Chez Pierre

Presents ...

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Special Chez Pierre Seminar

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” Topological Semimetals: Dirac, Weyl and Node-line Semimetals“

Topological semimetals, characterized by Weyl/Dirac nodes in the bulk and Fermi arcs on the surfaces, are new states of three-dimensional (3D) quantum matters, different from topological insulators. Weyl nodes are stable topological objects, and can be viewed as effective magnetic monopoles in the 3D momentum space. The 3D Dirac node, however, consists of two overlapped Weyl nodes with opposite chirality, and requires additional crystal symmetry protection. In some special case, the nodes can form a closed line in the momentum space and it is so called Node-line semimetal state. Novel properties, such as negative magneto-resistance and non-local transport, can be expected from these semimetal states, due to the presence of chiral anomaly. Recently, several Dirac semimetal (Na_3Bi [1] and Cd_3As_2 [2]), Weyl semimetal ($HgCr_2Se_4$ [3] and TaAs family [4]) and Node-line (all carbon Mackay-Terrones crystal [5] and Cu_3NPd [6]) compounds have been predicted and some of them have been experimentally verified. In this talk, I will review the theoretical progress with focus on the predictive roles of first-principles calculations in this field. [7, 8]

Reference

[1] Z. Wang et al., PRB 85, 195320 (2012); Z. Liu et al. Science 343, 864 (2014)
[2] Z. Wang et al., PRB 88, 125427 (2013); Z. Liu et al. Nat. Mat. 13, 677 (2014)
[3] G. Xu et al., Phys. Rev. Lett. 107,186806 (2011)
[4] H. Weng et al., Phys. Rev. X 5, 011029 (2015)
[5] H. Weng et al., Phys. Rev. B 92, 045108 (2015)
[6] R. Yu, H. Weng, et al., PRL 115, 036807 (2015)
[7] H. Weng et al., MRS Bulletin 39, 849 (2014)
[8] H. Weng et al., Adv. Phys. 64, 227(2015)