Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Theoretical investigation of the dynamics of a magnetic bilayer in the presence of spin transfer torque LYDIA NOVOZHILOVA, Western Connecticut State University, SERGEI URAZHDIN, Emory University — Magentoelectronic nanodevices, such as magnetic memory cells and spin torque nano-oscillators, generally utilize at least two magnetic layers, the "reference" and the "free" layer. While most previous studies focused only on the behaviors of the "free" layer, the dynamics of the "reference" layer can also be important due to the coupling between the layers. We utilize Landau-Lifshitz-Slonczewski equations in the macrospin approximation to analyze the dynamics of a magnetic bilayer driven by a dc current. We show that even in the absence of magnetic or RKKY interactions, coupling between the layers is efficiently mediated by the spin transfer torque. We use an axially symmetric approximation to derive an analytical stability condition for the bilayer. The stability is determined by the physical characteristics of the bilayer and two control parameters - the dc current and the external time-independent magnetic field. Additionally, we use an averaging technique to find synchronized precessional motions of the two nanomagnets. Finally, we show that for some conditions, the dynamics of the bilayer becomes chaotic. Such chaotic dynamics is prohibited for a single macrospin due to the limitations imposed by the dimensionality of the system.

Lydia Novozhilova
Western Connecticut State University

Date submitted: 13 Nov 2011 Electronic form version 1.4