Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Type-II Symmetry-Protected Topological Dirac Semimetals TAY-RONG CHANG, National Tsing Hua U., SU-YANG XU, DANIEL S. SANCHEZ, Princeton U., WEI-FENG TSAI, National U. of Singapore, SHIN-MING HUANG, National Sun Yat-Sen U., GUOQING CHANG, CHUANG-HAN HSU, National U. of Singapore, GUANG BIAN, ILYA BELOPOLSKI, Princeton U., ZHI-MING YU, SHENGYUAN A. YANG, Singapore U. of Tec. and Design, TITUS NEUPERT, U. of Zurich, Switzerland, HORNG-TAY JENG, National Tsing Hua U, HSIN LIN, National U. of Singapore, M. ZAHID HASAN, Princeton U. — The discoveries of Dirac and Weyl semimetal states in real materials led to the realizations of elementary particle analogs in table-top experiments. Recently, a new type of Weyl fermion attracted interest because it strongly violates Lorentz symmetry whose analog does not exist in the Standard Model. While this state has been dubbed the type-II Weyl semimetal and predicted in a number of materials, its Dirac counterpart has remained elusive. In this work, we propose the concept of the type-II Dirac fermion and theoretically identify this new state in MA_3 (M=V, Nb, Ta; A=Al, Ga, In) [1]. We show that the VAl_3 family features a pair of type-II Dirac nodes and that each Dirac node consists of four type-II Weyl nodes via symmetry breaking. Furthermore, we predict the Landau level spectrum arising from the type-II Dirac fermions in VAl_3 that is distinct from that of known Dirac/Weyl semimetals. We also show a topological phase transition from a type-II Dirac to a quadratic Weyl or a topological crystalline insulator via crystalline distortions.
[1] T.-R. Chang et al., arXiv:1606.07555

Tay-Rong Chang
National Tsing Hua Univ

Date submitted: 10 Nov 2016 Electronic form version 1.4