Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

A generalized spin diffusion equation with four electrochemical potentials for channels with spin-orbit coupling[1] SHEHRIN SAYED, Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907, SEOKMIN HONG, Intel Corporation, SUPRIYO DATTA, Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907 — We will present a general semiclassical theory for an arbitrary channel with spin-orbit coupling (SOC) [1], that uses four electrochemical potential ($U+$, $D+$, $U-$, and $D-$) depending on the sign of z-component of the spin (up (U), down (D)) and the sign of the x-component of the group velocity ($+, -$). This can be considered as an extension of the standard spin diffusion equation [2] that uses two electrochemical potentials for up and down spin states, allowing us to take into account the unique coupling between charge and spin degrees of freedom in channels with SOC. We will describe applications of this model to answer a number of interesting questions in this field such as: (1) whether topological insulators can switch magnets, (2) how the charge to spin conversion is influenced by the channel resistivity, and (3) how device structures can be designed to enhance spin injection. [1] S. Hong, S. Sayed, and S. Datta, "Spin Circuit Model for 2D Channels with Spin-Orbit Coupling". (Under Review). [2] T. Valet, and A. Fert, "Theory of the perpendicular magnetoresistance in magnetic mutilayers", Phys. Rev. B, 48, 7099, 1993.

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

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Date submitted: 06 Nov 2015 Electronic form version 1.4