Abstract Submitted
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Electrical Detection of Spin-to-Charge Conversion in a Topological Insulator Bi_2Te_3.[1] CONNIE H. LI, OLAF M.J. VAN 'T ERVE, Naval Research Laboratory, YAOYI LI, LIAN LI, University of Wisconsin, Milwaukee, BERRY T. JONKER, Naval Research Laboratory — Spin-momentum locking in topological insulators (TIs) dictates that an unpolarized charge current creates a net spin polarization. We recently demonstrated the first electrical detection of this spontaneous polarization in a transport geometry, using a ferromagnetic (FM) / tunnel barrier contact, where the projection of the TI surface state spin on the magnetization of detector is measured as a voltage [1]. Alternatively, if spins are injected into the TI surface state system, it is distinctively associated with a unique carrier momentum, and hence should generated a charge accumulation, similar to that of inverse spin Hall effect. Here we experimentally demonstrate both effects in the same device fabricated in Bi_2Te_3: the electrical detection of the spin accumulation generated by an unpolarized current flowing through the surface states, and that of the charge accumulation generated by spins injected into the surface states system. This reverse measurement is an independent confirmation of spin-momentum locking in the TI surface states, and offers additional avenue for spin manipulation. It further demonstrates the robustness and versatility of electrical access to the TI surface state spin system, an important step towards its utilization in TI-based spintronics devices.

[1] C. H. Li, et. al., Nat. Nanotech. 9, 218 (2014). Supported by NRL core funds and Nanoscience Institute.

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