MAR07-2006-003541

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Weak and strong localization of cold bosons in optical speckle potentials

CORD A. MÜLLER, Universität Bayreuth, Germany

Cold bosons in optical speckle potentials allow to study quantum transport in various geometries under the influence of disorder and dephasing. We use a diagrammatic Green's function approach to calculate the quantum diffusion constant for cold bosonic matter waves in the single-particle regime in optical speckle potentials. These random potentials display strong correlations that were suspected to reduce quantum coherent effects. Our analytical linear-response theory shows that current experiments should be able to measure weak localization corrections to the classical Boltzmann diffusion constant, even in 2 or 3 dimensions. Moreover, the threshold to the strongly (or Anderson) localized regime is accessible if atoms are cold enough and prepared with a sufficiently small momentum dispersion [R. Kuhn et al., Phys. Rev. Lett. 95, 250403 (2005)].