

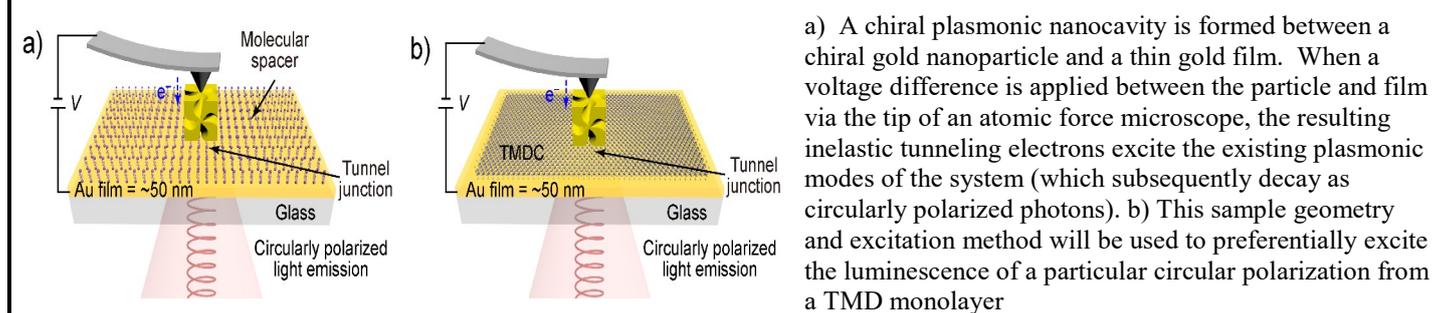
Proposition de stage/ Internship proposal (1 page max)

Date de la proposition : 13 octobre 2022

Responsable du stage / internship supervisor:		
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Nom du Laboratoire / laboratory name: Institut des Sciences Moléculaires d'Orsay (ISMO)		
Code d'identification :	UMR 8214	Organisme : CNRS – Université Paris-Saclay
Site Internet / web site:	http://www.ismo.universite-paris-saclay.fr/	
Adresse / address:	Bât. 520, rue André Rivière, Campus universitaire d'Orsay, 91405 Orsay cedex	
Lieu du stage / internship place:	à l'ISMO (même adresse)	

Titre du stage / internship title: Electrically-excited CHiral nanoCavities (ChiC)

Résumé / summary
 Chiral structures, whose initial and mirror structural images cannot be superimposed, interact differently with left-handed and right-handed circularly polarized light. This is called the “chiroptical response”. Chirality is a crucial property for many essential molecules in biology. Most often, however, the corresponding chiroptical response is very weak. Gold plasmonic nanoparticles, on the other hand, have a relatively strong chiroptical response. A plasmonic nanocavity is formed when a nanoscale gap separates a noble metal nanoparticle from a metallic substrate (see Fig. 1a). The electromagnetic field in such a nanocavity is dramatically enhanced, thanks to the plasmonic resonances which “concentrate” the electromagnetic field. The main idea of this project is thus to apply this principle to chiral plasmonic cavities and thus enhance the chiral interactions between light and matter.
 The goal of this internship is to locally and electrically excite chiral plasmonic nanocavities, with the goal of using them to enhance the chiral properties of a new class of two-dimensional semiconductors called TMDs (transition metal dichalcogenides). Examples of such structures are shown in the figure below. What makes these nanoparticles “plasmonic” is that they may support localized surface plasmons, i.e., collective surface electron oscillations coupled to an electromagnetic wave. In order to locally excite “right-handed” and “left-handed” nanocavities, and subsequently detect right-handed or left-handed circularly polarized light, we will complete the electric circuit using the conducting tip of an atomic force microscope (AFM). These experiments raise many fundamental questions; in particular, may the polarization of the emitted light be controlled by the “handedness” of the particle?
 During this internship, the student will acquire experience in (i) atomic force microscopy (imaging of the chiral structures and excitation), (ii) optical microscopy (the detection and analysis of the emitted light) and (iii) the theory of plasmonics and TMDs (“valleytronics”).



For more information about our work:
<https://www.youtube.com/watch?v=nqqpkWicR2k> (in French)
https://www.youtube.com/watch?v=bZAslW25_dQ (in French)
<http://www.ismo.u-psud.fr/spip.php?rubrique199> (available in French and English)

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: ANR-funded Ph.D. thesis available