Observation of pressure-induced Weyl state and superconductivity in a chirality-neutral Weyl semimetal candidate $SrSi_2$

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Quasi-particle excitations in solids described by the Weyl equation have attracted significant attention in recent years. Thus far, a wide range of solids that have been experimentally realized as Weyl semimetals (WSMs) lack either mirror or inversion symmetry. For the first time, in the absence of both mirror and inversion symmetry, $SrSi_2$ has been predicted as a robust WSM by recent theoretical works. Herein, supported by first-principles calculations, we present systematic angle-resolved photoemission studies of undoped $SrSi_2$ and Ca-doped $SrSi_2$ single crystals. Our results show no evidence of the predicted Weyl fermions at the $k_z = 0$ plane or the Fermi arcs on the (001) surface. With external pressure, the electronic band structure evolved and induced Weyl fermions in this compound, as revealed by first-principle calculations combined with electrical transport property measurements. Moreover, a superconducting transition was observed at pressures above 20 GPa. Our investigations indicate that the $SrSi_2$ system is a good platform for studying topological transitions and correlations with superconductivity.

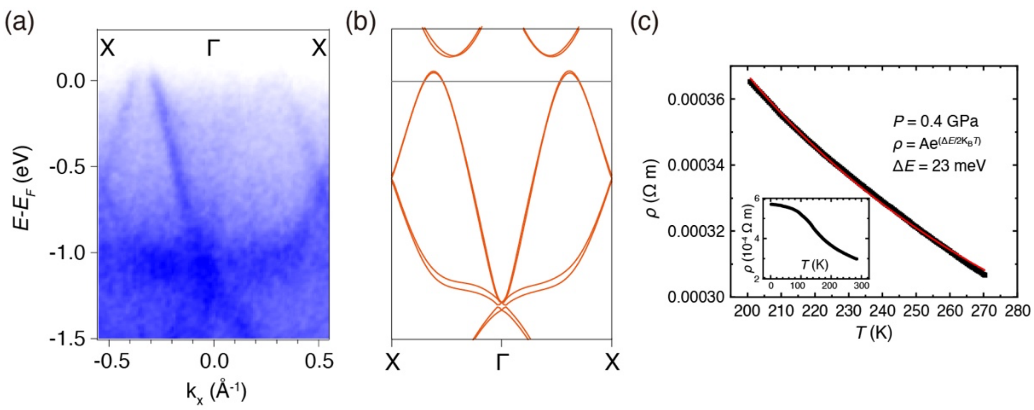

Fig. 1. (a-b) Photoemission intensity plot along the Γ-X direction and corresponding calculated band structure, respectively. (c) Resistivity measurement at pressure of 0.4 GPa demonstrated a semiconductor behavior at high temperature. A band gap of 23 meV was obtained.