

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Responsable du stage / *internship supervisor*: Dr. Paolo Maioli / Pr. Natalia Del Fatti

Tél : 04 72 44 81 82

Courriel / *mail*: paolo.maioli@univ-lyon1.fr

Nom du Laboratoire / *laboratory name*: Institut Lumière Matière (iLM) - FemtoNanoOptics group

Code d'identification : UMR5306

Organisme : Université Claude Bernard Lyon 1

Site Internet / *web site*: <http://ilm.univ-lyon1.fr/femtonanooptics>

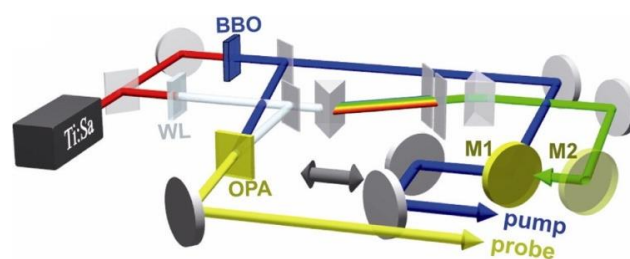
Adresse / *address*: Bâtiment Kastler, 10 rue Ada Byron, 69622 Villeurbanne CEDEX, France

Lieu du stage / *internship place*: Campus LyonTech-La Doua (LYON)

Ultrafast charge and energy transfer at the interface between metal nanoparticles and molecules

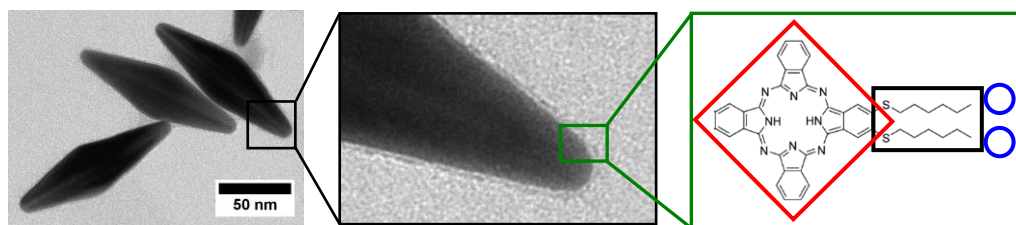
Organic-inorganic hybrid nanomaterials are a class of nanometric systems with promising applications for molecule detection, photocatalysis and photovoltaic energy conversion. The electrons in the molecule, after excitation by light absorption, may decay to lower energy states either by emitting light (luminescence) or migrating to the metal nanoparticle, which generates an electric current.

During this master project, we aim at experimentally investigating the charge and energy transfer processes at the interface between organic molecules (phthalocyanine) and metal nano-objects (gold nano-bipyramids) in nanohybrid systems, using **ultrafast laser spectroscopy** (Ti:Sa femtosecond laser). Applying a pump-probe approach developed in our group [1], we will characterize and optimize these transfers at the nanometric interface, through ultrafast measurement of the metal absorption change near the nanoparticle surface plasmon resonance. The effects of the shapes of nanoparticles (spherical or elongated, tip curvature effects, ...), of the type and morphology of the molecules and on the interface contact will be explored.



Laser setup for pump-probe spectroscopy

We will also **develop a unique experimental setup** leading to the determination of the absolute value of the absorption spectrum of a single nano-object correlated with the measurement of its luminescence spectrum (this setup is based on a spatial modulation microscopy coupled with a CCD camera): in this case investigations will be carried out on a **single nanohybrid**.



Transmission electron microscopy images of gold nano-bipyramids coated with phthalocyanine

The project is realized in **collaboration with the Laboratory of Chemistry of ENS** in Lyon (teams "Functional Materials and Photonics" for the sample synthesis and "Theoretical Chemistry" for the quantum modelling of interfaces) and is supported by the French Laboratoire d'Excellence LABEX iMUST.

This internship can be extended into a PhD.

[1] D. Mongin, E. Shaviv, P. Maioli, A. Crut, U. Banin, N. Del Fatti, and F. Vallée, ACS Nano 6, 7034 (2012)

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

Si oui, financement de thèse envisagé/ financial support for the PhD: Fellowship « école doctorale »

Lumière, Matière, Interactions

X

Lasers, Optique, Matière

X