Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Institut des NnaoSciences de Paris
CNRS identification code: UMR7588
Internship director'surname: MAITRE Agnès
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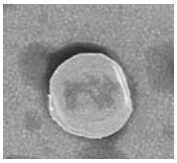
Web page:
Internship location:Jussieu, Tour 22-32, 5eme etage

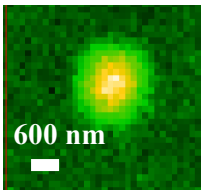
Thesis possibility after internship: YES
Funding: NO (Ecole Doctorale) If YES, which type of funding:

Plasmonic antenna in the high confinement regime

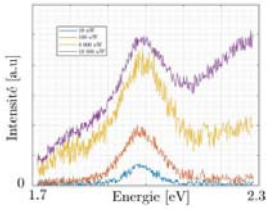
An optical antenna makes it possible to convert non propagation near field into a radiative and directive one. In the team, we couple nanoemitters to plasmonic patch antennas in order to improve their fluorescence characteristics such as emission rate or directivity.
We achieved inside plasmonic antennas a high interaction between the emitters and the confined field excited inside the antenna. The objective of our studies 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, which consists 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.
In the preceding years, we have developed lithographic methods making it possible to locate the emitter exactly in the center of the antenna to maximise interaction



a) Patch antenna



b) antenna emission



c) emission spectra with different pump power

We have evidenced for a single emitter an acceleration of spontaneous emission by a factor larger than 200, high brightness and radiative emission of multiexcitons. For high confinement dramatic broadening of emitted light could be obtained which require a new model to be interpreted.
During the internship, the student will study experimentally and theoretically regime of high interaction between field and nanoemitters. We will then investigate and interpretate the quantum properties of this nanosources.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO