The Impact and Pursuit of Magnetic Topological Insulator States

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Registration required (Zoom)

The introduction of concepts from topology greatly deepens our understanding of the electronic states in solids. In the last decade, due to both the high scientific interest and the promising applications in novel quantum devices, the study of topological states has been one of the most active and fruitful fields in the condensed matter physics. Although the nonmagnetic topological states have been extensively studied, the study of magnetic topological materials is just beginning. In this talk, I will report our two recent works in magnetic topological states. In the first work, guided by the study of a specific honeycomb lattice, we show that LuSI (YSI) is a 3D strong topological insulator with the right-handed helical surface states, while GdSI is the long-pursuing ideal magnetic Weyl semimetal with only two pairs of Weyl nodes residing at the Fermi level. The ideal Weyl semimetal is beneficial to the large negative magnetoresistance, large anomalous Hall conductivity and large anomalous Hall angle, which are important for the related device designs. In the second work, we propose that multiple topological semimetal phases can be achieved in “soft” ferromagnetic material EuB₆ by simply tuning the direction of the magnetic moment. The corresponding topological phase transitions can be monitored by the measurement of topological surface states or anomalous Hall conductivity. Moreover, large-Chern number quantum anomalous Hall effect can be realized in its [111]-oriented quantum-well structures.

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