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Ultracold atom dynamics in tailored disorder and synthetic gauge fields FANGZHAO AN, ERIC MEIER, BRYCE GADWAY, Univ of Illinois - Urbana — Ultracold atoms in optical lattices have shown to be a versatile and useful platform for investigating a wide range of transport phenomena. Here we extend the range of cold atom quantum simulation with key advances in the study of both disordered and topological systems. By controlling laser-driven dynamics of a ^{87}Rb condensate in a momentum-space lattice, we demonstrate and apply our ability to engineer arbitrary patterns of disorder and flux (and thus field strength). We compare the dynamical responses to static tunneling phase disorder, dynamically-varying phase disorder akin to coupling with a thermal bath, and quasiperiodic site energy disorder. We study synthetic gauge fields in both a two-leg square ladder geometry and a zig-zag ladder geometry. We present measurements of chiral edge states in a uniform flux ladder, and of quantum reflection in the presence of an effective magnetic defect. We show similar flux-dependent dynamics in the zig-zag ladder, and further observe a flux-dependent metal-insulator transition in the presence of quasiperiodic disorder.

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