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# Interacting Topological Insulators with Synthetic Dimensions

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Recent developments of experimental techniques have given us unprecedented opportunities of studying topological insulators and emergent Dirac and chiral fermions in high dimensions, while some of the dimensions are “synthetic”, in the sense that the effective lattice momenta along these synthetic dimensions are controllable periodic tuning parameters. We study interaction effects on topological insulators with synthetic dimensions. We show that although the free fermion band structure of high dimensional topological insulators can be precisely simulated with the “synthetic techniques”, the generic interactions in these effective synthetic topological insulators are qualitatively different from the local interactions in ordinary condensed matter systems. And we show that these special but generic interactions have unexpected effects on topological insulators, namely they would change (or reduce) the classification of topological insulators differently from the previously extensively studied local interactions.

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