Abstract Submitted
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Spin-dependent scattering in the presence of polarized nuclei in n-GaAs[1] KEVIN CHRISTIE, CHAD GEPPERT, MUN CHAN, University of Minnesota, QI HU, CHRIS PALMSTRØM, University of California, Santa Barbara, PAUL CROWELL, University of Minnesota — We report on all-electrical measurements of the inverse spin Hall effect (ISHE) in epitaxial (100) Fe/GaAs heterostructures with a channel doping (Si) of $n = 5 \times 10^{16}$ cm^{-3} and highly doped Schottky tunnel barriers. Under measurement conditions of large (10-20%) spin accumulation at the injection electrode, a significant dynamic nuclear polarization (DNP) enhances the size of the ISHE. The electron spin dynamics are shown to match the predictions of the usual drift-diffusion model, including the applied, hyperfine, and Knight fields. The DNP, however, also enhances the scattering of spin-polarized carriers, which is not understood. To separate the roles of the electronic and nuclear spin systems, we have employed a pump-probe method to vary the nuclear spin polarization $\langle I \rangle$ and electron spin polarization S independently. The size of the ISHE is proportional to $\langle I \rangle$ when the DNP is small, but it eventually saturates. When the nuclear polarization is fixed, the ISHE is linear in S, as expected. We conclude therefore that the measured signal scales linearly with the spin current multiplied by a transport skewness parameter that depends strongly on $\langle I \rangle$.

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