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Detection of chiral anomaly and valley transport in Dirac semimetals CHENG ZHANG, ENZE ZHANG, YANWEN LIU, Fudan Univ, ZHIGANG CHEN, The University of Queensland, SIHANG LIANG, JUNZHI CAO, XIANG YUAN, LEI TANG, QIAN LI, TENG GU, YIZHENG WU, Fudan Univ, JIN ZOU, The University of Queensland, FAXIAN XIU, Fudan Univ — Chiral anomaly is a non-conservation of chiral charge pumped by the topological nontrivial gauge field, which has been predicted to exist in the emergent quasiparticle excitations in Dirac and Weyl semimetals. However, so far, such pumping process hasn't been clearly demonstrated and lacks a convincing experimental identification. Here, we report the detection of the charge pumping effect and the related valley transport in Cd_3As_2 driven by external electric and magnetic fields (E•B). We find that the chiral imbalance leads to a non-zero gyrotropic coefficient, which can be confirmed by the E•B-generated Kerr effect. By applying B along the current direction, we observe a negative magnetoresistance despite the giant positive one at other directions, a clear indication of the chiral anomaly. Remarkably, a robust nonlocal response in valley diffusion originated from the chiral anomaly is persistent up to room temperature when B is parallel to E. The ability to manipulate the valley polarization in Dirac semimetal opens up a brand-new route to understand its fundamental properties through external fields and utilize the chiral fermions in valleytronic applications.

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