

Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Measurement-induced Localization in an Ultracold Lattice Gas¹
SRIVATSAN CHAKRAM, YOGESH SHARAD PATIL, MUKUND VENGALATTORE, Cornell University — We demonstrate the control of quantum tunneling in an ultracold lattice gas by the measurement backaction imposed by an imaging process. The backaction induced by position measurements modifies the coherent quantum tunneling of atoms within the lattice. We vary the rate at which atoms are imaged, and observe the crossover from the weak measurement regime, where the measurement has a negligible effect on coherent dynamics, to the strong measurement regime, where measurement-induced localization leads to a dramatic suppression of tunneling - a manifestation of the Quantum Zeno effect [1]. Our technique demonstrates a powerful tool for the control of an interacting many-body quantum system via spatially resolved measurement backaction. We also shed light on the implications of quantum measurement on the coherent evolution of a mesoscopic quantum system.

[1] Y. S. Patil *et al.* arXiv: 1411.2678

¹This work is supported by the ARO MURI on non-equilibrium dynamics.

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Date submitted: 30 Jan 2015

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