

# Spécialité de Master « Optique, Matière, Paris »

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

## Proposition de stage

Date de la proposition : 24/10/2017

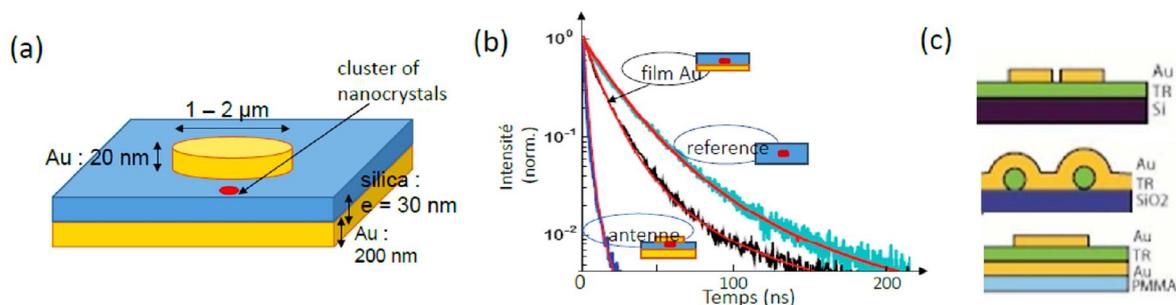
<b>Responsable du stage / internship supervisor:</b>	
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<b>Nom du Laboratoire / laboratory name:</b> Institut de NanoSciences de Paris (INSP)	
Code d'identification : UMR 7588	Organisme : CNRS - UPMC
Site Internet / web site: <a href="http://www.insp.jussieu.fr/-Nanostructures-et-optique-.html">http://www.insp.jussieu.fr/-Nanostructures-et-optique-.html</a>	
Adresse / address: campus Jussieu	
Lieu du stage / internship place: campus Jussieu, 22-32,5° étage	

### Titre du stage / internship title: Coupling an optical nano-antenna to the fluorescence of rare-earth ions

The group « Nanophotonics and quantum optics » at INSP studies how light emission from a nano-emitter depends not only on the emitter itself, but also on its optical environment (as stated by Fermi's golden rule which relates the rate of light emission to the density of available photonic states). Various types of structures are studied (photonic crystal, nano-cavity), among which metallic structures provide the highest electromagnetic field enhancement due to evanescent modes confined in extremely small volumes. Metallic optical nano-antennas can be fabricated to manipulate light-matter interaction and control the luminescence dynamics, direction, polarization etc.

Various antenna geometries have been demonstrated. For instance, our group has studied the coupling of fluorescent semiconductor nanocrystals to patch antennas (fig. a) consisting in a sandwich of a gold layer and a gold disk separated by a silica spacer where the emitter is located. We have shown that the nanocrystals decay rate (fig. b) was increased significantly by the antenna (by a factor 2 to 80 depending on the emitting dipole orientation) [1].

The purpose of the internship is to study the coupling of rare-earth (europium) ions embedded in nanocrystals or thin films (fabricated by Ph. Goldner and A. Ferrier at IRCP à Chimie Paris) to a nano-antenna. Rare-earth ions are used in various optical devices such as lighting or fibers, and their very slow dynamics and long coherence times raise interest for quantum information applications. The internship work will consist in fabricating antennas of various geometries (fig. c) and characterizing the optical properties of the obtained structures by photoluminescence microscopy.



(a) Schematic of a patch antenna. (b) Emission decay curves of nanocrystals clusters inside an antenna, on a gold film and in a reference homogeneous medium. (c) Proposed geometries for the insertion of rare-earth (TR)-doped nanocrystals or thin layers inside nano-antennas.

[1] C. Belacel et al., Nano Lett. 13, 1516 (2013)

<b>Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Yes</b>			
<b>Si oui, financement de thèse envisagé/ financial support for the PhD: No funding for me from Ecole Doctorale this year but other PhDs possible in the group</b>			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

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