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Quantifying absolute spin polarization with non-magnetic contacts in FM/n-GaAs heterostructures[1] CHAD GEPPERT, LEE WIENKES, KEVIN CHRISTIE, University of Minnesota, SAHIL PATEL, CHRIS PALMSTRØM, University of California, Santa Barbara, PAUL CROWELL, University of Minnesota — We report on a novel method of quantifying spin accumulation in Co_2MnSi/n-GaAs and Fe/n-GaAs heterostructures using a non-magnetic probe. The presence of a non-equilibrium spin polarization generates a large electrostatic potential shift relative to the equilibrium state. This is due to the combination of (1) the parabolic (non-constant) density of states and (2) the population imbalance between the two spin sub-bands. We observe this shift as a Hanle effect in a non-local, non-magnetic semiconducting contact. Since this signal depends only on experimentally accessible parameters of the bulk semiconductor, its magnitude may be used to quantify the injected spin polarization in absolute terms. By comparison with the (smaller) spin-valve signal observed with a second ferromagnetic contact, we demonstrate that this electrostatic shift scales quadratically with spin polarization, dephases in the presence of both applied and hyperfine fields, and is observable to higher temperatures than traditional non-local measurements. Quantitative modeling allows extraction of absolute polarizations in excess of 50 % at low temperatures, and further indicates that this contribution constitutes a large fraction of the three-terminal signal observed in these devices.

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