Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage

Date de la proposition : 10 octobre 2013

Responsable du stage */ internship supervisor*:

Nom / *name*: COOLEN Prénom/ *first name* : Laurent

Tél : 01.44.27.78.31 Fax :

Courriel */ mail*: laurent.coolen@insp.jussieu.fr

Nom du Laboratoire / *laboratory name*: Institut de NanoSciences de Paris (INSP)

Code d'identification :UMR 7588 Organisme :UPMC / CNRS

Site Internet / *web site*: http://www.insp.upmc.fr/axe3/2_couches_minces/themes_III_25.php

Adresse / *address:* 4 place Jussieu, 75005 Paris

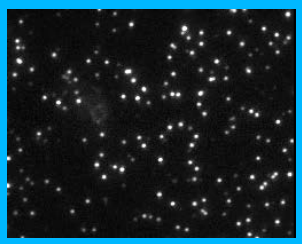
Lieu du stage / *internship place*: campus Jussieu, couloir 22-32, 5e étage

Fluorescence properties of a single colloidal nano-emitter

The internship will take place at the INSP, in a group which studies the effect of a **photonic or plasmonic structure** (photonic crystal, optical cavity, nano-antenna…) on the **fluorescence of a single nano-emitter**. The principle of these studies is that the fluorescence properties of a nano-emitter are not only a function of its intrinsic characteristics, but also of its environment and its density of available photonic states (Fermi's golden rule). The nano-emitters in consideration are **nanocrystals**, CdSe spheres of a few nm, obtained by chemical synthesis. These nanocrystals are very bright and versatile ; their emission wavelength is determined by their size (quantum confinement) and tunable over the whole visible spectrum. By fluorescence microscopy, it is possible to image single nanocrystals deposited on a substrate (fig. a).

The aim of the internship will be to study various aspects of the fluorescence properties of nano-emitters. First, we will characterize the effect of the excitation wavelength on nanocrystals. Nanocrystals can be excited on a very broad range of wavelengths but several results show that emission fluctuations (for instance the well-known "blinking" of nanocrystals from "on" emitting states to "off" non-emitting states) are increased when the excitation wavelength is lower due to the excess photon excitation energy. Such effects were up to now difficult to characterize because it required to tune the excitation wavelength of a single emitter, but our recent acquisition of a tunable supercontinuum laser will allow us to perform **photoluminescence excitation study on a single nanocrystal**. For the largest nanocrystals with the largest absorption cross-section, two-photon infrared excitation will also be studied.

The internship will also consider the **effect of an external electric field of the fluorescence of single nanorods** (nanocrystal with elongated shell). Our work showed that the orientation of the emission dipole of a single nanorod (determined from its emission polarization) is not parallel to its elongation axis. This could be related to strong local electric fields caused by electrons trapped on the surface of the nanorod. Such trapped charges and local electric field have been demonstrated on nanocrystals and are responsible for fluctuations of emission intensity (blinking) and wavelength (spectral diffusion). We will consider whether an external electric field modifies the emission polarization and the dipole orientation of a single nanorod.

a) 

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 :* **Bourse de l'ED**

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