

Title: Topological Insulators: non-magnetic vs. magnetic

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Abstract:

Topological insulator is a new state of quantum matter, characterized by topological invariants like Z or Z_2 numbers. Exotic quantum phenomena, such as Majorana Fermions, magneto-electric effect, and quantum anomalous Hall effect, have been expected from topological insulators, while their experimental realizations remain challenging, due to the lack of suitable samples or requirement of extreme conditions. Within recent couple of years, more and more topological insulators were discovered, yet lots of new compounds still wait to be explored. In this talk, I will start from our earlier predictions for Bi_2Se_3 family compounds [1], and discuss the characterization of topological nature from the Wannier representation and Willson loop method [2]. I then move to the recent study for the topological aspect and quantum magnetoresistance of Ag_2Te [3]. The possible realization of quantized Anomalous Hall effect and Majorana fermions after breaking time reversal symmetry will be discussed from the view point of materials design [4,5,6].

References:

- [1] H. J. Zhang, C. X. Liu, X. L. Qi, X. Dai, Z. Fang, S. C. Zhang, "Topological insulators in Bi_2Se_3 , Bi_2Te_3 and Sb_2Te_3 with a single Dirac cone on the surface", *Nature Physics*, vol. 5, 438 (2009).
- [2] R. Yu, X. L. Qi, A. Bernevig, Z. Fang, X. Dai, "An equivalent expression of Z_2 topological invariant for band insulators using non-abelian berry's connection", arXiv:1101.2011 (2011).
- [3] W. Zhang, R. Yu, W. X. Feng, Y. G. Yao, H. M. Weng, X. Dai, and Z. Fang, "Topological aspect and quantum magnetoresistance of Ag_2Te ", arXiv: 1101.0667 (2011, accepted by PRL)
- [4] R. Yu, W. Zhang, H.J. Zhang, S. C. Zhang, X. Dai, Z. Fang, "Quantized Anomalous Hall Effect in Magnetic Topological Insulators", *Science* 329, 61 (2010).
- [5] H. M. Weng, G. Xu, H. J. Zhang, S. C. Zhang, X. Dai, Z. Fang, "Half-metallic surface states and topological superconductivity in NaCoO_2 " arXiv: 1103.1930 (2011).
- [6] J. L. Zhang, S. J. Zhang, H. M. Weng, and et.al., "Pressure-induced superconductivity in topological parent compound Bi_2Te_3 " *PNAS*, 108, 24 (2011).