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Chern numbers counted in a synthetic-dimension quantum Hall strip

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Ultra cold atoms are remarkable systems with a truly unprecedented level of experimental control and one application of this control is creating topological band structures. The most natural approach centers on creating suitable real-space lattice potentials that the atoms experience. Here we present our experimental work which uses the internal atomic states as an additional "synthetic" dimension. We engineered a two-dimensional magnetic lattice in an elongated strip geometry, with effective per-plaquette flux about 4/3 times the flux quanta. The long direction of this strip is formed from a 1D optical lattice while the short direction is built from the 5 mF states comprising the f=2 ground state hyperfine manifold of Rb-87. We imaged the localized edge and bulk states of atomic Bose-Einstein condensates in this strip, with single lattice-site resolution along the narrow direction. In this 5-site wide strip we are able to delineate between bulk behavior quantified by Chern numbers and edge behavior which is not.