Title: Femtosecond Stark Spectroscopy of Two-dimensional Perovskite Semiconductor Nanostructures

Summary:

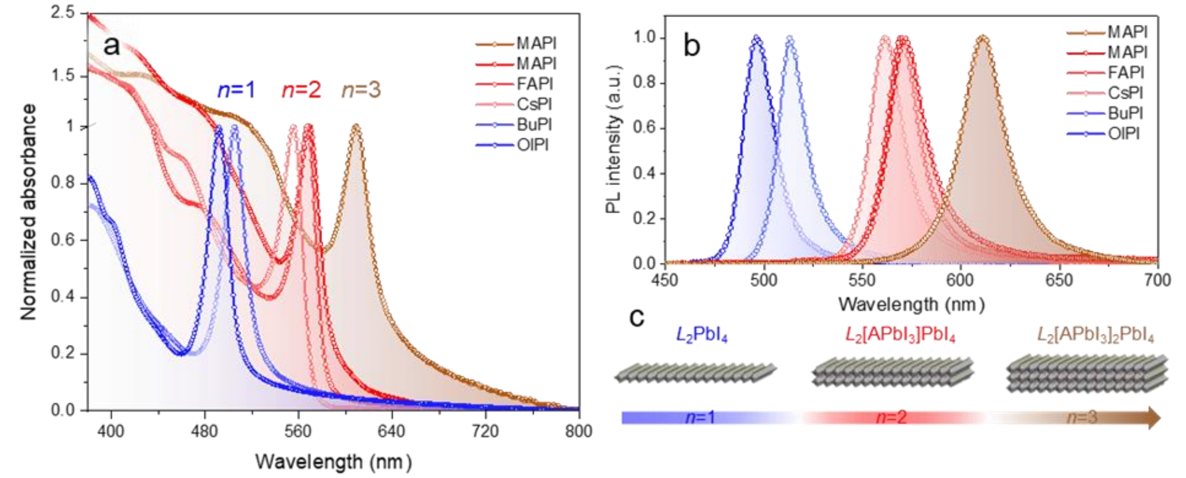

Figure 1. Absorption **(a)** and photoluminescence **(b)** spectra of 2D perovskite nanoplatelets of 1 to 3 monolayer in thickness (*n*=1, 2, 3) with corresponding schematics **(c)**. *L*=alkylammonium ligands, A= methylammonium (MA), formamidinium (FA) or cesium (Cs).

Context: 2D semiconductor nanostructures have emerged as very promising photoactive materials for various opto-electronic applications such as LEDs and lasers, as well as solar cells, photodetectors or solar concentrators. The optical and electronic properties of these 2D materials rely on the strong 1D confinement along their thickness, composed of only a few monolayers, that leads to quantum well nanostructures with quasi-2D excitons and thickness-dependent optical bandgap. However, in order to increase the performance of the light-energy conversion in the opto-electronic devices, a deep understanding of the fundamental photophysics in these 2D photoactive materials and dynamics are necessary, such as charge- and energy- transfer in the hybrid- and/or hetero-nanostructures, hot exciton relaxation, multiple exciton interactions and recombination.

Project: In this project, we propose to combine femtoseconde pump-probe and Stark (differential emission or absorption with and without applied electric field) spectroscopy to investigate the effect of the in-plane exciton delocalization and charge transfer character (misoverlap between the electron and hole wavefunction) in hybrid- and hetero- 2D nanostructures such as colloidal perovskite (**Fig. 1**) or metal chalcogenide nanoplatelets. The student will be using the femtosecond transient absorption and/or the TR-photoluminescence apparatus available at NOOS/LuMIn research team/lab and will develop and run the TR-Stark experiments. Measurements at cryogenic temperatures will be considered. This Master internship could lead to a PhD thesis.

Requirement: A strong background in Physics, with training on nonlinear Optics, quantum Mechanics, and solid-state Physics. Motivated student only. Additional skills: good knowledge in in-line coding for data treatments and eventually in Labview programing.

Contact: **Elsa CASSETTE** (elsa.cassette@universite-paris-saclay.fr); Jean-Sébastien LAURET (lauret@ens-paris-saclay.fr)

Laboratoire Lumière, Matière et Interfaces
FRE 2036, Université Paris-Saclay, CNRS, ENS Paris-Saclay, Centrale-Supélec

Team website: https://www.noos.universite-paris-saclay.fr/.
Lab website: https://www.lumin.universite-paris-saclay.fr/