Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage

Date de la proposition : 21 Septembre 2016

Responsable du stage / *internship supervisor*:

Nom / *name*:	BIDAULT	Prénom/ *first name* :	Sébastien
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Nom du Laboratoire / *laboratory name*: Institut Langevin

Code d'identification : UMR 7587 Organisme : ESPCI et CNRS

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

Adresse / *address:* 1 rue Jussieu 75005 Paris

Lieu du stage / *internship place*: 1 rue Jussieu 75005 Paris

Titre du stage / *internship title*: **Nanoscale light harvesting in DNA templated optical antennas**

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. To position excitons with nanometer accuracy in optical antennas, we develop, at Institut Langevin, bottom-up fabrication strategies in which two gold particles are linked by a short DNA double-strand (M.P. Buson et al, Nano Lett. 11, 5060 (2011)) on which fluorescent emitters can be introduced (Fig. 1-a and b). This approach has allowed us to study precisely the interaction between a single quantum emitter and a broadband plasmon-based resonator at room temperature (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), Fig. 1-c).

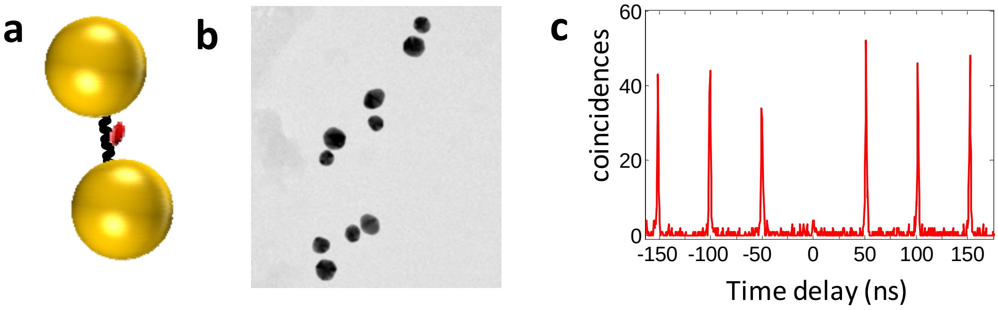

Figure 1: (a) Representation of a DNA-templated dimer with one fluorescent molecule. (b) TEM images of 30nm – 40nm gold particle dimers linked by a 30bp DNA strand. (c) Photon emission statistics of a dimer with one quantum emitter demonstrating photon antibunching and short fluorescence lifetimes.

Inspired by how nature optimized light-harvesting properties in photosynthetic proteins, we will analyze during this internship and a consecutive PhD thesis, how DNA can allow us to couple together fluorescent dyes that either intercalate between or replace nucleotides, providing unprecedented control over their position and relative orientations at the nanoscale. Associating these coupled emitters to a plasmonic antenna will allow us to further enhance emission rates in the femtosecond range to study coherent many-body effects at room temperature (such as superradiance). The optical response of these nanostructures will be studied by temporal and spectral measurements of the fluorescence signal from single nanoantennas and ensembles in suspension.

The assembly of fluorescent emitters in a broadband resonator should provide unprecedented control over temporal coherence from coupled excitons at room temperature and allow the optimization of light harvesting at the nanoscale.

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*: **Demandes de financements prévues (ANR, région Ile de France)**

Lasers, Optique, Matière	**OUI**	Lumière, Matière : Mesures Extrêmes	**OUI**
Plasmas : de l'espace au laboratoire	**OUI**		