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*:	DUCCI	Prénom/ *first name* :	Sara
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Nom du Laboratoire / *laboratory name*: Matériaux et Phénomènes Quantiques

Code d'identification : UMR7162 Organisme :Université Paris Diderot/CNRS

Site Internet / *web site*: http://www.mpq.univ-paris7.fr/spip.php?article1513

Adresse / *address:* 10 rue A. Domon et L. Duquet Paris 13ème

Lieu du stage / *internship place*: 10 rue A. Domon et L. Duquet Paris 13ème

Titre du stage / *internship title*: ***Hybrid III-V / Si photonic devices for quantum information***

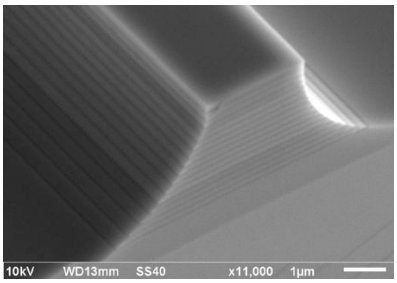
This project is focused on the demonstration of electrically driven integrated quantum photonic circuits including photon pair generation and manipulation, working at room temperature and telecom wavelength. Starting from the III-V semiconductor sources of nonclassical states of light recently demonstrated in our team[1-2], the project will have 3 main objectives: the optimization of the source, the characterization of the original quantum properties of the emitted bi-photon states and the hybrid integration of these devices with Si-based quantum photonic circuits.

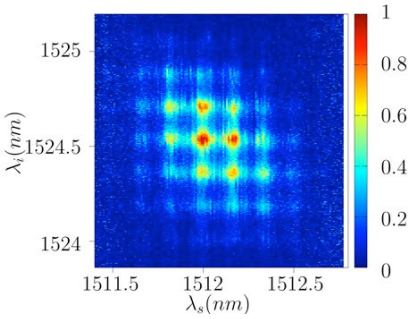
This internship / PhD thesis is focused on a semiconductor microcavity emitting counterpropagating entangled photons. The indistinguishability of the emitted photons has been tested via a Hong-Ou-Mandel experiment, and the demonstration of polarization entanglement has been done via a density matrix reconstruction. The objective now is to proceed to the electrical pumping of the device and to go on with the quantum characterization of the photon pairs by controlling the frequency correlations via the spectral and spatial properties of the pump beam to generate hyper-entangled states, non Gaussian states, etc... This will be done by exploiting some novel techniques recently proposed and demonstrated by our team in collaboration with theoretical groups[3-4].

The third objective will build on the recent progress on the hybrid integration of III-V on Si to combine the advantages of the sources developed at MPQ with those of Si-based quantum photonic circuits which have already demonstrated their potential as next generation components for quantum communications, information processing and metrology.

This work will be done in the framework of a collaboration between the Laboratory MPQ (Université Paris Diderot), the Laboratory LPN (CNRS) and the Clarendon Laboratory (University of Oxford).

Left: SEM picture of a III-V source of entangled photons. Right: high resolution reconstruction of a joint spectral intensity.





[1] *A. Orieux et al. 'Direct Bell States Generation on a III-V Semiconductor Chip at Room Temperature'*, ***Phys. Rev. Lett. 110****, 160502–5 (2013).*

[2] *F. Boitier et al.'Electrically injected photon pair source at room temperature'* ***Phys. Rev. Lett. 112****, 183901 (2014).*

[3] *A. Eckstein et al' High-resolution spectral characterization of two photon states via classical measurements'* ***Laser Photonics Rev. 8*** *L76 (2014).*

[4] *T. Douce et al.'Direct Measurement of the Biphoton Wigner Function through Two-Photon Interference',* ***Sci. Rep****.3, 3530 (2013).*

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***:DGA, EDPIF, other..**

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