Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Systematic study of spin transport in Si nanowires with axial doping gradient KONSTANTINOS KOUNTOURIOTIS, JORGE BARREDA, TIM KEIPER, MEI ZHANG, PENG XIONG, Florida State Univ — Spin transport experiments have been widely employed to study spin relaxation mechanisms in bulk and two-dimensional semiconductors. Quasi 1D systems such as semiconductor nanowires (NWs) could offer some advantages as spin transport channels; it was predicted that quantum confinement can lead to significant enhancement in spin lifetime and diffusion lengths. We have performed systematic spin transport, including local 2T, 3T, and nonlocal 4T spin valve measurements, in phosphorus-doped Si NWs exhibiting a pronounced doping gradient along the axial direction. The doping gradient enables the formation of Ohmic contacts and Schottky barriers of different widths and heights between a series of ferromagnetic electrodes and a single NW. This facilitates a methodical study of the dependence of the spin signal on interfacial resistance. Spin injection/extraction is effective within a window of interfacial resistance, which in our devices corresponds to zero-bias 2T resistances between 100 kΩ and 2 MΩ, corresponding to the estimated carrier densities between 6.810^{17} cm^{-3} and 4.510^{18} cm^{-3}. Within this region we measured nonlocal spin signals of magnitudes between 1 μV and 50 μV (at I=20 nA). Also, the spin signals are observed to increase when the spins are injected from a more resistive interface. Comparison of the local 2T and nonlocal 4T signals and the effects of interchanging the injector and detector electrodes for the same transport channel will be presented.
*Work supported by NSF Grant DMR-1308613.

Konstantinos Kountouriotis
Florida State Univ

Date submitted: 20 Nov 2016 Electronic form version 1.4