Abstract Submitted
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Direct comparison of current-induced spin polarization in topological insulators and InAs Rashba states.[1] CONNIE LI, OLAF VAN 'T ERVE, Naval Research Lab, SHIVANI RAJPUT, Physics, University of Wisconsin, Milwaukee, LIAN LI, Physics, West Virginia University, BERRY JONKER, Naval Research Lab — 3D topological insulators (TIs) exhibit time-reversal symmetry protected, linearly dispersing Dirac surface states. Band bending at the TI surface may also lead to coexisting trivial two-dimensional electron gas (2DEG) states with parabolic energy dispersion that exist as spin-split pairs due to Rashba spin-orbit coupling (SOC). A bias current is expected to generate spin polarization in both systems arising from their helical spin-momentum locking, but with different magnitude and sign.[1] Here, we compare spin potentiometric measurements of bias current-generated spin in Bi_2Se_3(111) films where Dirac surface states coexist with trivial 2DEG states, and InAs(001) where only trivial 2DEG states are present.[2,3] We observe spin polarization in both cases, with opposite signs of the spin voltage for the TI and InAs. We present a model based on spin dependent electrochemical potentials to directly derive the signs expected for the TI surface states, and show that the current-generated spin measured in TI is dominated by Dirac surface states. This direct electrical access of the helical spin texture of Dirac and Rashba 2DEG states is an enabling step towards the electrical manipulation of spins in next generation TI and SOC based quantum devices. 1. S. Hong et al., PRB **86**, 085131 (2012). 2. C. H. Li et al., *Nature Nanotech.* **9,** 218 (2014). 3. C. H. Li et al., *Nat. Commun.*, *in press* (2016).

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