M2 Internship offer:

Light-trapping and conductive nanopatterns for Perovskite and Colloidal Quantum Dot-Based Solar Cells

Research team: i-Lum, light engineering and conversion

Locations: La Doua Campus, Ecole Centrale de Lyon

Keywords: Solar cells, Halide perovskites, Nanofabrication, Nanoimprint, Nanophotonics

Profile: Material science, physico-chemistry, thin film technologies

Duration: 4-6 month.

Context:
For future tandem solar cells, combining two halide perovskite absorbing layers is a very promising solution, combining solution-based processes and high efficiency. This internship is part of the ANR NBG_SolarCells project, which aims to develop innovative perovskite solar cells capable of absorbing near-infrared (NIR) photons. The goal is to design solar cells using lead-free or low-lead materials, such as Sn-Pb perovskites and $AgBiS_2$ colloidal quantum dots. A pivotal stage in this undertaking involves creating nanopatterns that function simultaneously as contact layer, light-trapping structure and a supportive framework for these dynamic substances. This action aims to boost charge collection effectiveness and the overall efficiency of the solar cell.

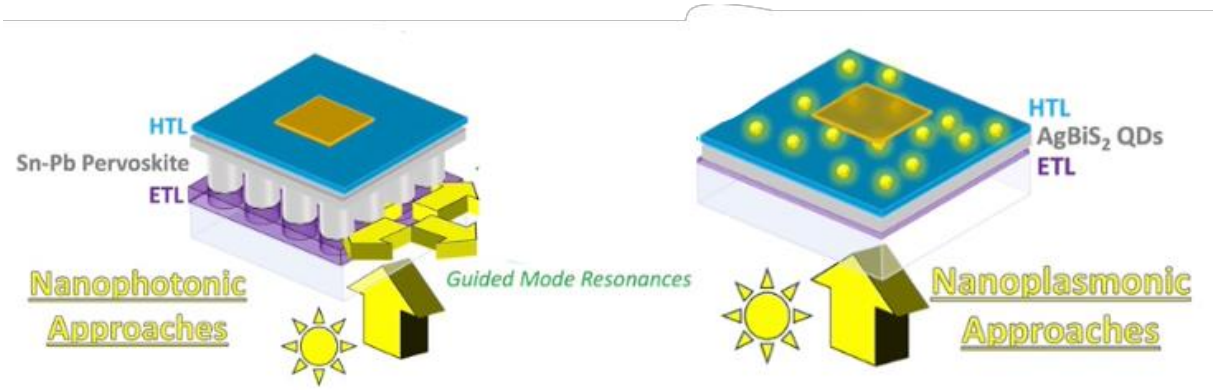

Figure 1: Schematic exhibiting the two NBG solar cell systems and proposed approaches .

Internship objectives:
The student will participate in the fabrication and optimization of nanostructures using the Nano-Imprint Lithography (NIL) process available at the NanoLyon platform. This process allows the creation of well-defined, low-roughness patterns, suited for charge transport layers (ETL and HTL) in photovoltaic devices. The main tasks will include:

- Fabrication of nanostructures for electron transport layers (ETL) based on SnO_2 and hole transport layers (HTL) using polymer (PTAA or doped PTAA).
- Fabrication of the master stamps to perform the NIL step, using laser interference lithography and dry etching.

- Optimization of NIL process parameters (pressure, temperature, etc.) to ensure nanostructures are tailored to the active materials.
- Characterization of the nanostructures to assess their quality and compatibility with perovskite and colloidal quantum dot absorbers.

Candidate profile:
We are looking for a Master's student (M2) with a background in physical chemistry, ideally in materials science applied to thin-film photovoltaic technologies. The applicant should have a foundational understanding of thin-film deposition methods and material characterization techniques, such as electron microscopy and spectroscopy. Scientific curiosity, teamwork skills, and a strong interest in experimental research are essential qualities for this internship.

Integration at INL:
The research will primarily be conducted within the Nanolyon technological platform, including cleanroom facilities for Micro-Nano Fabrication spread across the two INL sites, La Doua campus (Villeurbanne) and Écully.

Supervision / Contact:
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