

Prize Talk PV VIII Wed 14:00 V53.01
3D Anderson localization of ultracold atoms in an optical disordered potential — ●ALAIN ASPECT — Institut d'Optique, Palaiseau, France — Laureate of the Herbert-Walther-Prize

Anderson localization (AL) is a quantum interference phenomenon proposed to understand how disorder can lead to the total cancelation of electron conduction. Its classical waves counterpart has been studied in acoustics or electromagnetism, but direct observation with particles remains a challenge. I will report on our observation of three dimensional (3D) localization of ultra-cold atoms, in a disordered potential created by a speckle laser field. A phenomenological analysis

of our data allows us to identify a localized component and a diffusive component. The localization we observe can be interpreted neither as classical trapping of particles with energy below the classical percolation threshold in the disorder, nor as quantum trapping in local potential minima. In contrast, our data are compatible with the self-consistent theory of AL applied to our specific situation, provided we introduce a heuristic energy shift whose interpretation remains to be elucidated. We will discuss how experimental progress will allow us to have a genuine cold atoms quantum simulator, allowing us to shed light on an emblematic problem of Condensed Matter Physics for which no microscopic exact theory exists.