Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 26/11/2015

Responsable du stage / *internship supervisor*:

Nom / *name*:	Long	Prénom/ *first name* :	Romain
Tél :	01 44 32 34 18	Fax :	01 44 32 34 34
Courriel / *mail*:	long@lkb.ens.fr		

Nom du Laboratoire / *laboratory name*: Laboratoire Kastler Brossel

Code d'identification : UMR 8552 Organisme : ENS/CNRS/UPMC/Collège de France

Site Internet / *web site*: http://www.lkb.ens.fr/-Atom-Chips-Group-

Adresse / *address:* 24 rue Lhomond, 75005 Paris

Lieu du stage / *internship place*: Département de Physique de l'ENS

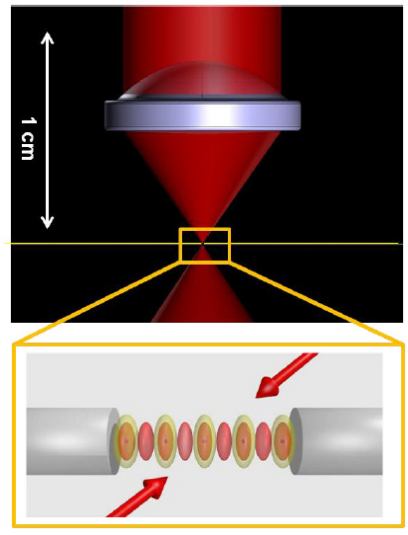
Titre du stage / *internship title*: **Atomic Qubit Register in an Optical Microcavity**

Résumé / *summary*

Creating and characterizing multi-particle entanglement in systems of material particles is becoming a major focus of experimental quantum physics. Besides its fundamental importance, such entanglement is the key ingredient for new applications such as quantum metrology, quantum simulations and quantum information.

The goal of this project is to extend the generation of multi-particle entanglement to "mesoscopic" ensembles of up to ~100 neutral atoms while maintaining analysis at the single-atom level. To achieve this goal, we will combine methods of optical Cavity Quantum Electro-Dynamics (CQED) with quantum gas microscope techniques developed in the field of optical lattices. We will realize a single-atom qubit register in a one-dimensional (1D) optical lattice, where each lattice site is strongly and identically coupled to the mode of a high-finesse optical microcavity.

We use a new type of fiber-based Fabry-Pérot (FFP) cavity developed in our group, which allows creation of symmetric entangled states thanks to the collective interaction of the atoms with the cavity mode. The high-resolution microscope will add the capability to perform local operations on each atom of the register, opening the way for the generation and analysis of entangled states beyond the symmetric ones. This system provides an ideal test-bed to investigate different methods for multi-particle entanglement generation and to study their fundamental limits.



The goal of the internship is to develop a 2D magneto-optical trap to produce a cold atoms beam that will load a 3D magneto-optical trap close to the optical cavity. The student will work first on his/her own setup to characterize and optimize the 2D-MOT. During the internship, he/she will have the opportunity to gain experiences in optics, lasers, and cold atoms physics.

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***: EDPIF**

Lumière, Matière, Interactions	✖	Lasers, Optique, Matière	✖

Fiche à transmettre (fichier pdf ***obligatoirement****) sur le site http://stages.master-omp.fr*