PHYSIKALISCHES KOLLOQUIUM

AM 8. JUNI 2015 UM 17 UHR C.T.

IM GROßEN HÖRSAAL

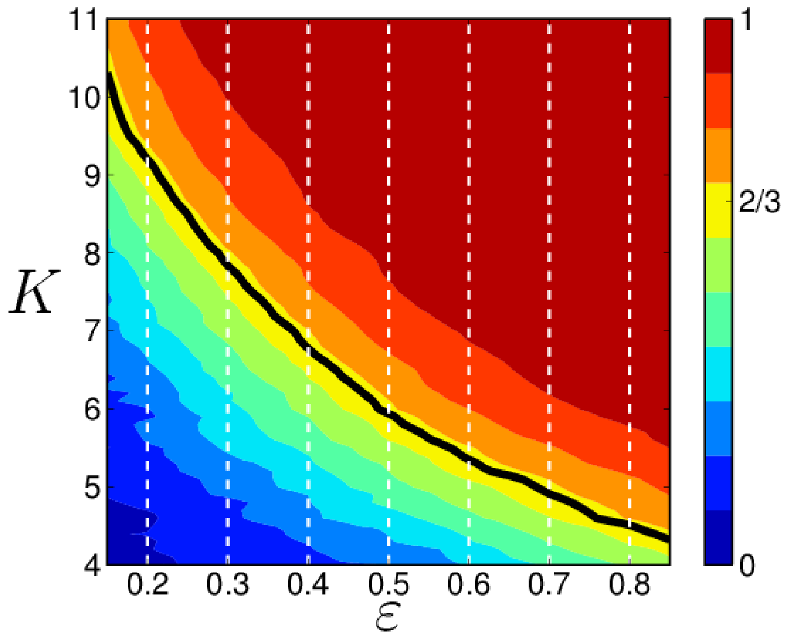

Figure: Anisotropy phase diagram of the Anderson transition:

QUANTUM CHAOS AND DISORDER: SIMULATING THE ANDERSON MODEL WITH THE ATOMIC KICKED ROTOR

PROF. DR. JEAN-CLAUDE GARREAU

UNIVERSITE DE LILLE

“Quantum simulation” is one of the most active trends in ultracold-atom physics. A quantum simulator is a system that mimics the dynamics of another system; the advantage being that the quantum simulator is simpler than the original, either from the experimental or the theoretical point of view (or both).

The Anderson model is a paradigm for quantum disorder, originally introduced in the realm of solid-state physics; however, quantum solid-state disordered systems are very difficult to study experimentally and numerically (except in the one-dimensional case). The kicked rotor is a paradigm for classical and quantum Hamiltonian chaos, essentially because it is very easy to simulate it in a computer. Its quantum realization with ultracold atoms is a relatively simple, “clean” (e.g. of decoherence sources) and controllable system. Amazingly, the quantum kicked rotor can be mathematically mapped onto the Anderson model. It is thus a subtle quantum simulator of the physics of disordered systems.

In this talk I will describe a series of experiments we have performed in Lille taking advantage of the correspondence between disordered physics and the atomic kicked rotor to investigate experimentally in great detail the Anderson metal-insulator transition, which lead, in particular, to the first experimental measurement of its critical exponent.