INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Laboratoire de Physique des Solides (LPS)
CNRS identification code: UMR 8502
Internship director'surname: Luiz Tizei
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Internship location: LPS, Orsay

Thesis possibility after internship: YES
Funding: NO If YES, which type of funding:

Heat transport in confined metal nanowires

The miniaturization of electronic devices has led to a critical need for understanding heat transport at the nanoscale. Phonons, the carriers of heat in solids, play a crucial role in determining the performance and reliability of these devices. However, measuring phonon transport in nanostructures with both high temporal and spatial resolution remains a significant challenge. In this internship, we will explore a novel technique that allows us to directly probe the thermal behavior of nanomaterials at unprecedented scales.
Recent advances in event-based direct detectors in electron microscopy [1] open new possibilities. At the LPS Orsay, a new method based on synchronized focused-photon excitation and electron scattering of nanostructures [2] allows for temperature measurements with nanosecond and nanometer resolution [3]. In this M2 internship we will explore this new technique to first measure the thermal transport properties of nanoscale metallic nanowires.
This internship will involve the production of metallic nanowires using electron beam lithography and metal evaporation, the realization of electron spectroscopy in a state-of-the-art electron microscope, including world-wide unique light injection experiments, and data modeling for thermal transport. The ideal candidate will have a strong background in solid-state physics, with a focus on experimental techniques. Experience with data analysis tools (specifically Python) is essential. Familiarity with thermal transport theory and modeling would be a plus.
References
[1] Y. Auad et al., Ultramicroscopy 239 (2022) 113539; Y. Auad, et al., Ultramicroscopy 257 (2024) 113889.
[2] Y. Auad, et al., Nat. Comm. 14 (2023) 4442; N. Varkentina et al. Sci. Adv. 8 (2022) eabq4947.
[3] F. Castioni, et al., in preparation (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: NO Theoretical Physics: NO