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Engineering arbitrary synthetic gauge fields in multiple geometries FANGZHAO AN, ERIC MEIER, BRYCE GADWAY, Univ of Illinois - Urbana

— Atoms in a uniform synthetic gauge field mimic the behavior of electrons in a homogeneous magnetic field, yet realizing this simple two-dimensional topological model with tunable flux (and thus field strength) has been a challenge. By implementing multiple "synthetic dimensions" of atomic momentum states, we engineer easily tunable, arbitrary flux patterns to study atomic dynamics in both a two-leg ladder geometry and a zig-zag ladder geometry. Starting with a uniform flux ladder, we observe chiral edge states whose flow changes from clockwise to counterclockwise as we tune the applied flux across the entire range of values. Starting with a uniform flux ladder, we demonstrate the ability to tune the applied flux across the entire range of values, observing chiral edge states whose handedness changes from clockwise to counter-clockwise with varying flux. By introducing a step-like jump in the flux pattern, we show topological reflection from a magnetic defect. In a separate zig-zag ladder geometry, we again explore flux-dependent atom dynamics over the full range of values. Within this geometry, we further study quantum localization driven by added pseudo-disorder, and observe a flux-dependent transition between metal to insulator.

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