TOPLOGICAL SEMIMETAL $SR_{1-Y}MN_{1-Z}SB_2$

J.Y. Liu [1], J. Hu [1], D. Graf [2], S.M.A. Radmanesh[3], D.J. Adams [3], Y.L. Zhu[1], G.F. Chen [1], X. Liu[1], J. Wei[1], I. Chiorescu [2,4], L. Spinu[3] and Z.Q. Mao

[1]Institution [1] Department of Physics and Engineering Physics, Tulane University, New Orleans, LA 70018
[2]National High Magnetic Field Lab, Tallahassee, FL 32310
[3]Department of Physics and AMRI, University of New Orleans, New Orleans, LA 70148
[4]Department of Physics, Florida State University, Tallahassee, FL 32306

Recent discoveries of three dimensional (3D) topological Dirac semimetals (DSM) in Na_3Bi [1,2] and Cd_3As_2 [3-5] and Weyl semimetals (WSM) in monopnictides TX (T=Ta/Nb, X=As/P) [6-9] and photonic crystals [10] have generated immense interests since they represent new topological states of quantum matter. Both classes of materials feature relativistic fermions with linearly dispersing excitations. WSMs can be seen as evolving from DSMs in the presence of the breaking of time reversal symmetry (TRS) or space inversion symmetry. WSMs caused by the loss of space inversion symmetry have been experimentally realized in non-centrosymmetric crystals of TX [8-11]. For TRS breaking WSMs, despite numerous theoretical and experimental efforts, only one example, $YbMnBi_2$, has recently been reported [11]. However, the origin of TRS breaking remains unclear in this material.

In this talk, we report a new type of topological semimetal phase arising from 2D Sb layers in $Sr_{1-y}Mn_{1-z}Sb_2$ (y, z < 0.1) (Fig. 1a), which coexists with ferromagnetism [12]. Through quantum transport measurements (Fig. 1b) on this material, we reveal remarkable signatures of relativistic fermions, including light effective quasiparticle mass, high carrier mobility, a π Berry phase and valley polarized interlayer conduction. Given $Sr_{1-y}Mn_{1-z}Sb_2$ shows ferromagnetism, it offers a wonderful opportunity to explore the TRS breaking Weyl state.

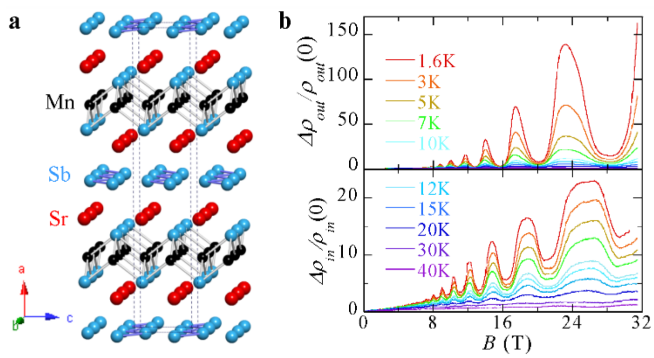

Fig. 1: (a) Crystal structure of SrMnSb2. (b) the out-of-plane and in-plane magnetoresistivity as a function of magnetic field at various temperatures [16]

[1]. Z. Wang *et al*. *Phys. Rev. B* **85**, 195320, (2012).
[2]. Z.K. Liu *et al*. *Science* **343**, 864-867, (2014).
[3]. Z. Wang, H. Weng, Q. Wu, X. Dai, & Z. Fang, *Phys. Rev. B* **88**, 125427, (2013).
[4]. Z.K. Liu *et al*. *Nature Mater.* **13**, 677-681, (2014).
[5]. M. Neupane *et al*., *Nature Commun.* **5**, (2014).
[6]. H. Weng *et al*., *Phys. Rev. X* **5**, 011029, (2015).
[7]. S.M. Huang *et al*., *Nature Commun.* **6**, (2015).
[8]. S.Y. Xu *et al., Science* **349**, 613-617 (2015).
[9]. B.Q. Lv *et al., Phys. Rev. X* **5**, 031013, (2015).
[10]. L. Lu *et al*., *Science* **349**, 622-624 (2015).
[11] S. Borisenko *et al., arXiv:1507.04847*, (2015).
[12] J.Y. Liu et al., *arXiv:1507.07978*, (2015).

Category: TM
Email: zmao@tulane.edu