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Density-dependent light-assisted tunneling in fermionic optical lattices[1] WENCHAO XU, WILLIAM MORONG, BRIAN DEMARCO, University of Illinois at Urbana-Champaign — Many recent theoretical proposals have discussed the possibility to realize density-dependent tunneling in optical lattices via external periodic driving. These methods enable the simulation of novel many-body quantum phases. Here we present experimental progress on realizing density-dependent tunneling for ultracold 40K atoms trapped in a cubic optical lattice via stimulated Raman transitions. After preparing a spin-polarized gas in the Mott insulator regime of the Hubbard model, a pair of Raman beams is applied to flip the spin of atoms. The Raman beams also introduce an effective density-dependent tunneling that can be tuned by the Raman frequency difference and Rabi rate. The Mott gap inferred from measurements of the fraction of atoms transferred between spin states as the Raman frequency difference is adjusted matches the prediction based on a tight-binding model. We also observe the interaction-dependent tunneling by measuring the fraction of doubly-occupied sites created by the Raman driving. This method allows the engineering of density-dependent tunneling and effective nearest-neighbor interactions in fermionic optical lattices.

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