INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Laboratoire Lumière, Matière et Interfaces (LuMIn)
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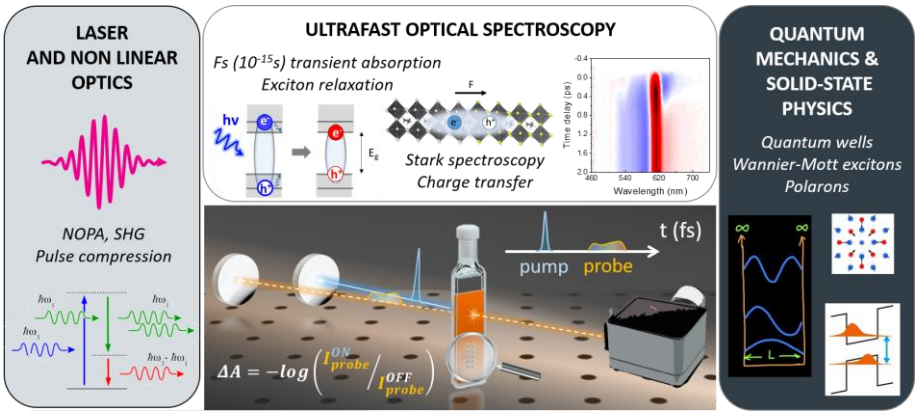
Thesis possibility after internship: YES
Funding: NO If YES, which type of funding:

Ultrafast Stark Spectroscopy of Two-dimensional Semiconductor Nanostructures

Keywords: ultrafast optical spectroscopy, exciton photophysics, charge transfer, Stark effect, 2D heterostructure, nonlinear optics, colloidal quantum wells



Context: 2D semiconductor nanostructures have emerged as very promising photoactive materials for various opto-electronic applications (LEDs, lasers, solar cells, photodetectors, etc...). The strong confinement along their thickness leads to quantum well nanostructures with quasi-2D excitons, resulting in strongly thickness-dependent optical and electronic properties. The recent development of original in-plane and out-of plane colloidal hetero-structures composed of 2D semiconductors of only a few monolayers in thickness opens a way to control these properties to a higher level by precisely engineering the excitonic states. However, it requires a deep understanding of the photo-physics in these nanostructures and in particular the exciton dynamics, which is of fundamental interest to reach the highest performances of the light-energy conversion.

Project: In this project, we aim at investigating the ultrafast dynamical processes in colloidal hetero-nanoplatelets composed of halide perovskite and/or metal chalcogenide semiconductors, such as charge- and energy- transfer, hot exciton relaxation, (multiple) exciton interactions and recombinations. We propose to combine ultrafast optical technics with Stark spectroscopies to investigate the effect of the in-plane exciton delocalization and charge transfer character (spatial separation of the electron and hole wavefunctions). The student will be using the femtosecond transient absorption and the time-resolved photoluminescence apparatus (picosecond streak camera) available in our group and will develop and run the TR-Stark experiments.

Requirement: Background in Physics: nonlinear Optics, Quantum Mechanics and Solid-State Physics

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO