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Topological Insulator Materials with Strong Interaction[1]

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All kinds of topological insulator materials have recently been discovered in two-and three-dimensional systems with strong spin-orbit coupling (SOC) hosting helical gapless edge or surface states consisting of odd number of Dirac fermion states inside the bulk band gap. Most of these discovered topological insulators have negligible interaction. Here we theoretically predict a new class of topological insulators with strong interaction. The typical examples are PuTe and AmN, with a simple rocksalt structure, which lie on the boundary between metals and insulators. We show that the interaction can effectively enhance SOC and drives a quantum phase transition to the topological insulator phase with a single Dirac cone on the surface (001). In addition, this kind of compounds has fully or partly filled f states, which could exhibit all kinds of magnetic phases, potentially leads to the discovery of intrinsic quantum anomalous Hall effect (QAHE) and topological magnetic insulators with dynamic axion field.

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