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Resonance Imaging and Coherent Transport of Atoms in an Optical Lattice JAE HOON LEE, ENRIQUE MONTANO, POUL JESSEN, Center for Quantum Information and Control, College of Optical Science, University of Arizona — We describe experimental progress towards a resonance imaging protocol for optical lattices, aimed at robust preparation, addressing and transport of atoms with sub-wavelength resolution. Our setup consists of a 3D optical lattice, and a superimposed long-period (30 to 80 lattice sites) 1D "superlattice" that creates a position dependent shift of the transition frequency between two spin states in the ground manifold. We show that isolated planes of atoms can be prepared by flipping resonant spins with a microwave pulse and removing the remaining non-resonant spins. A second microwave pulse in a translated superlattice subsequently allows us to probe these planes with a resolution of better than 400nm. We further show that composite pulse techniques can reduce the sensitivity of the preparation to small variations in the relative position and intensity of the lattices. Finally, we explore the use of microwave pulses to drive coherent motion between lattice sites.

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