Magneto-transport properties of nanoflakes of the ferromagnetic topological insulator $MnSb_2Te_4$

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The new family of intrinsically magnetic van-der-Waals layered topological insulators Mn(Bi,Sb)Te, with strong spin-orbit coupling, is of great interest to investigate the interplay between topology and magnetic order in electronic band structures [1]. In presence of a long-range magnetic order in a 3D topological insulator, an exchange gap and/or the magnetic symmetry can generate topological quantum states, like the quantum anomalous Hall effect (QAH) or the axion insulator [2], which can be tuned by the magnetization.

Our recent studies consider the $MnSb_2Te_4$ compound, a ferromagnet with a perpendicular-to-plane anisotropy and a critical Curie-Weiss temperature as high as 35K. $MnSb_2Te_4$ has been controversially discussed to be a magnetic Weyl semimetal or a candidate to realize the axion insulator [3,4]. We investigated the thickness-dependent properties of exfoliated nanoflakes using magneto-transport measurements, revealing the change of important parameters such as the resistivity, the Curie temperature and the magnetic coercive field. Our results confirm the influence of both the intrinsic electrical doping and disorder in this material, and an analysis of the anomalous Hall conductivity does not give a proof of the existence of a magnetic Weyl semimetal.

More generally, a major limitation to realizing the topological quantum states in this material family is the intrinsic bulk charge carrier doping, effectively hiding the topological signatures in transport measurements. We present some results of a promising technique to passivate bulk charge carriers and tune the Fermi level using a low-power hydrogen plasma.

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References

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