Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Anderson localization and correlation-induced delocalization in N-leg optical lattices TIGRAN SEDRAKYAN, Fine Theoretical Physics Institute, University of Minnesota, JASON KESTNER, SANKAR DAS SARMA, University of Maryland, College Park — Recent experiments demonstrated localization of ultracold neutral atoms in a disordered optical potential. The great advantage of these atomic systems is the control of disorder form and strength, interactions, dimensionality, etc., in principle allowing for unambiguous observation of the phenomenon under a variety of circumstances. However, the localization observed so far is qualitatively indistinguishable from classical localization of particles in a disordered trapping potential. We propose a realization of the one-dimensional random dimer model and certain N-leg generalizations using cold atoms in an optical lattice. These models exhibit multiple delocalization energies that depend strongly on the symmetry properties of the corresponding Hamiltonian. We demonstrate that the N-leg systems possess similarities with their 1D ancestors but are demonstrably distinct. The existence of critical delocalization energies leads to dips in the momentum distribution which serve as a clear signal of the localization-delocalization transition.

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Date submitted: 08 Dec 2011 Electronic form version 1.4