Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Illuminating the chirality of Weyl fermions QIONG MA, SU-YANG XU, CHING-KIT CHAN, Massachusetts Inst of Tech-MIT, CHENG-LONG ZHANG, Peking University, GUOQING CHANG, HSIN LIN, National University of Singapore, SHUANG JIA, Peking University, PATRICK LEE, NUH GEDIK, PABLO JARILLO-HERRERO, Massachusetts Inst of Tech-MIT — In particle physics, Weyl fermions (WF) are elementary particles that travel at the speed of light and have a definite chirality. In condensed matter, it has been recently realized that WFs can arise as magnetic monopoles in the momentum space of a novel topological metal, the Weyl semimetal (WSM). Their chirality, given by the sign of the monopole charge, is the defining property of a WSM, since it directly serves as the topological number and gives rise to exotic properties such as Fermi arcs and the chiral anomaly. Moreover, the two chiralities, analogous to the two valleys in 2D materials, lead to a new degree of freedom in a 3D crystal, suggesting novel pathways to store and carry information. By shining circularly polarized light on the WSM TaAs, we illuminate the chirality of the WFs and achieve an electrical current that is highly controllable based on the WFs' chirality. Our results open up a wide range of new possibilities for experimentally studying and controlling the WFs and their associated quantum anomalies by optical and electrical means, which suggest the exciting prospect of "Weyltronics".

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Date submitted: 08 Nov 2016 Electronic form version 1.4