**, 9967 (2010)*

*2) X. Caillet et al., "A semiconductor source of counterpropagating twin photons: a versatile device allowing the control of the two-photon state," J. of Mod. Optics **56**, 232 (2009)*

*3) A. De Rossi et al. ""A third-order-mode laser diode for quantum communication" Semicond. Sci. Technol. **19**, L99 (2004)*

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***:** Fellowship from Doctoral School, preparation of projects to be submitted to ANR, C'Nano, DGA

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