Institut Langevin
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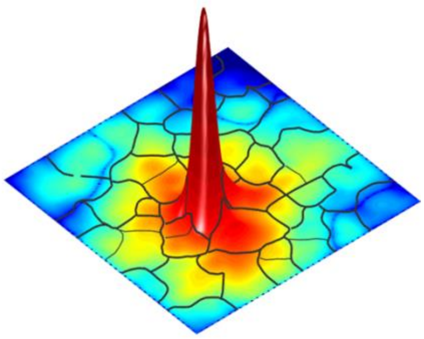
# Anderson transition in random graphs and small world networks

## Context of the internship

The internship is part of a research project on wave localization and in particular on Anderson localization. The latter consists in the exponentially strong localization of waves propagating through a disordered medium. In the case of matter waves (quantum), the disorder is introduced through a random potential. It was predicted theoretically in 1958 by the American physicist Philip W. Anderson (Nobel Prize 1977, link), but it was not observed until 2008 in a quantum model system (by Alain Aspect's team, Nobel prize 2022, link). The deep mechanisms of Anderson localization, as well as the implications of localization on wave transport raise many unresolved questions, and are the subject of active research. In particular, depending on the dimension or connectivity of the space, and depending on the energy of the state, a transition between localized states at low energy and delocalized states at higher energy can appear. The determination of the threshold of this transition ("the mobility edge") and of the associated critical exponents remains a completely open problem.

## Goal of the internship

In 2012, M. Filoche and S. Mayboroda introduced a theoretical and mathematical tool called localization landscape (link), which brought a completely renewed perspective on this phenomenon. The objective of the internship will be to study numerically and theoretically the Anderson transition in networks with random connectivity (random graphs), and to understand the position of the "mobility edge" by using the localization landscape theory.



*Anderson localization of a quantum wave in a random potential. The dark lines represent the possible confinement regions predicted by the localization landscape.*

The candidate should be comfortable with the use of numerical tools and have some basic programming skills (Matlab or Python).

This internship may lead to a PhD thesis within the "Localization of Waves" project (https://wave.umn.edu) funded by the Simons Foundation.

## Contact

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