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Bulk Dirac Points in Distorted Spinels JULIA STEINBERG, University of Pennsylvania, STEVE YOUNG, Naval Research Laboratory, SAAD ZAHEER, CHARLES KANE, EUGENE MELE, ANDREW RAPPE, University of Pennsylvania — A Dirac point is characterized by four degenerate states that disperse linearly with momentum around a single point bk in the Brillouin zone. The resulting low energy theory is pseudorelativistic. A well-known example in two dimensions is graphene, which has a Fermi surface consisting exclusively of Dirac points that are responsible for many of its exotic properties. We report on an analogous Dirac-like Fermi surface in three-dimensional bulk materials in a distorted spinel structure on the basis of density functional theory (DFT) as well as tight-binding theory. The four examples we provide in this paper are $BiZnSiO_4$, $BiCaSiO_4$, $BiMgSiO_4$, and $BiAlInO_4$. A necessary characteristic of these structures is that they contain a Bi lattice which forms a hierarchy of chain-like substructures, with consequences for both fundamental understanding and materials design.

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