Spécialité de Master « Optique, Matière, Paris »

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 18/10/2017

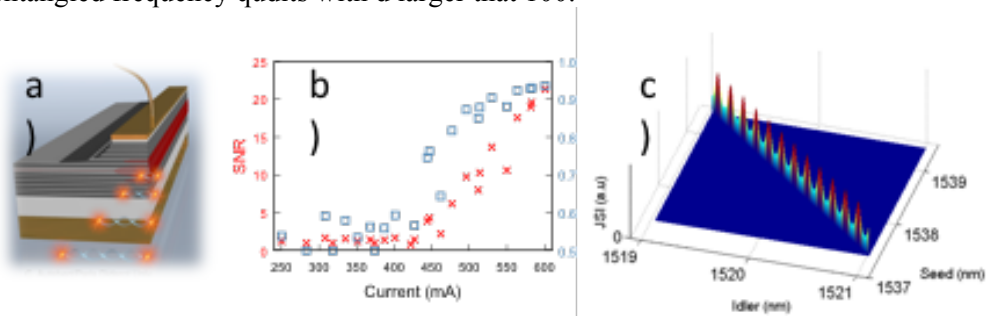
Responsable du stage / *internship supervisor*:	**DUCCI Sara**	**AMANTI Maria**	
Nom / *name*:	DUCCI	Prénom/ *first name* :	Sara
Tél :	0157276225	Fax : 0157276241	
Courriel / *mail*:	Sara.ducci@univ-paris-diderot.fr		
Nom du Laboratoire / *laboratory name*:	Matériaux et Phénomènes Quantiques		
Code d'identification :	Organisme : UMR 7162		
Site Internet / *web site*: https://www.mpq.univ-paris-diderot.fr/			
Adresse / *address:* 10 rue A. Domon et L. Duquet Paris 13ème			

Titre du stage / *internship title*: **Electrically driven quantum light sources @ Room T**

The generation of nonclassical states of light in miniature chips is a crucial step toward practical implementations of future quantum technologies. For the sake of practicality and scalability, these quantum sources should be easily produced, operate at room temperature, and be electrically excited and controlled. The QITe team is a world leader in the research on AlGaAs-based quantum photonic devices. Indeed this platform presents a strong case for the miniaturization of different quantum components in the same chip: strong second order nonlinearity and electro-optic effect, direct bandgap, generation of entangled photons in the telecom band [1-4].

QITe team demonstrated the first electrically injected twin photons source operating at room temperature (Fig a) [2]; in this project we will push further the capabilities of our devices:

- we will investigate and engineer the quantum properties of the emitted bi-photon state under electrical injection. Preliminary characterizations show that the signal to noise ratio should allow demonstrating a high quality entangled state leading to the violation of Bell inequalities (Fig b).
- we will explore the possibility to develop quantum photonic circuits with new functionalities exploiting the electro-optic effect to manipulate the generated quantum states.
- we will exploit the cavity effects dues to facets reflectivity to generate frequency entangled qudits (i.e. quantum units of information that may take any of d states). Such states present a particular interest since they could directly be used for quantum information processing in optical fibers, for example to increase channel capacity and security in quantum communications [5]. Preliminary results (Fig. c) show that our devices generate comb-like spectral correlations corresponding to entangled frequency qudits with d larger that 100.



The candidate will have the possibility to participate to all aspects of the project, from the clean-room fabrication of the devices to the quantum optics experiments and the theoretical analysis, in synergy with the theoreticians of our team. The work will benefit from our numerous collaborators in France and abroad.

[1] A. Orieux et al., Phys. Rev. Lett. 110, 160502 (2013).
[2] F. Boitier et al., Phys. Rev. Lett. 112, 183901 (2014).
[3] C. Autebert et al., Optica 3, 143 (2016).
[4] C. Autebert et al. Quantum Sci. And Technol. 1 01LT02 (2016).
[5] M. Kues et al. Nature 546, 622 (2017).

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***:**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**