MAR15-2014-020490

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Topological Spintronics: Materials, Phenomena and Devices

NITIN SAMARTH, Penn State University

The two-dimensional surface states of three-dimensional topological insulators such as Bi_2Se_3 and $(Bi,Sb)_2Te_3$ possess a spin texture that can potentially be exploited for spintronics applications. We provide a perspective on the emergence of "topological spintronics," demonstrating how this spin texture can be engineered using either quantum tunneling between surfaces [1] or by breaking time-reversal symmetry [2]. We then discuss recent experiments that show striking spintronic phenomena useful for proof-of-concept devices, including a spin-orbit torque of record efficiency at room temperature [3] and an electrically-gated "giant anisotropic magnetoresistance" at low temperature [4].

This work was carried out in collaboration with A. Richardella, S.-Y. Xu, M. Neupane, A. Mellnik, A. Kandala, J. S. Lee, D. M. Zhang, M. Z. Hasan and D. C. Ralph. We acknowledge funding from the DARPA Meso program, ONR and C-SPIN (under sponsorship of MARCO and DARPA).

[1] M. Neupane, A. Richardella *et al.*, Nature Communications **5**, 3841 (2014).
[2] S.-Y. Xu *et al.*, Nature Physics **8**, 616 (2012).
[3] A. Mellnik, J. S. Lee, A. Richardella *et al.*, Nature **511**, 449 (2014).
[4] A. Kandala, A. Richardella, *et al.*, submitted.