Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Equilibration in All-Perpendicular Spin Valves Subject to Short Current Pulses * DANIEL BEDAU, HUANLONG LIU, JONATHAN SUN, JORDAN KATINE, ERIC FULLERTON, STEPHANE MANGIN, ANDREW KENT, NEW YORK UNIVERSITY, NEW YORK, NY TEAM, IBM T.J. WATSON RESEARCH CENTER, P.O.BOX218 NY TEAM, HITACHI-GST, SAN JOSE, CA TEAM, UNIVERSITY OF CALIFORNIA,SAN DIEGO,CA TEAM, NANCY-UNIVERSITY, NANCY, FRANCE TEAM — Our recent experiments have shown that all-perpendicular spin valves can be switched by short current pulses (<5 ns) [1]. In this limit we found that the switching probability only depends on the spin-angular momentum in the pulse [1]. However, such studies do not directly resolve the magnetization dynamics and relaxation. To study equilibration of spin valves driven out of equilibrium by short current pulse we have developed a pump-probe method, capable of 50 ps resolution. A probe pulse, a variable delay after the pump pulse, is used to determine the magnetization relaxation rate. When the delay between the pump and probe pulses is less than 1 ns the net switching probability differs from that at longer delays. An analysis of this difference shows that the free layer angular-momentum decays exponentially with time after the pump pulse. From these studies we obtain a lifetime, which we use to estimate the free layer damping. [1] Bedau et. al. Appl. Phys. Lett. 96, 022514 (2010) & ArXiv:1009.5240
*supported by: USARO Grant No. W911NF0710643

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Date submitted: 09 Dec 2010 Electronic form version 1.4