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Progress towards measurement of entanglement entropy dynamics in one-dimensional interacting systems in the presence of disorder[1]
ALEXANDER LUKIN, M. ERIC TAI, MATTHEW RISPOLI, ROBERT SCHITTKO, TIM MENKE, ADAM KAUFMAN, MARKUS GREINER, Harvard University — Many-body localized states appear at odds with thermalization as they preserve the memory of their initial state. This behavior has drawn significant theoretical and experimental attention in recent years. Real space localization has been observed on various platforms and under a number of experimental conditions, both with and without interactions. However, the characteristic logarithmic growth of entanglement entropy, which distinguishes the many-body localized state from the non-interacting Anderson localized state, has only been studied in numerics and has yet to be investigated experimentally. We are working towards the phenomenon of localization in one dimensional, interacting Bose-Hubbard system using a quantum gas microscope. With site-resolved addressing and readout, our microscope provides full control over the studied system, in particular it allows us to add disorder into our system using a Fourier plane hologram. This gives us access to both local observables, such as the occupation of individual lattice sites, as well as the entanglement entropy. I will present our progress towards measuring the dependence of the entanglement entropy grows on the disorder strength and interactions in our system.

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