Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Multi-terminal potentiometric spin signal measurement on channels with spin-momentum locking[1] SHEHRIN SAYED, Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907, USA, SEOKMIN HONG, Intel Corporation, Hillsboro, OR 97124, USA, SUPRIYO DATTA, Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907, USA — We will discuss multi-terminal potentiometric measurements on channels with spin-momentum locking (SML) e.g. topological insulator, Rashba interface, heavy metals etc. Using these results in conjunction with the Onsager reciprocity relation [1], we argue that multi-terminal spin valves on such channels [2] should show two distinct values of anti-parallel resistance $R_{AP}^{(1)}$ and $R_{AP}^{(2)}$ such that $R_{AP}^{(1)} > R_P > R_{AP}^{(2)}$ depending on the direction of spin flow relative to SML (R_P: parallel resistance). This remarkable signature originating from SML can only be observed in multi-terminal measurements and has been experimentally observed recently on heavy metals [3]. We argue from Onsager reciprocity that 2-terminal measurement will only show the usual result $R_{AP}^{(1)} = R_{AP}^{(2)} > R_P$. We present numerical results using a detailed semiclassical model which uses four electrochemical potentials depending on group velocity (+ or −) and spin polarization (up or down) of the channel electronic states. Finally, we propose novel spintronic applications based on the potentiometric measurement. [1] Jacquod et al., Phys. Rev. B 86, 155118, 2012. [2] Sayed et al., Sci. Rep. 6, 35658, 2016. [3] Pham et al., Nano Lett., DOI:10.1021/acs.nanolett.6b02334, 2016.

[1]This work was supported by FAME, one of six centers of STARnet, a Semiconductor Research Corporation program sponsored by MARCO and DARPA.

Shehrin Sayed
Purdue Univ

Date submitted: 11 Nov 2016 Electronic form version 1.4