Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Nematic superconductivity in intercalated Bi_2Se_3 systems"

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Abstract: Unconventional superconductivity is characterized by the spontaneous symmetry breaking of the superconducting gap function in addition to the ordinary gauge-symmetry breaking. Recently, superconductivity with rotational-symmetry breaking in the gap *amplitude* or in the spin part of the order parameter has been termed as "nematic superconductivity" [1], and has been attracting much attention as a new-class of superconducting states with novel symmetry breaking.

Nematic superconducting nature in $Cu_xBi_2Se_3$ has been first observed in the spin part of the superconducting order parameter by using the NMR technique [2], and subsequently in the superconducting gap amplitude by using the field-angle-resolved calorimetry [3]. Almost simultaneously to Ref. [3], nematicity in the upper-critical field of $Sr_xBi_2Se_3$ investigated by magnetoresistivity [4] and in vortex-pinning anisotropy of $Nb_xBi_2Se_3$ observed by torque magnetometory [5] has been also reported. More recently, nematic nature in these doped Bi_2Se_3 systems has been reported by other groups [6,7]. The observed nematic nature of superconductivity in doped Bi_2Se_3 is consistent with the E_u representation states (the so-called Δ_{4x} and Δ_{4y} states), which have been theoretically proposed [8]. However, there remain some issues; in particular, it has not been settled which of the Δ_{4x} and Δ_{4y} states are actually realized. For example, the NMR study [2] favors the Δ_{4x} state but the calorimetry [3] favors the Δ_{4y} state. A recent experiment on $Sr_xBi_2Se_3$ suggest that the favored states are actually sample dependent [6].

In this presentation, we explain our magneto-calorimetry study on $Cu_xBi_2Se_3$ [3] and compare and discuss results reported by various groups.

[1] L. Fu, *Phys. Rev. B.* **90**, 100509R (2014).
[2] K. Matano *et al.*, *Nature Phys.* **12**, 852 (2016).
[3] S. Yonezawa *et al.*, *Nature Phys.* **13**, 123 (2017).
[4] Y. Pan *et al.*, *Sci. Rep.* **6**, 28632 (2016).
[5] T. Asaba *et al.*, *Phys. Rev. X* **7**, 011009 (2017).
[6] G. Du *et al.*, *Sci. China-Phys. Mech. Astron.* **60**, 037411 (2017).
[7] J. Shen *et al.*, *npj Quantum Mater.* **2**, 59 (2017).
[8] L. Fu and E. Berg, *Phys. Rev. Lett.* **105**, 097001 (2010).

12:00pm noon
Friday, April 27, 2018
Duboc Room (4-331)

Host: Liang Fu