Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Evidence for non-local damping in individual nano structures with a single magnetic layer HANS NEMBACH, JUSTIN SHAW, CARL BOONE, TOM SILVA, Electromagnetics Division, National Institute of Standards and Technology, Boulder, CO 80305 — The spin excitation damping α in nanomagnets is a critical parameter for switching in STT-MRAM because the required power depends on α^2. We experimentally demonstrate that intralayer spin-pumping is a significant source of damping. Ferromagnetic resonance spectra were measured by heterodyne magneto-optical microwave microscopy for individual Ni80Fe20 nanomagnets down to 100 nm. Micromagnetic simulations show that one spin-wave mode, i.e. the "center-mode," is distributed throughout the nanomagnet, whereas the two "end-modes" are localized at the ends. α is found to increase for the "center-mode" with decreasing nanomagnet size but shows the opposite trend for the "end-modes." It was proposed that dissipative transverse spin-currents can increase α. Calculations of this additional damping are in agreement with the experimental data. We also used micromagnetics to test the hypothesis that an area of increased damping close to the edges of the nanomagnets forms during patterning. Such simulations predict that α for both spin-wave modes increases with decreasing size of the nanomagnets, contrary to our experimental observations. Thus, we conclude that non-local contributions to α are the dominant mechanism for size-dependence of α.

Hans Nembach
Electromagnetics Division, National Institute of Standards
and Technology, Boulder, CO 80305

Date submitted: 27 Nov 2012 Electronic form version 1.4