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Quantum Hall Physics with Ultracold Atoms in Lattices with Multiply-Connected Topology[1] ANNA FARETTY, GERALD CURRAN, JACOB CHRIST, KUNAL DAS, Kutztown University of Pennsylvania — We demonstrate that all the salient features of the Harper model associated with the Quantum Hall effect can be implemented with ultracold atoms trapped in a bichromatic ring-shaped lattice; such features include criticality, localization transition and edge states. Using realistic sinusoidal lattice potentials rather than assume the idealized tight-binding picture, we determine the optimal conditions necessary to realize the critical point where the spectrum becomes fractal, and we identify the nature and cause of the departures from the discrete model predictions. We explore generalizations of the model to more complex configurations with multiply-connected topologies, such as disk, cylinder or torus, with a view to implementation with cold atoms in designer lattices, and we examine the spectrum as well as dynamical effects.

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