Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quantum coherence versus dephasing effects in the giant spin Hall current and nonlocal voltage in magnetotransport through multiterminal graphene bridges[1] CHIEN-LIANG CHEN, CHING-RAY CHANG, Department of Physics, National Taiwan University, Taipei 10617, Taiwan, BRANISLAV K. NIKOLIC, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716, USA — Motivated by the recent experiments [D. A. Abanin *et al.*, Science **323**, 328 (2011)] probing magnetotransport near the Dirac point in six-terminal graphene bridges from low to room temperature, we develop a nonequilibrium Green function (NEGF) theory of this phenomena. In the quantum-coherent regime, we find giant spin Hall (SH) conductance in four-terminal bridges, where the SH current is pure only at the Dirac point (DP), as well as the nonlocal voltage at a remote location in six-terminal bridges where the direct and inverse SH effect operate at the same time. The momentum-relaxing dephasing reduces their values at the DP by two orders of magnitude while washing out features away from the DP. Our theory is based on the linearized version of the Meir-Wingreen formula applied to multiterminal devices where dephasing is introduced through the self-energy within the active region of the bridge and currents and voltages are connected via generalized matrix of conductance coefficients.

[1]This work was supported in part by the DOE Grant No. DE-FG02-07ER46374 through the Center for Spintronics and Biodetection at the University of Delaware.

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Date submitted: 11 Nov 2011 Electronic form version 1.4