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Real-space detection and manipulation of topological edge modes with ultracold atoms

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Conventional topological insulators exhibit exotic gapless edge or surface states, as a result of non-trivial bulk topological properties. In periodically-driven systems the bulk-boundary correspondence is fundamentally modified and knowledge about conventional bulk topological invariants is insufficient. While ultracold atoms provide excellent settings for clean realizations of Floquet protocols, the observation of real-space edge modes has so far remained elusive. Here, I report on recent results, where we have demonstrated an experimental protocol for realizing chiral edge modes in optical lattices, by creating a topological interface in the form of a potential step using a programmable optical potential [1]. We efficiently prepared particles in chiral edge modes in three distinct Floquet topological regimes that are realized in a periodically-driven honeycomb lattice. Moreover, the properties of the edge mode can be modified by controlling the height and sharpness of the potential step. In addition, I will present preliminary results on the interplay between disorder and topology.
[1] arXiv:2304.01980

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