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Towards Simulating Charged Particles in a Magnetic Field with a Bose-Einstein Condensate Using Light-induced Vector potentials YU-JU LIN, ROBERT COMPTON, ABIGAIL PERRY, WILLIAM PHILLIPS, TREY PORTO, IAN SPIELMAN, Joint Quantum Institute, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, AND UNIVERSITY OF MARYLAND TEAM — We experimentally study light-induced gauge potentials in a ^{87}Rb Bose-Einstein condensate. The atoms, dressed by a two-photon Raman coupling between the three $F = 1$ hyperfine ground states, acquire a controllable quasi-momentum (static in the lab frame). We adiabatically load the atoms into the lowest energy dressed state, whose measured spin and momentum decomposition agrees quantitatively with a simple single- particle model. The effective Hamiltonian of these neutral atoms is like that of charged particles in a uniform magnetic vector potential, whose magnitude is set by the strength and detuning of Raman coupling. This technique can be extended to non-uniform vector potentials, giving non-zero effective magnetic fields. Current efforts are focused on eliminating heating of the dressed state from technical noise in the relative phase between two driving Raman beams, which limits the lifetime of the dressed state. This will then allow the observation of vortex nucleation into the condensate, signature of an effective magnetic field, upon addition of a detuning gradient.

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