MAR13-2012-020261

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Observation of the planar Nernst effect in Permalloy and Nickel Thin Films with In-plane Thermal Gradients[1]

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The reliable generation of pure spin currents is an important ingredient in future spintronic circuits that may offer lower power consumption and greater processing capabilities than current technology. Over the past few years some groups have reported that such a spin current can be generated simply by applying a thermal gradient to a ferromagnetic material. This effect, called the spin Seebeck effect (SSE), has generated tremendous interest in the interaction of heat, charge and spin in ferromagnetic systems. In this talk we will present our own recent measurements of thermoelectric and thermomagnetic effects in thin film metallic ferromagnets. These are enabled by a micromachined thermal isolation platform that removes potentially confounding effects introduced in such measurements by the presence of a highly thermally conductive bulk substrate. One of the main results is the observation of a transverse thermopower, called the planar Nernst effect (PNE), that is caused by spin-dependent scattering. This PNE should therefore be present in any attempted measurement of the SSE in a metal system where spin-dependent scattering of electrons occurs. Furthermore our "zero substrate" experiment shows no signal with the expected symmetry of the SSE, suggesting that the presence of the substrate is required to cause such a signal. Further experiments are required to determine if a pure spin current is actually involved in the generation of the signal associated with the SSE in ferromagnetic metal films. This work was performed in collaboration with A. D. Avery, and M. R. Pufall.

[1]This work is supported by the NSF CAREER award (DMR-0847796)