Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Preparing and probing many-body correlated systems in a Quantum Gas Microscope by engineering arbitrary landscape potentials MATTHEW RISPOLI, ALEXANDER LUKIN, RUICHAO MA, PHILIPP PREISS, M. ERIC TAI, RAJIBUL ISLAM, MARKUS GREINER, Harvard University — Ultracold atoms in optical lattices provide a versatile tool box for observing the emergence of strongly correlated physics in quantum systems. Dynamic control of optical potentials on the single-site level allows us to prepare and probe many-body quantum states through local Hamiltonian engineering. We achieve these high precision levels of optical control through spatial light modulation with a DMD (digital micro-mirror device). This allows for both arbitrary beam shaping and aberration compensation in our imaging system to produce high fidelity optical potentials. We use these techniques to control state initialization, Hamiltonian dynamics, and measurement in experiments investigating low-dimensional many-body physics – from one-dimensional correlated quantum walks to characterizing entanglement.

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Date submitted: 30 Jan 2015 Electronic form version 1.4