Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

Pure spin transport in metallic nanostructures

GORAN MIHAJLOVIC, Materials Science Division, Argonne National Laboratory

While spin transport in most cases refers to spin-polarized charge currents, spin and charge currents can be decoupled using nonlocal geometries. Investigation of these pure spin currents can provide new insight into spin-dependent physics. This presentation will focus on two different aspects of pure spin transport in metallic nanostructures: spin Hall effects and spin relaxation. Spin Hall effects occur due to spin-dependent electron scattering, and they have been suggested as a pathway to pure spin currents without using ferromagnets. We studied the possibility of observing spin Hall effects in purely paramagnetic structures by investigating non-local transport in mesoscopic Hall bars fabricated from gold. However, our experiments did not show large spin Hall effects in gold, despite the strong spin-orbit coupling in this metal [1]. We will also present our results on pure spin transport in mesoscopic silver wires where spin current is generated via spin injection from permalloy. Using the nonlocal spin valve geometry and Hanle effect measurements we directly probed the spin relaxation in silver. By studying the temperature dependence of the spin relaxation rate, we were able to distinguish between different physical mechanisms leading to spin relaxation. We found that a diffusive electron transport in the wire produces a temperature dependent spin relaxation rate for electron scattering from the surfaces, with surface spin-flip probability ~ 5 times higher than for the bulk scattering [2]. *Work done in collaboration with A. Hoffmann, J. E. Pearson, S. D. Bader, and M. A. Garcia, and supported by UChicago Argonne, LLC, operator of Argonne National Laboratory, a U.S. Department of Energy Office of Science laboratory, operated under contract No. DEAC02-06CH11357.

[1] G. Mihajlovic, J. E. Pearson, M. A. Garcia, S. D. Bader, A. Hoffmann, Phys. Rev. Lett. 103, 166601 (2009)
[2] G. Mihajlovic, J. E. Pearson, S. D. Bader, A. Hoffmann, arXiv:0910.2744v2.