Abstract Submitted
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Effective Models for Topological Phases[1] R. WINKLER, H. DESHPANDE, Northern Illinois University — Edge states in topological insulators (TIs) disperse near one of the time-reversal invariant momenta Λ_i with a protected degeneracy at Λ_i. Commonly TIs are distinguished from trivial insulators by the values of one or multiple topological invariants that require an analysis of the bulk band structure across the Brillouin zone. We propose effective Hamiltonians based on a Taylor expansion about Λ_i that provide an accurate description of the protected edge states though the concept of a Brillouin zone is not part of such effective models. Graphene has served as an archetype for TIs. We show that an expansion about the graphene M point faithfully describes the protected edge states for both zigzag and armchair edges in graphene ribbons. We show that the edge states are determined by a band inversion local in k space reflecting the boundary conditions at the edges of the TI. This allows one to select Λ_i for the edge states. Our findings highlight the interplay between boundary conditions in real space and the location of edge states in reciprocal space.

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