

Post-doc: Modeling quantum transport at the nanoscale in disordered semiconductors

Presentation of Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris

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It has 400 engineering students, 600 researchers in 9 joint research units, and approximately 100 research and teaching support staff.

Institution

The work will take place at the Langevin Institute (ESPCI, CNRS UMR 7587), in the 5th arrondissement of Paris, under the supervision of Marcel Filoche. The Langevin Institute is renowned worldwide for its work on wave control in complex media.

Position description

Nitride-based III-N semiconductor alloys, such as InGaN, exhibit random local compositional fluctuations that have a profound impact on the structure of the electron and hole wave functions. Depending on the composition of the material and the energy considered, these wave functions can significantly depart from the Bloch waves found in a perfect crystal which are delocalized in the whole structure, and on the contrary localize exponentially at specific sites. The electronic transport is then deeply modified at the nanometric scale, especially at low energy, taking percolation paths through the structure.

The project will consist in developing a quantum model of transport at the nanoscale in these materials based on the localization landscape theory (Filoche & Mayboroda, PNAS 2012) in a Wigner-Weyl type approach (in phase space). The localization landscape theory is a recently developed and groundbreaking approach that sheds new light on the role of structural disorder in the formation of standing waves, and in particular quantum waves.

Profile

Required background:

- Very good knowledge of wave physics in complex media and of matrix algebra.
- Very good knowledge of localization phenomena of eigenfunctions, in particular for quantum waves.
- Significant background in semiconductor physics will be highly appreciated, in particular regarding disordered semiconductor alloys of the III-nitride family.
- Very good writing skills.

Required education (or degree): Ph.D. thesis

Experience: wave physics, semiconductor physics, programming, numerical simulation by finite elements.

Hiring

Category: Post-doc

Salary: Depending on experience.

Position opened from: April 1st, 2023

Contact

Applications (CV, cover letter) should be sent by email to Marcel Filoche (marcel.filoche@espci.psl.eu).

Location

Institut Langevin, 1, Rue Jussieu 75005 Paris