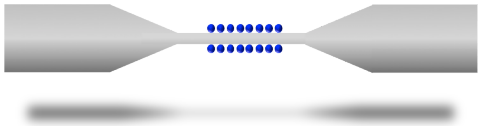
Spécialité de Master « Optique, Matière, Plasmas »

Proposition de stage

Date de la proposition : 21 octobre 2013

Responsable du stage / *internship supervisor*:			
Nom / *name*:	LAURAT	Prénom/ *first name* :	Julien
Tél :	0144273064	Fax :	
Courriel / *mail*:	Julien.laurat@upmc.fr		
Nom du Laboratoire / *laboratory name*:	Laboratoire Kastler Brossel	Quantum Optics Group	
Code d'identification :	UMR8552		
Site Internet / *web site*: lkb.ens.fr			
Adresse / *address:* LKB Site Jussieu			
Lieu du stage / *internship place*: Site Jussieu			

Quantum memory protocols based on nanofiber-trapped atoms



An important challenge for quantum information networks is the development of efficient quantum memory for light. A promising category of quantum memory is **based on ensembles of neutral atoms**. The motivation comes from the fact that collective effects related to large number of atoms make it much easier in principle to achieve a strong and controllable coupling between the memory and the light to be stored. We are currently developing a new interface based on an ensemble of **cold atoms trapped in the vicinity of a nanofiber** (the name 'fiber-coupled atoms' has sometimes been given to this interface), which will enable to obtain a larger optical thickness, a better coupling between collective excitations and light modes and thus a larger efficiency than previous ensemble-based implementations.

Nanofibers offer indeed a unique platform: atoms can be trapped in the evanescent field and addressed efficiently by the guided mode. The field is still in its infancy and only few groups have started to investigate this approach. We are aiming at implementing quantum memory protocols with this system, i.e EIT-based reversible storage or single-photon generation with tunable delay.

Nanofibers are obtained by stretching a fiber to a sub-wavelength diameter: they exhibit a strong radial confinement of the light and a large evanescent field. Their unique properties attracted a large interest in photonics but the difficulty in fabricating low-loss nanofibers was a strong limitation. However, in 2003, a first efficient fabrication process was proposed and triggered their use in many fields. It was rapidly followed by another technique, based on flame-pulling, which enables now to produce nanofibers with low surface roughness and transmission close to unity. We are now producing our own fibers with all the required properties. A vacuum chamber has also been build and the fibers can be placed close to a magneto-optical trap. The next step is to trap the atoms in the evanescent field.

The internship will be mostly experimental and will focus on the **atom trapping in the vicinity of the nanofiber and on first light-matter interaction experiments** in the developed system.

This work will be part of the ERC StG HybridNet and the European network « QSCALE : extending the range of quantum communications ».

***Possibility of a PhD* ? : yes**
***financial support for the PhD*: ED or ERC grant**

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