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Topological Semimetals in Realistic Compounds

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Topological semimetal, characterized by Weyl/Dirac nodes in the bulk and Fermi arcs on the surfaces, is a new state of three-dimensional (3D) quantum matters, different from the 3D topological insulators. Weyl nodes are stable topological objects, and can be viewed as effective magnetic monopoles in the 3D momentum space. Its time-reversal invariant version — 3D Dirac node, however, consists of two copies of distinct Weyl nodes with opposite chirality, and requires additional symmetry protection, such as the crystal symmetry. Novel properties, such as the giant diamagnetism and the linear quantum magnetoresistance can be expected for such semimetal states. In this talk, I will first present a general description of topological semimetal states, and then discuss its possible material realizations based on the first-principles calculations. We will show two theoretical predictions, Na_3Bi and Cd_3As_2, where the 3D Dirac cones are experimentally observed recently.

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