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Prediction of an arc-tunable Weyl Fermion metallic state in $\mathbf{Mo_xW_{1-x}Te_2}$ TAY-RONG CHANG, Natl Tsing Hua U., SU-YANG XU, Princeton U., GUOQING CHANG, CHI-CHENG LEE, SHIN-MING HUANG, National University of Singapore, BAOKAI WANG, Northeastern U., GUANG BIAN, HAO ZHENG, DANIEL SANCHEZ, ILYA BELOPOLSKI, NASSER ALIDOUST, MADHAB NEUPANE, Princeton U., ARUN BANSIL, Northeastern U., HORNG-TAY JENG, Natl Tsing Hua U., HSIN LIN, National University of Singapore, M. ZAHID HASAN, Princeton U. — A Weyl semimetal is a new state of matter that hosts Weyl fermions as emergent quasiparticles. The Weyl fermions correspond to isolated points of bulk band degeneracy, Weyl nodes, which are connected only through the crystals boundary by an exotic Fermi arc surface state. The length of the Fermi arc gives a measure of the topological strength, because the only way to destroy the Weyl nodes is to annihilate them in pairs in k space. To date, Weyl semimetals are only realized in the TaAs class. Here, we propose a tunable Weyl metallic state in $Mo_xW_{1-x}Te_2$ via our first-principles calculations, where the Fermi arc length can be continuously changed as a function of Mo concentration, thus tuning the topological strength of the system [1]. Our results provide an experimentally feasible route to realizing Weyl physics in the layered compound $Mo_xW_{1-x}Te_2$ where non-saturating magneto-resistance and pressure driven superconductivity have been observed.
[1] T.-R. Chang et al., arXiv:1508.06723.

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