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Bulk-Defect Correspondence in Particle-Hole Symmetric Insulators and Semimetals ANDREAS RUEGG, ETH Zurich, FERNANDO DE JUAN, DUNG-HAI LEE, UC Berkeley and Lawrence Berkeley National Laboratories — Lattices with a basis can host crystallographic defects which share the same topological charge (e.g. the Burgers vector $\vec{b}$ of a dislocation) but differ in their microscopic structure of the core. We demonstrate that in insulators with particle-hole symmetry and an odd number of orbitals per site, the microscopic details drastically affect the electronic structure: modifications can create or annihilate non-trivial bound states with an associated fractional charge. We show that this observation is related to the behavior of end modes of a dimerized chain and discuss how the end or defect states are predicted from topological invariants in these more complicated cases. Furthermore, using explicit examples on the honeycomb lattice, we explain how bound states in vacancies, dislocations and disclinations are related to each other and to edge modes and how similar features arise in nodal semimetals such as graphene.

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