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Electronic properties of new topological quantum materials[1]

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Topological materials are characterized by the presence of nontrivial quantum electronic states, where often the electron spin is locked to its momentum. This opens up the possibility for developing new devices in which information is processed or stored by means of spin rather than charge. In this talk we will discuss the electronic properties of several of newly discovered topological quantum materials. In WTe2 we have observed a topological transition involving a change of the Fermi surface topology (known as a Lifshitz transition) driven by temperature. The strong temperature-dependence of the chemical potential that is at the heart of this phenomenon is also important for understanding the thermoelectric properties of such semimetals. Both WTe2 and MoTe2 were proposed to host type II Weyl semimetalic state. Indeed our data provides first experimental confirmation of such state in both of these materials. We will also present evidence for a new topological state in PtSn4 where pairs of extended Dirac node arcs rather are present rather than Dirac points, that is so far not understood theoretically. Our research opens up new directions on enhancing topological responsiveness of new quantum materials. [1] Yun Wu, Daixiang Mou, Na Hyun Jo, Kewei Sun, Lunan Huang, S. L. Bud'ko, P. C. Canfield, and Adam Kaminski, Observation of Fermi arcs in the type-II Weyl semimetal candidate WTe2. Phys. Rev. B 94, 121113(R) (2016) [2] Lunan Huang, Timothy M. McCormick, Masayuki Ochi, Zhiying Zhao, Michi-To Suzuki, Ryotaro Arita, Yun Wu, Daixiang Mou, Huibo Cao, Jiaqiang Yan, Nandini Trivedi Adam Kaminski, Spectroscopic evidence for a type II Weyl semimetallic state in MoTe2. Nature Materials (2016), doi:10.1038/nmat4685 [3] Yun Wu, Tai Kong, Lin-Lin Wang, D. D. Johnson, Daixiang Mou, Lunan Huang, Benjamin Schrunk, S. L. Bud'ko, P. C. Canfield, and Adam Kaminski, Asymmetric mass acquisition in LaBi: Topological semimetal candidate. Phys. Rev. B 94, 081108(R) (2016) [4] Yun Wu, Lin-Lin Wang, Eundeok Mun, D. D. Johnson, Daixiang Mou, Lunan Huang, Yongbin Lee, S. L. Budko, P. C. Canfield Adam Kaminski, Dirac node arcs in PtSn4. Nature Physics (2016), doi:10.1038/nphys3712

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