Doctoral positions
2018-2019

Thesis Supervisor

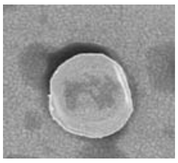
Name: Maître Agnès
Group: Optics and nanostructures
E-mail: agnes.maitre@insp.upmc.fr
Tel: +33 (0)1 44 27 42 17

Location:
4 place Jussieu, 75005 Paris
Tower 22-32 5th Floor

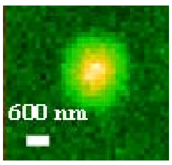
Group website: http://www.insp.jussieu.fr/-Nanostructures-et-optique-.html?lang=en

Thesis title: **Plasmonic antennas in the high confinement regime**

An optical antenna make it possible to convert non propagation near field into a radiative and directive one. In the team, we couple nanoemitters to plasmonic patch antennas in order to improve their fluorescence characteristics such as emission rate or directivity.
We achieve inside the plasmonic antennas a high interaction between the emitters and the confined field excited inside the antenna. The objective is to study how thanks to a very high confinement, the emitters gain specific original quantum properties.
Nanometric semi-conductor colloidal nanocrystals, like CdSe/CdS ones, stable and bright, are excellent single photon sources. We couple these nanoemitters in patch nanoantenna, consisted of a thin dielectric medium (30-40nm) sandwiched between a thick gold layer and gold patch whose diameter is typically of the order of de 100nm-1µm. We can collect their emission in far field and get efficient single photon sources. Moreover because of plasmonic modes and high confinement, emission can be accelerated by a large factor.
.



a)Patch antenna



b) emission diagram

In the preceeding years, we have developed lithographic methods making it possible to locate the emitter exactly in the center of the antenna to maximise interaction. We have evidenced for a single emitter an acceleration of spontaneous emission by a factor 200 and directive emission
The objective of the thesis is to explore the quantum properties of emission for nanomemitters or non linear nanocrystals highly confined in plasmonic nanostructures, in order to realize nanosources for quantum technology. In the first part of the thesis, following our protocol, the student will fabricate antennas for which the interaction between field and nanoemitters is maximised. Then he will investigate the quantum properties of this nanosource. New designs will be considered. In the last part of the thesis focus on realization and study of non-linear nanosources, highly promising sources for quantum optics at the nanoscale.

Source of funding available: Doctoral School

Unité mixte de recherche 7588 – CNRS / Sorbonne Université
Campus Jussieu – Tours 22 et 23 – Case courrier 840
4 place Jussieu – 75252 Paris Cedex 5 – France
Tél. : +33 (0)1 44 27 63 72 – Fax : +33 (0)1 44 27 46 09 – www.insp.upmc.fr