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A driven dissipative phase transition in an ultracold lattice gas
YOGESH S PATIL, HIL F H CHEUNG, MUKUND VENGALATTORE, Cornell University — Optical lattice gasses have emerged as a powerful platform for the study of correlated quantum behavior both in equilibrium and in non-equilibrium settings. Most studies to date have benefited from the isolation of these gasses from environmental sources of dissipation to realize long-lived coherent quantum dynamics. However, a growing body of theoretical work [1,2] has focused on novel forms of many-body phases arising from the interplay between coherent quantum dynamics and dissipation. Such driven, dissipative systems are predicted to exhibit quantum critical behavior, dynamical phase transitions and quantum many-body effects that lie beyond the conventional description and classification of equilibrium phase transitions. Here, we describe the realization of a metal-to-insulator transition (MIT) in an ultracold lattice gas arising from the competition between quantum coherence and dissipation in the form of tunable photon scattering. We discuss key aspects of the phase diagram of this system, novel features arising from its non-equilibrium nature and correspondences between our system and quantum percolation models in the presence of quenched disorder. [1] S. Diehl et al., Nature Physics 4, 878 - 883 (2008) [2] L. M. Sieberer et al., Phys. Rev. Lett. 110, 195301

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