

INTERNSHIP PROPOSAL

Laboratory name: Institut des NanoSciences de Paris

CNRS identification code: UMR 7588

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Web page: [quantum nanophotonics](http://quantumnanophotonics)

Internship location: Sorbonne université, Jussieu, 22-32, 5th floor

Thesis possibility after internship: YES

Funding: YES If YES, which type of funding: doctoral school

Collective resonance of a nano-antennas lattice

Keywords: plasmons, lithography, quantum dots, fluorescence

Under electromagnetic excitation, metal nano-objects can support collective electron oscillations, known as plasmon waves which allows the nanoparticle to be assimilated to an oscillating dipole that absorbs and scatters light. When illuminated with white light, a resonance (Localised Surface Plasmon Resonance, LSPR) whose center and width, typically a few tens of nanometres, depend on the dielectric constant of the metal, the shape of the nanoparticle and on the dielectric environment of the nanoparticle. This property makes it possible to create sensitive sensors based on the detection of LSPR resonance shifts when the nanoparticle's environment changes. However, the sensitivity of these sensors is limited by the width of the LSPR resonance. To increase sensitivity, these nanoparticles can be positioned as a lattice on a substrate. Given the periodicity of this arrangement, the first order diffraction of incident light at a given wavelength can propagate in the plane of the array resulting in a much thinner resonance used to increase the sensitivity of the sensor. This resonance is called Surface Lattice Resonance (SLR).

As part of this internship, we will fabricate arrays of gold nanoparticles above a gold mirrors, enabling us to observe collective resonance of such antennas lattice. We will characterize them optically and optimize the parameters to maximize the signal and its spectral finesse. In a second step, we will deposit CdSe/CdS quantum dots that resonate or do not resonate with the SLR modes, and study how their emission is modified by the resonance.

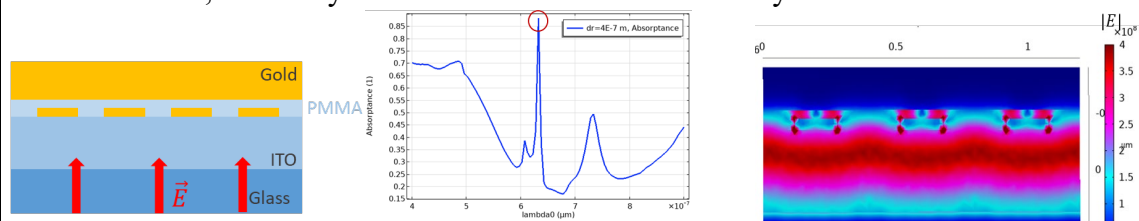


Figure 1: a) scheme of the antenna lattice, b) absorptance spectrum, c) resonance

: M1 and M2

Condensed Matter Physics: YES Quantum Physics: YES

Quantum Engineering: YES