

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: **GEMaC**
CNRS identification code: **UMR 8635**
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Internship location: **GEMaC 45 Avenue des Etats-Unis 78035 Versailles**

Thesis possibility after internship: **YES**
Funding: **YES** If YES, which type of funding: **ANR project**

Excitonic and spin properties of halide perovskites

In recent years, halide perovskites have demonstrated exceptional optoelectronic properties. This new class of semiconductor materials has proved an extraordinary potential for the production of low-cost solar cells and light-emitting devices.[1] Perovskite solar cells have made lightning progress, and now boast efficiencies over 26%, on par with the best silicon-based solar cells. This success leads to significant research effort to understand the physical origins of their performance.[2-4] Halide perovskites are also promising for spintronic applications. They present a strong spin-orbit coupling, a relatively long spin relaxation times, and optical accessibility for spin generation and defection. Room temperature coherent optical manipulation of spins has been recently achieved.[5] High spin injection efficiency has been demonstrated at room temperature at a chiral perovskite/III-V interface.[6] The objective of the Master thesis, which could be followed by a PhD thesis, is to explore the exciton and spin properties of halide perovskites. The samples are synthesized in collaboration with LuMIn and ISMO laboratory from University Paris-Saclay, in the context of the ANR project HAPERO. The candidate will study high quality perovskite thin films, obtained by vacuum growth, and controlled in-situ with extremely sensitive characterization techniques.

The candidate will conduct experimental research based on optical microscopy and spectroscopy. The set-up includes a confocal microscope operating at cryogenic temperature (4K-300K), a superconducting magnet for application of magnetic field (9T). The candidate should have a good background in solid-state physics and optics, and have a taste for experimental research. Good communication skills in English are required. The research work will take place at GEMaC (Versailles, France), in the Quantum Nanophotonics axis.

The GEMaC is a joint unit of the CNRS and the Université de Versailles Saint-Quentin-en-Yvelines, member of the Université Paris-Saclay.

- [1] Azmi, R et al. Nature 628(8006), 93—98, 2024
[2] Urban, J. M et al., physica status solidi (RRL) 17(7), 2300005, 2023
[3] Delpont, G. et al., J. Phys. Chem. Lett. 10(17), 5153—5159, 2019
[4] Diab, H. et al, J. Phys. Chem. Lett. 7, 5093—5100, 2016
[5] Lin, X. et al., Nature Nanotechnology 18(2), 124—130, 2022
[6] Hautzinger, M. P et al., Nature 631(8020), 307—312, 2024

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