Surface Fermi arc states and bulk spin Hall effect in Weyl semimetals

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Fermi arc is believed to be one of the most intrinsic proofs for the existence of Weyl semimetals. Our theory calculations in collaboration with ARPES measurement observed the tunable surface Fermi arcs on the surface of TaAs-type of Weyl semimetals. We have provided an effective method to obtain pure Fermi arcs on the surface state of Weyl semimetals and proved their robustness. In the bulk we have predicted large spin Hall conductivity that is comparable to 4d and 5d transition metals. The spin Hall effect originates intrinsically from the bulk band structure of Weyl semimetals, which exhibit a large Berry curvature and spin–orbit coupling, so the bulk carrier problem is naturally avoided as in the topological insulators. Both the manipulation of the surface states and strong spin Hall effect of the bulk provide a profound platform for the future exploration and application in spintronics.