Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 20/10/2017

Responsable du stage / *internship supervisor*:

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Nom du Laboratoire / *laboratory name*: Institut Langevin

Code d'identification : UMR7587 Organisme : ESPCI / CNRS

Site Internet / *web site*: https://www.institut-langevin.espci.fr/optical_antennas

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Active control of a single quantum emitter at room temperature

Gold nanostructures are broadband resonators that act as the optical equivalent of radiowave antennas by coupling a propagating field to a nanoscale element of matter, allowing them to enhance the fluorescence emission of a single quantum emitter at room temperature. At Institut Langevin, we exploit the DNA-driven self-assembly of gold particles to position single fluorescent molecules in the gap of plasmonic antennas providing enhancements of emission intensities and decay rates by more than two orders of magnitude (our recent results on this subject: Nature Commun. 3, 962 (2012), Angew. Chem. Int. Ed. 51, 11083 (2012), Nano Lett. 14, 284 (2014), ACS Nano 10, 4806 (2016) & ACS Photonics 3, 895 (2016)).

During this masters internship, the idea is to dynamically control the fluorescence intensity and lifetime of a single molecule by actively modulating the morphology of the plasmonic antenna (see figure 1). The idea is to tune the interparticle distance by physical (static electric field) or chemical (ionic strength) stimuli. We also recently designed gold nanoparticle dimers that stochastically shift in conformation. Because the coupling between a single fluorescent molecule and gold nanoparticles depends on their relative position at the nanometer scale, the conformation changes of the plasmonic antenna should tune the fluorescence intensity and lifetime by more than one order of magnitude.

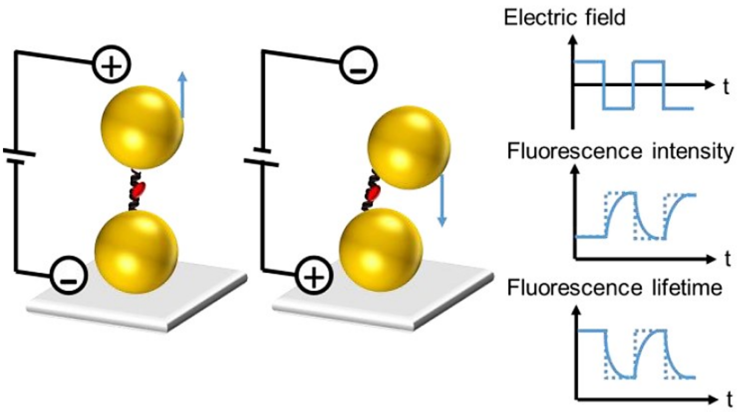

Figure 1: (Left) Schematic representation of a gold nanoparticle dimer that features a single fluorescent molecule in its gap and whose morphology is modulated by an applied static electric field. (Right) The dynamically controlled interparticle distance change induces a modulation of the fluorescence intensity and lifetime from a single quantum emitter at room temperature.

This master project can be followed by a PhD thesis during which these plasmonic antennas will be used to enhance the luminescence of multiple emitters and influence many-body processes such as superradiance. Another part of the PhD project can involve silicon-based optical antennas (see our recent papers: Phys. Rev. Applied 6, 064016 (2016) & Nano Lett. 16, pp 5143 (2016)) to control luminescence from solid-state emitters at room temperature by manipulating magnetic or electric light-matter interactions.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : oui**

Si oui, financement de thèse envisagé/ *financial support for the PhD***:** Submitted funding applications (ANR / ERC) under review. Ecole doctorale

Lumière, Matière, Interactions	**oui**	Lasers, Optique, Matière	**oui**

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