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Thermodynamic signatures of edge states in Topological Insulators ANTON QUELLE, EMILIO COBANERA, CRISTINAE MORAIS SMITH, Univ of Utrecht — Topological insulators are states of matter distinguished by the presence of symmetry protected metallic boundary modes. These edge modes have been characterised in terms of transport and spectroscopic measurements, but a thermodynamic description has been lacking. The challenge arises because in conventional thermodynamics the potentials are required to scale linearly with extensive variables like volume, which does not allow for a general treatment of boundary effects. In this paper, we overcome this challenge with Hill thermodynamics. In this extension of the thermodynamic formalism, the grand potential is split into an extensive, conventional contribution, and the subdivision potential, which is the central construct of Hill's theory. For topologically non-trivial electronic matter, the subdivision potential captures measurable contributions to the density of states and the heat capacity: it is the thermodynamic manifestation of the topological edge structure. Furthermore, the subdivision potential reveals phase transitions of the edge even when they are not manifested in the bulk, thus opening a variety of new possibilities for investigating, manipulating, and characterizing topological quantum matter solely in terms of equilibrium boundary physics.

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