MnBi$_2$Te$_4$.nBi$_2$Te$_3$: 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$_2$Te$_4$ 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$_2$Te$_4$.nBi$_2$Te$_3$ (n=1 and 3) which consist of alternating [MnBi$_2$Te$_4$] and n[Bi$_2$Te$_3$] layers [1, 2]. I will show that by reducing the interlayer magnetic coupling with the increasing number of spacer [Bi$_2$Te$_3$] layers, MnBi$_2$Te$_4$.nBi$_2$Te$_3$ 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$_4$Te$_7$ 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.


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