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Three Terminal Spin Extraction Resistance in Fe/GaAs Heterostructures E.S. GARLID[1], T. KONDO[1], Q. HU[1,2], C.J. PALMSTRØM[1,2], P.A. CROWELL[1], [1]U. Minnesota, [2]UC Santa Barbara — Spin transport measurements have been difficult to interpret in two terminal Fe/GaAs/Fe devices where current flows in both the injector and detector electrodes. This is due to the strong non-monotonic dependence of the spin accumulation on the Fe/GaAs interface bias, which affects the spin injection and detection efficiencies. To address this, we measured the four terminal non-local spin valve resistance and the three terminal spin extraction resistance in epitaxial Fe/GaAs heterostructures with a systematically varied Schottky barrier doping profile. Lateral devices were fabricated from epitaxial Fe/n^+/n-GaAs (100) heterostructures in which the thickness of the n^+ layer ($n^+ = 5 \times 10^{18}$) was varied from 5 to 50 nm while $n = 5 \times 10^{16}$ in the 2.5 μm channel. The three terminal resistance measured using a single contact as the injector and detector is $\approx 100\times$ larger than the non-local spin valve resistance, an effect which cannot be attributed to spin relaxation in the channel. In the case of a three terminal measurement, we obtain both a large spin accumulation as well as an enhanced detection sensitivity under forward bias conditions. This can be analyzed by considering the measured non-local spin polarization as a function of bias, as well as the electric fields at the Fe/GaAs interface in the presence of a charge current. Supported by ONR and the NSF MRSEC, and NNIN programs.

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