Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Nonlinear Synchronization in Spin Torque Magnetic Nano-Oscillators[1] PHILLIP TABOR, West Virgina University, SERGEI URAZHDIN, West Virginia University, VASIL TIBERKEVICH, ANDREI SLAVIN, Oakland University — The magnetic oscillations driven in nanomagnetic devices by spin transfer torque exhibit strongly nonlinear behaviors indicated by the large frequency shifts with the driving current. We demonstrate experimentally that the synchronization of magnetic oscillators with a microwave magnetic field exhibits several signatures of nonlinear behaviors. First, the synchronization occurs not only when the frequency fe of the driving signal is close to the frequency f0 of the oscillation, but also for several other integer and rational relations between the two frequencies. Second, the synchronization exhibits a hysteresis with respect to the driving frequency, i.e. the synchronization limit depends on whether the driving frequency is being increased or decreased. The latter behaviors also depend on the relative orientation of the microwave field with respect to the dc bias field. We show that the observed behaviors can be understood in terms of the nonlinear dynamical properties of the nano-oscillators.

[1]Supported by NSF DMR-0747609 and ECCS-0653901, the Cottrell Scholarship from the Research Corporation, U.S. DOD MURI W911NF- 04-1-0247, U.S. Army TARDEC, RDECOM W56HZV-09-P-L564, and Oakland University Foundation

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Date submitted: 20 Nov 2009 Electronic form version 1.4