Fermi-arc-induced chiral transport in Weyl semimetal TaAs

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Abstract: Whether the topological surface states, known as Fermi arcs, exhibit chirality in Weyl semimetals remains an open question. Here, we report Fermi-arc-induced chiral transport in the prototype Weyl semimetals TaAs. The crystals are precisely tailored using focused ion beam techniques, enabling simultaneous measurement of opposite surfaces. While the chiral anomaly signature of bulk Weyl fermions is masked, we directly observe Fermi-arc-induced chiral transport, with reversed chirality between opposing topological surfaces. The topological origin is responsible for a higher-order angular dependence resolved in the chiral transport, which is well captured by theoretical modeling under symmetry constraints. These robust surface states generate considerable chiral transport signals even at room temperature, highlighting their potential for future applications in chiral electronics using Weyl semimetal.