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High Resolution Control of Magnetism in a Tilted Optical Lattice JONATHAN SIMON, WASEEM BAKR, RUICHAO MA, ERIC TAI, PHILIPP PREISS, MARKUS GREINER, Harvard University — Mott Insulators in tilted optical lattices form a rich platform for the study of strongly correlated phases of matter. When the tilt per lattice site approaches the onsite interaction energy, each atom is localized to two adjacent lattice sites and is further constrained by the behaviour of neighboring atoms, thus producing strong nearest-neighbor interactions. We have recently employed such a system to observe a quantum phase transition from a paramagnetic phase to an antiferromagnetic phase. Using a spatial light modulator we are now able to tailor the lattice topography with very high resolution. Local tailoring at the single-site level enables us to generate site-resolved spin flips for potential studies of spin diffusion, and domain-wall-quasiparticle interactions. High resolution potentials applied over large regions enable investigations of dynamical frustration, and more generally the timescale for a quantum phase transition in the presence of various types of controlled disorder. We will discuss both results and prospects for future studies.

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