Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Electrical detection of a hyperfine-induced spin-dependent Hall effect in ferromagnet-semiconductor heterostructures M.K. CHAN, E.S. GARLID, P.A. CROWELL, University of Minnesota, Twin Cities, Q.O. HU, C.J. PALMSTRØM, University of California, Santa Barbara — We report electrical measurements of a spin-dependent Hall effect (SHE) in ferromagnet-semiconductor heterostructures. Steady state electron spin polarization is established in bulk n-GaAs by a forward biased Fe contact. We observe a Hanle effect in the Hall voltage measured across the spin-polarized region of the GaAs channel, consistent with spin dephasing. This signal changes sign under Fe contact magnetization reversal, indicating sensitivity to electron spin direction. The observed spin-dependent Hall signal is approximately two orders of magnitude larger than that expected from previous optical measurements of the SHE in n-GaAs, which was attributed to skew-scattering. This suggests that a different mechanism is active in our system. We demonstrate full suppression of the spin-dependent Hall signal by eliminating the nuclear spin polarization through a field cycling procedure. Additionally, while the electron spin accumulation, detected by a spin sensitive Fe contact, persists up to 200 K, the spin-dependent Hall signal is not observed above 120 K, in coincidence with the disappearance of the nuclear spin polarization due to delocalization of donor electrons. We conclude that the observed spin-dependent Hall signal is coupled to the nuclear spin polarization. NSF DMR 0804244.

Mun Chan
University of Minnesota, Twin Cities

Date submitted: 19 Nov 2009 Electronic form version 1.4