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Identifying the Dirac line node in the 3D semimetal ZrSiS[1]
BENT WEBER, Monash University, MICHAEL S LODGE, University of Central Florida, GUOQING CHANG, BAHADUR SINGH, National University of Singapore, JACK HELLERSTEDT, MARK EDMONDS, Monash University, DARIUSZ KACZOROWSKI, Polish Academy of Sciences, MD MOFAZZEL HOSEN, MADHAB NEUPANE, University of Central Florida, HSIN LIN, National University of Singapore, MICHAEL S FUHRER, Monash University, MASA ISHIGAMI, University of Central Florida — With the advent of novel topological phases of matter, 3D Dirac semimetals are emerging as classes of materials which promise topological protection of electronic states within their bulk. In line-nodal Dirac semimetals in particular, the conductance and valence bands touch along a closed loop in momentum space, giving rise to predictions of exotic states at their surface such as Dirac line node arcs and spin vortex rings. However, in many compounds – including ZrSiS – the line node itself is located above the Fermi energy, which makes it inherently inaccessible to experimental techniques such as angle-resolved photoemission spectroscopy (ARPES). Here we employ quasiparticle interference (QPI) spectroscopy at 4.5K in combination with numerical modelling as complementary techniques to ARPES, allowing us to identify the position of the Dirac line node and the Dirac dispersion hundreds of meV into the conduction band.

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