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*:

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Nom du Laboratoire / *laboratory name*: Laboratoire Aimé Cotton

Code dôidentification: UPR3321 Organisme :CNRS

Site Internet / *web site*: http://www.lac.u-psud.fr/spip.php?rubrique86

Adresse / *address:*

Lieu du stage / *internship place*: ENS Cachan

Titre du stage / *internship title*: **Carbon nanotubes single photon sources**

Résumé / *summary*

For a carrier confinement in all three spatial directions (0D), the ability to emit photons one to one is due to the phase space filling, a direct consequence of the Pauli principle. In contrast, at 1D, this is not a priori clear how the quantum confinement will affect the statistics of photon emission. Indeed, a 1D density of states should allow the coexistence of several excitons and thus the multiple photon emission. However, the nonlinearities that give rise to phenomena of exciton-exciton annihilation can be effective enough to ensure subpoissonian statistical photon emission. In particular, the Auger-type process can promote non-radiative recombination of a second exciton, thereby inhibiting the simultaneous emission of two photons. In 2008, the group of Prof. A. Imamoglu has shown that carbon nanotubes could be single photon sources. This observation opens a whole field of research in quantum optics of this 1D object. But the question of the origin of this non-classical light is still open. In this internship, we propose first to work to answer this question by studying the nonlinearities of carbon nanotubes and the influence of the nanotube structure on their statistical emission of photons. In a second step, we will perform experiments involving the carbon nanotubes interacting with light confined in different types of optical cavities.

The applicant should have a good knowledge of solid state physics and optics. He (she) will study the statistics of light emission of carbon nanotubes using microphotoluminescence experience coupled with a Handbury-Brown and Twiss setup. Cryogenic techniques will be used to study the influence of temperature on these statistics (from 10 K to 300K). These experiments can be compared to ultrafast optical experiments also conducted in the lab. Finally, the applicant will use and develope theoretical models related to the above experiments.

References

[1] a. Högele et al, Phys. Rev. Lett. 100, 217401 (2008)

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***: Privé, Ecole Doctorale**

Lasers, Optique, Matière	**OUI**	Lumière, Matière : Mesures Extrêmes	**OUI**
Plasmas : de lôespace au laboratoire	**NON**		

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