Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 03/10/2016

Responsable du stage / *internship supervisor*:

Nom / *name*:	COOLEN	Prénom/ *first name* :	Laurent
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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.jussieu.fr/-Nanophotonique-et-optique,158-.html

Adresse / *address:* INSP, UPMC, boîte courrier 840, 4 place Jussieu, 75005 Paris

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

Optical and electronic properties of fluorescent semiconductor nanocrystals

The group « Nanophotonics and quantum optics » studies how the fluorescence from a nano-emitter is modified depending in which photonic environment it is placed (such as metallic nano-antenna, photonic crystal, plasmonic structure…). The fluorescent emitters of study are CdSe nanocrystals (spheres of a few nm) ; they are used in opto-electronics to fabricate LEDs, as luminescent labels for bio-imaging, and as single-photon sources in quantum optics. By fluorescence microscopy, individual nanocrystals can be distinguished and studied without any averaging effects (fig. a).

Due to boundary conditions, the charges (electron and hole) inside these nanocrystals present discrete energy levels which depend on the nanocrystal size (quantum confinement). The fine structure of the emitting level determines the light emission properties : polarization, angular radiation distribution… ; it depends on many parameters such as the nanocrystal size, shape or crystalline structure. One usually describes the emission in terms of a single energy level (« 1D » linear dipole) or 2 degenerate levels with orthogonal dipoles (« 2D » dipole).

Determining the 1D or 2D nature of emission is delicate ; to do so, we recently demonstrated a method conbining the study of an individual emitter in both polarization and Fourier plane image (which gives access to the emission angular distribution TF[**E**](**k**)). We showed that the emission from flat nanocrystals (nano-platelets) consists of a perfect 2D dipole (fig. b). The purpose of the internship will be to analyze other types of nanocrystals : spherical or elongated (nano-rods). Various different behaviors can be expected : if the fine structure presents several levels separated by an energy of the order of kT, the 1D/2D nature will vary with temperature ; if the emitting level corresponds to a forbidden transition, the study of the 1D/2D nature will provide information on the mechanism responsible for the emission (associated with phonons ?) etc.

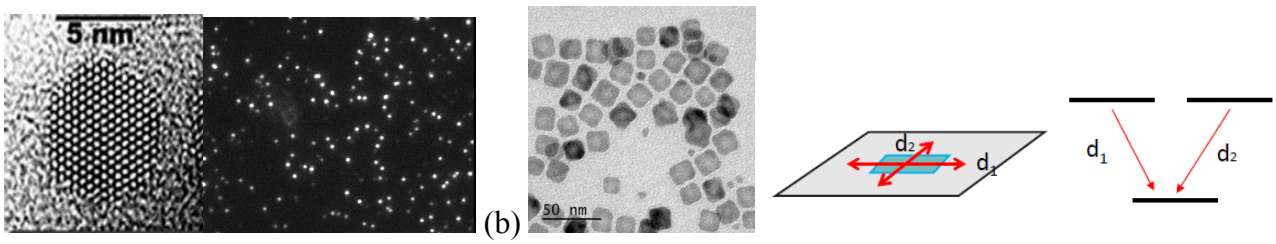

Figure : *(a) TEM and optical image of single CdSe nanocrystals,*
a) TEM image of a nanoplatelet, and schematics of its 2D dipole structure

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***: Application to Ecole Doctorale funding**

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