Stage de master de physique / Physics Master Internship

Proposition de stage/ Internship proposal (1 page max)

Date de la proposition : 13 octobre 2022

Responsable du stage / *internship supervisor*:

Nom / *name*:	Le Moal	Prénom/ *first name* :	Eric
Tél :	0169156697	Fax :	
Courriel / *mail*:	eric.le-moal@universite-paris-saclay.fr		

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*: Controlling the luminescence of two-dimensional semiconductors on the nanoscale

Résumé / *summary*

Two-dimensional (2D) semiconducting materials, such as transition metal dichalcogenide (TMD) monolayers, are key in the development of future device technologies. This is because such materials are only a few atoms thick and have unique optical and electronic properties. TMD monolayers are also considered an ideal platform for the study of excitons, i.e., bounded electron-hole pairs, in 2D materials. Controlling the generation of excitons, their radiative decay, and their interactions with free charge carriers in 2D semiconductors is crucial for applications, e.g., in photovoltaic and light emitting devices.

In this Masters thesis, the student will use nano-optical tools to probe the excitonic properties of TMD monolayers on the nanometer scale. The tunneling current between the sample and the tip of a scanning tunneling microscope (STM) will serve to locally excite the electroluminescence of the 2D semiconductor and to control the local density of charge carriers in the 2D semiconductor. The resulting light will be analyzed using optical microscopy and spectroscopy.

In the PhD thesis following this Masters project, the student will carry out cutting-edge nano-optics experiments using the STM on "twist-engineered" heterostructures of these TMD monolayers. As has been recently discovered, new material properties appear in such layered heterostructures for certain values of the misalignment angle (or "twist") between adjacent layers.

During this internship, the student will acquire experience in (i) STM-based nano-optics, (ii) optical microscopy and spectroscopy and (iii) exciton physics in novel 2D materials.

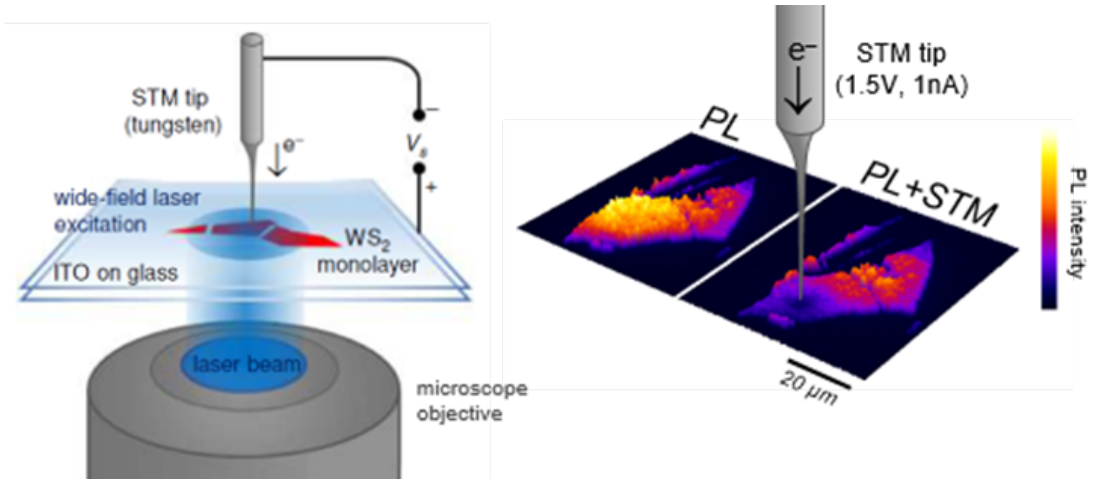

Figure: schematics of the experiment. The tunnelling current between the STM tip and the sample is used to control the photoluminescence (PL) yield of a tungsten disulfide (WS_2) monolayer.

For more information about our work: https://arxiv.org/abs/2205.12789 (in English)
https://www.inp.cnrs.fr/fr/cnrsinfo/cartographier-lechelle-nano-lelectroluminescence-dun-semiconducteur-bidimensionnel (in French)

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**