Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Observation of quantum thermalization and progress towards the many-body localized regime ADAM KAUFMAN, ERIC TAI, ALEX LUKIN, MATTHEW RISPOLI, ROBERT SCHITTKO, TIM MENKE, Harvard University, PHILIPP PREISS, University of Heidelberg, MARKUS GREINER, Harvard University — In classical thermodynamics entropy plays a crucial role. A classical many-body system equilibrates to a maximally entropic state, and will quickly re-thermalize when perturbed. In contrast, the total entropy of an isolated quantum many-body system does not change following a global or local quantum quench. Nevertheless, sufficiently local observables quickly thermalize to steady state values which are well described by entropic thermal ensembles. Surprisingly, this thermalization is absent in the presence of sufficiently high disorder. In this regime, the system can retain memory of its initial state even at infinite times. We explore these phenomena in a 1D Bose-Hubbard system of ultracold rubidium atoms under a quantum gas microscope. Our microscope gives us unique access to local observables as well as the ability to measure entanglement entropy both locally and globally. We observe a fast growth in subsystems' entanglement entropy after the quench and describe how it provides thermalization for local observables. We have now added disorder to our system to study the breakdown of thermalization in the many-body localized regime; we will present our progress towards these measurements.

Adam Kaufman
Harvard University

Date submitted: 29 Jan 2017 Electronic form version 1.4