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Discovery of topological nodal-line semimetals in PbTaSe2 and TlTaSe2. GUANG BIAN, University of Missouri, Columbia — Topological nodal-line semimetal is a new topological phase of condensed matter where the conduction and valence bands cross each other at closed lines instead of discrete points in Weyl semimetals. The nodal-line fermion resembles a particle that moves in the speed of light in the radial and out-of-plane directions but has infinite mass in the tangential direction. Such a strange and exotic particle does not even exist in the theory of high-energy physics. The nontrivial band topology of nodal-line semimetals guarantees the existence of a new type boundary states on the surfaces, "drumhead" surface states. The electrons on this drumhead surface can be extremely heavy, resulting in a strong correlation between electrons and, consequently, a potential high-temperature surface superconductivity. Here we report on the discovery of two nodal-line semimetals PbTaSe2 and TlTaSe2 by using a combined method of first-principles calculations and photoemission measurements, and discuss the exotic properties of the two compounds.

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