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Spin Transport Experiments in Topological Insulator Bi_2Se_3 Thin Films JIFA TIAN, ISAAC CHILDRES, HELIN CAO, Department of Physics and Birck Nanotechnology Center, Purdue University, West Lafayette, IN, 47907, IREK MITKOWSKI, Department of Physics, Purdue University, West Lafayette, IN, 47907, YONG P. CHEN, Department of Physics and Birck Nanotechnology Center, Purdue University, West Lafayette, IN, 47907 — Topological insulators are an unusual phase of quantum matter with an insulating bulk gap and gapless spin-momentum locked Dirac surface states. Such a spin-helical surface state provides rich opportunities for potential applications in spintronics. We performed spin valve experiments on exfoliated Bi_2Se_3 thin films ($\sim$ 10 nm thick) with ferromagnetic electrodes using a DC driving current in an in-plane magnetic field. We observed the two- terminal resistances are asymmetric between the large positive ($>$ 0.5 T) and negative ($<$-0.5 T) in-plane magnetic fields. The high and low resistance states can be reversed by changing the direction of the driving DC current. Furthermore, the measured resistance asymmetry decreases as temperature increases. One interpretation of our observation is related to the spin-momentum helical locking of topological surface states producing a spin-polarized surface current. We also performed the non-local spin valve measurements, and observed an asymmetry in the measured signal between opposite large magnetic fields.

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