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Diffusion dynamics in the disordered Bose Hubbard model[1]
LAURA WADLEIGH, PHILIP RUSS, BRIAN DEMARCO, University of Illinois at Urbana-Champaign — We explore the dynamics of diffusion for out-of-equilibrium superfluid, Mott insulator, and Bose glass states using an atomic realization of the disordered Bose Hubbard (DBH) model. Dynamics in strongly correlated systems, especially far from equilibrium, are not well understood. The introduction of disorder further complicates these systems. We realize the DBH model—which has been central to our understanding of quantum phase transitions in disordered systems—using ultracold Rubidium-87 atoms trapped in a cubic disordered optical lattice. By tightly focusing a beam into the center of the gas, we create a hole in the atomic density profile. We achieve Mott insulator, superfluid, or Bose glass states by varying the interaction and disorder strength, and measure the time evolution of the density profile after removing the central barrier. This allows us to infer diffusion rates from the velocities at the edge of the hole and to look for signatures of superfluid puddles in the Bose glass state.

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