

# Anderson localization in a disorder-free atomic mixture

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Anderson localization – the halt of quantum transport in a strongly disordered potential – has been observed for quantum gases in optical potentials. An important stage of experiments is the creation and characterization of the optical (speckle) potential that typically features nontrivial correlations complicating the interpretation of measurements. We realize an alternative route towards Anderson localization of cold atoms using a mixture of two strongly mass-imbalanced atomic species without any externally imposed disordered potential [1]. On short time scales, the heavy component can be considered immobile and creates a quasi-static scattering potential for the light component that experiences Anderson localization under appropriate conditions. Experimental results allow for a quantitative description based on the model of randomly distributed resonant point scatterers. This demonstrates an interesting and fruitful link between the phenomenon of (single-particle) Anderson localization and the so-called many-body localization that takes place in interacting quantum systems composed of many particles, which is the case of our experimental system.

[1]. S. Finelli, B. Restivo, A. Ciamei, A. Trenkwalder, M. Inguscio, D.S. Petrov, S.E. Skipetrov, M. Zaccanti, Anomalous diffusion and localization in a disorder-free atomic mixture, <https://doi.org/10.48550/arXiv.2601.13226>