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First-Order Character and Observable Signatures of Topological Quantum Phase Transitions GIORGIO SANGIOVANNI, University of Wuerzburg, Germany, ADRIANO AMARICCI, SISSA Trieste, Italy, JAN CARL BUDICH, University of Innsbruck, Austria, MASSIMO CAPONE, SISSA Trieste, Italy, BJOERN TRAUZETTEL, University of Wuerzburg, Germany — Topological quantum phase transitions are characterized by changes in global topological invariants. These invariants classify many-body systems beyond the conventional paradigm of local order parameters describing spontaneous symmetry breaking. For noninteracting electrons, it is well understood that such transitions are continuous and always accompanied by a gap closing in the energy spectrum, given that the symmetries protecting the topological phase are maintained. Here, we demonstrate that a sufficiently strong electron-electron interaction can fundamentally change the situation: we discover a topological quantum phase transition of first-order character in the genuine thermodynamic sense that occurs without a gap closing. Our theoretical study reveals the existence of a quantum critical endpoint associated with an orbital instability on the transition line between a 2D topological insulator and a trivial band insulator. Remarkably, this phenomenon entails unambiguous signatures related to the orbital occupations that can be detected experimentally.
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