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Disorder-induced transition in a Harper-Hofstadter system QI-YU LIANG, Joint Quantum Institute, University of Maryland, DIMITRIOS TRYPOGEORGOS, INO-CNR BEC Center and Dipartimento di Fisica, ANA VALDS-CURIEL, MINGSHU ZHAO, JUNHENG TAO, Joint Quantum Institute, University of Maryland, IAN SPIELMAN, Joint Quantum Institute, University of Maryland, National Institute of Standards and Technology — The Harper-Hofstadter model describes particles in two-dimensional (2D) lattices subjected to a uniform magnetic field. Ultracold atomic gases in optical lattices are an ideal platform to study this model, thanks to their capability for realizing large and tunable magnetic fluxes per lattice plaquette. We experimentally assembled such a 2D lattice rolled into a long tube, just 3-site around, thereby realizing periodic boundary conditions. These three sites were constructed from a synthetic dimension built from the atoms' internal degrees of freedom. We inserted an additional longitudinal flux through the long axis of the cylinder, a process which has no analogy in a planar geometry. We observed an unexpected disorder-induced transition. Counterintuitively, the dynamic evolution of the system is exquisitely phase sensitive without disorder, and the sensitivity can be suppressed by introducing disorder. This phenomenon can be understood in two ways: (1) a spatial self-averaging effect and (2) interference between different matter-wave momentum states. Future prospects include characterizing exotic phases and phase transitions and realizing topological fractional charge pumping in strongly correlated regimes.

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