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Designer quantum spin Hall phase transition in molecular graphene POUYAN GHAEMI, University of Illinois at Urbana-Champaign, SARANG GOPALAKRISHNAN, University of Illinois at Urbana-Champaign, Harvard University, TAYLOR HUGHES, University of Illinois at Urbana-Champaign
— Graphene was the first material predicted to be a time-reversal-invariant topological insulator; however, the insulating gap is immeasurably small owing to the weakness of spin-orbit interactions in graphene. A recent experiment demonstrated that designer honeycomb lattices with graphene-like "Dirac" band structures can be engineered by depositing a regular array of carbon monoxide atoms on a metallic substrate. Here, we argue that by growing such designer lattices on metals or semiconductors with strong spin-orbit interactions, one can realize an analog of graphene with strong intrinsic spin-orbit coupling, and hence a highly controllable two-dimensional topological insulator. We estimate the range of substrate parameters for which the topological phase is achievable, and consider the experimental feasibility of some candidate substrates.

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