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Simulating Charged Particles in a Magnetic Field with Ultra-cold Atoms Using Light-induced Effective Gauge Fields YU-JU LIN, WILLIAM PHILLIPS, JAMES PORTO, IAN SPIELMAN, Joint Quantum Institute, National Institute of Standards and Technology and University of Maryland, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY TEAM, UNIVERSITY OF MARYLAND TEAM — We experimentally study light-induced gauge potentials in a ^{87}Rb Bose-Einstein condensate. Instead of rotating the trap, we prepare the atoms in a spatially-varying optically dressed state. The atomic spin state is dressed by a spatially varying two-photon Raman coupling between the three $F = 1$ hyperfine ground states. The resulting effective magnetic field is equivalent to rotating the condensate (and transforming to the rotating frame), and thus generates vortices. The inter-vortex distance is given by $\sqrt{2\pi} l_B$. Using the technique, the minimum possible $l_B \approx \sqrt{R_{\mathrm{TF}}\lambda/8\pi}$ is the magnetic length for a uniform field, R_{TF} is the condensate diameter, and $\lambda \approx 805$ nm is the optical wavelength. We prepare the condensate in the dressed state, whose projection onto internal states of various state-dependent Bragg momenta are well understood.

Yu-Ju Lin
Joint Quantum Institute, National Institute of Standards and Technology
and University of Maryland

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