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Observation of quasi-two-dimensional Dirac fermions in ZrTe5 XIANG YUAN, CHENG ZHANG, YANWEN LIU, SHOUDONG SHEN, XING SUI, JIE XU, HAOCHI YU, ZHENGHUA AN, JUN ZHAO, HUGEN YAN, FAXIAN XIU, Fudan University — Since the discovery of graphene, layered materials have attracted extensive interests owing to their unique electronic and optical characteristics. Among them, Dirac semimetal, one of the most appealing categories, has been a long-sought objective in layered systems beyond graphene. Recently, layered pentatelluride ZrTe5 was found to host signatures of Dirac semimetal. However, the low Fermi level in ZrTe5 strongly hinders a comprehensive understanding of the whole picture of electronic states through photoemission measurements, especially in the conduction band. Here, we report the observation of Dirac fermions in ZrTe5 through magneto-optics and magneto-transport. By applying magnetic field, we observe a square-root-B-dependence of inter-Landau-level resonance and Shubnikov-de Haas oscillations with non-trivial Berry phase, both of which are hallmarks of Dirac fermions. The angular-dependent SdH oscillations show a clear quasi-two-dimensional feature with highly anisotropic effective mass and Fermi velocity, in stark contrast to the 3D Dirac semimetal such as Cd3As2. With the confined interlayer dispersion and reducible dimensionality, our work establishes ZrTe5 as an ideal platform for exploring exotic physical phenomena of Dirac fermions. Another work about the optics on Cd3As2 thin film will also be discussed.

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