Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Asymmetric Voltage Dependence of Spin Torque in Magnetic Tunnel Junction Devices DEEPANJAN DATTA, BEHTASH BEHIN-AEIN, Dept of Electrical Engineering, Purdue University, SAYEEF SALAHUDDIN, Dept of Electrical Engineering and Computer Science, UC Berkeley, SUPRIYO DATTA, Dept of Electrical Engineering, Purdue University — A key mystery in our current understanding of spin-transfer torque in Magnetic Tunnel Junction (MTJ) devices is its voltage asymmetry. Experimentally it is seen that the free ferromagnetic layer of a MTJ device experiences a larger torque when a negative (rather than positive) voltage is applied to the fixed layer. This remains a key unsettled issue since there is no intrinsic difference between two magnets that could cause the effect. Theoretical treatments are divided on this issue and no explanation is available at this time. In this paper, we provide a simple physical explanation, based on the polarization of both ferromagnetic contacts in the energy range of transport. Our explanation is justified on the basis of a Non-Equilibrium Green's Function (NEGF)-based model, which we also believe to be the first theoretical model that provides quantitative agreement with experimentally measured (1) differential resistances, (2) Magnetoresistance (MR), (3) In-plane torque and (4) Out-of-plane torque over a range of bias voltages.

Deepanjan Datta
Graduate Student, EE, Purdue University

Date submitted: 24 Nov 2009 Electronic form version 1.4