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Symmetry-protected ideal Weyl semimetal in HgTe-class materials SHAO-KAI JIAN, Institute for Advanced Study, Tsinghua University, Beijing 100084, China, JIAWEI RUAN, National Laboratory of Solid State Microstructures, School of Physics, Nanjing University, Nanjing 210093, China, HONG YAO, Institute for Advanced Study, Tsinghua University, Beijing 100084, China, HAIJUN ZHANG, National Laboratory of Solid State Microstructures, School of Physics, Nanjing University, Nanjing 210093, China, SHOU-CHENG ZHANG, Department of Physics, McCullough Building, Stanford University, Stanford, CA 94305-4045, USA, DINGYU XING, National Laboratory of Solid State Microstructures, School of Physics, Nanjing University, Nanjing 210093, China — Ideal Weyl semimetals with all Weyl nodes exactly at the Fermi level and no coexisting trivial Fermi surfaces in the bulk, similar to graphene, could feature deep and novel physics such as exotic transport phenomena induced by the chiral anomaly. Here, we show that HgTe and half-Heusler compounds, under a broad range of inplane compressive strain, could be the first materials in nature realizing ideal Weyl semimetals with four pairs of Weyl nodes and topological surface Fermi arcs. Generically, we find that the HgTe-class materials with nontrivial band inversion and noncentrosymmetry provide a promising arena to realize ideal Weyl semimetals. Such ideal Weyl semimetals could further provide a unique platform to study emergent phenomena such as the interplay between ideal Weyl fermions and superconductivity in the half-Heusler compound LaPtBi.

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