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Higher-order Topological Insulators and Superconductors FRANK SCHINDLER, ASHLEY COOK, University of Zurich, MAIA GARCIA VERGNIORY, University of the Basque Country, TITUS NEUPERT, Univ of Zurich — Symmetry-protected topological bulk insulators in d dimensions are typically characterized by the presence of gapless modes localized on $(d-1)$-dimensional symmetry-preserving boundary segments. Here, we introduce a class of three-dimensional topological insulators which calls for a generalization of this bulk-boundary correspondence: while these systems host no gapless surface states for a generic symmetry-preserving termination, they feature topologically protected gapless edge states. They are topologically protected by spatio-temporal symmetries and classified by a three-dimensional bulk Z_2 invariant based on Wilson loop spectroscopy. We give both time-reversal breaking and time-reversal invariant examples, with chiral and Kramers paired edge states, respectively. Possible realizations, including topological insulators with triple-Q (π, π, π) magnetic order, are discussed. Furthermore, the equivalent concept for topological superconductors is explored: We show that a three-dimensional superconductor with $p + \mathrm{id}_{\mathrm{x}^2-\mathrm{y}^2}$ pairing symmetry hosts chiral Majorana edge states. As well as being of great fundamental interest, these phases may be important for a variety of lossless transport applications.

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