Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Site-resolved probing of the many-body localization transition in one dimension[1] JULIAN LEONARD, ALEXANDER LUKIN, MATTHEW RISPOLI, ROBERT SCHITTKO, SOOSHIN KIM, VEDIKA KHEMANI, Harvard University, ADAM KAUFMAN, University of Colorado, Boulder, M. ERIC TAI, MARKUS GREINER, Harvard University — Many-body localization (MBL) challenges our understanding of thermalization in quantum systems. While non-equilibrium systems usually relax and approach thermal equilibrium, MBL systems remain in a state far from equilibrium. We study this behavior in a Bose-Hubbard chain that is subject to a controlled disorder potential. We start with a system at unity filling and prepare it in an out-of-equilibrium state by quenching the tunneling rate from zero a to a finite value. By performing site-resolved full counting statistics, we are able to locally measure the atom number distribution and extract the on-site entropy. We observe the breakdown of thermalization at a critical disorder strength, time dynamics in the thermal, the critical, and the MBL regimes, and an increasing density-density correlation length when approaching the critical point.

[1]National Science Foundation, Gordon and Betty Moore Foundations EPiQS Initiative, Air Force Office of Scientific Research MURI program

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Date submitted: 26 Jan 2018 Electronic form version 1.4