The Alabama Collaborative for Materials Exploration (ACME)

Research Seminar Series

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Zoom Registration Link

$MnBi_2Te_4.nBi_2Te_3$: A happy marriage of magnetism and topology

Magnetic topological material provides a great platform for discovering new topological states, such as the axion insulators, the Chern insulators, and the 3D quantum anomalous Hall (QAH) insulators. Recently, $MnBi_2Te_4$ was discovered to be the first material realization of an intrinsic antiferromagnetic topological insulator (TI) where the QAH effect was observed at a record high temperature in its two-dimensional limit. Since the interplay of magnetism and band topology determines their topological natures, understanding and manipulating the magnetism inside magnetic TIs will be crucial. In this talk, I will present our discovery of two new magnetic topological materials $MnBi_2Te_4.nBi_2Te_3$ (n=1 and 3) which consist of alternating [$MnBi_2Te_4$] and n[Bi_2Te_3] layers [1, 2]. I will show that by reducing the interlayer magnetic coupling with the increasing number of spacer [Bi2Te3] layers, $MnBi_2Te_4.nBi_2Te_3$ can be tuned from Z2 antiferromagnetic TIs (n=0,1,2) to ferromagnetic axion insulators. Furthermore, I will show that a continuous fine control of the magnetism in $MnBi_4Te_7$ can be made by Sb doping where an AFM to FM switching emerges due to the formation of the Mn/Sb antisite disorders [3]. Our study provides a rare tunable material platform to investigate various emergent phenomena arising from the interplay of magnetism and band topology.

[1] C. W. Hu, et.al, Nature Communications, 11, 97 (2020)
[2] C. W. Hu, et.al, Science Advances, 6, eaba4275 (2020)
[3] C. W. Hu, et.al, Physical Review B, 104, 054422 (2021)

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