Abstract Submitted
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Correlation of electrical spin injection and non-linear charge-transport in Fe/MgO/Si[1] JONAS BEARDSLEY, YONG PU, Dept. of Physics, The Ohio State University, PATRICK ODENTHAL, ADRIAN SWARTZ, ROLAND KAWAKAMI, Dept. of Physics, University of California, Riverside, P. CHRISTOPHER HAMMEL, EZEKIEL JOHNSTON-HALPERIN, Dept. of Physics, The Ohio State University, JAIRO SINOVA, Dept. of Physics, Texas A&M University, JON PELZ, Dept. of Physics, The Ohio State University — The three-terminal (3T) Hanle method has recently been used by several groups to measure electrical spin injection into Si up to 500K, with signals that can be orders of magnitude larger than expected for spin injection into bulk Si states. While much discussion has centered on the possible origin of the enhanced spin signal, there has been little discussion of the anomalously-strong bias dependence of the spin resistance area product (SRA) often measured at low-temperatures. We report 3T-Hanle measurements MBE grown Fe/MgO/Si tunnel diodes which show an SRA up to seven orders larger at low temperature than the bulk prediction, which is both strongly bias dependent and highly correlated with the differential resistance area product, dV/dJ, over a large range of bias and temperature. This cannot be explained by current theories that assume energy-independent tunneling into localized or bulk states. We show that a simple model with strongly energy-dependent tunneling can explain the strong bias-dependences and correlation of the SRA and dV/dJ, and suggests that the intrinsic spin-injection properties may have little bias dependence even though the measured SRA decreases by three orders of magnitude with increasing bias.

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