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Distinct evolutions of Weyl fermion quasiparticles and Fermi arcs with bulk band topology in Weyl semimetals[1] NAN XU, Paul Scherrer Institut, GABRIEL AUTES, cole Polytechnique Fdrale de Lausanne (EPFL, CHRISTIAN MATT, Paul Scherrer Institut, BAIQING LV, Beijing National Laboratory, Chinese Academy of Sciences, FEDERICO BISTI, VLADIMIR STROCOV, DARIUSZ GAWRYLUK, EKATERINA POMJAKUSHINA, KAZIMIERZ CONDER, NICHOLAS PLUMB, MILAN RADOVIC, Paul Scherrer Institut, TIAN QIAN, Beijing National Laboratory, Chinese Academy of Sciences, OLEG YAZYEV, cole Polytechnique Fdrale de Lausanne (EPFL), JOEL MESOT, Paul Scherrer Institut, HONG DING, Beijing National Laboratory, Chinese Academy of Sciences, MING SHI, Paul Scherrer Institut — By performing ARPES and first-principle calculations, we demonstrate that Weyl fermions quasiparticles in bulk and Fermi arc on surface show distinct evolutions with the bulk band topology in transition-metal monophosphides. While Weyl fermion quasiparticles exist only when the chemical potential is located between two saddle points of the Weyl cone features, the Fermi arc states extend in a larger energy scale and are robust across the bulk Lifshitz transitions associated with the recombination of two non-trivial Fermi surfaces enclosing one Weyl point into a single trivial Fermi surface enclosing two Weyl points of opposite chirality. Therefore, in some systems (NbP), Fermi arc states are preserved even if Weyl fermion quasiparticles are absent in the bulk. Our findings not only provide insight into the relationship between the exotic physical phenomena and the intrinsic bulk band topology in Weyl semimetals, but also resolve the apparent puzzle of the different magneto-transport properties observed in TaAs, TaP and NbP, where the Fermi arc states are similar.

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