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Potential Engineering of Fermi-Hubbard Systems using a Quantum Gas Microscope GEOFFREY JI, ANTON MAZURENKO, CHRISTIE CHIU, MAXWELL PARSONS, MRTON KANSZ-NAGY, RICHARD SCHMIDT, FABIAN GRUSDT, EUGENE DEMLER, DANIEL GREIF, MARKUS GREINER, Harvard University — Arbitrary control of optical potentials has emerged as an important tool in manipulating ultracold atomic systems, especially when combined with the single-site addressing afforded by quantum gas microscopy. Already, experiments have used digital micromirror devices (DMDs) to initialize and control ultracold atomic systems in the context of studying quantum walks, quantum thermalization, and many-body localization. Here, we report on progress in using a DMD located in the image plane of a quantum gas microscope to explore static and dynamic properties of a 2D Fermi-Hubbard system. By projecting a large, ring-shaped anti-confining potential, we demonstrate entropy redistribution and controlled doping of the system. Moreover, we use the DMD to prepare localized holes, which upon release interact with and disrupt the surrounding spin environment. These techniques pave the way for controlled investigations of dynamics in the low-temperature phases of the Hubbard model.

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