Abstract Submitted
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Electron Drift Speed And Current-Induced Drive Torques On A Domain Wall LUC BERGER, Physics Dept., Carnegie Mellon University, Pittsburgh, PA 15213 — It has become fashionable to describe [1] current-induced torques on a DW in terms of an electron drift speed u = - $P^*j^*mu_B/e^*M$ where mu_B is the Bohr magneton and M the saturation magnetization. While appropriate for adiabatic torques, this quantity u is misleading and not the best choice in the case of non-adiabatic torques. For example, it leads [2] to beta not equal to alpha, where beta represents the intensity of the non-adiabatic torque, and alpha is the damping parameter. By writing equations of motion for conduction- electron spins in a moving frame where the electron gas is at rest, we find [3] a direct relation between damping and non- adiabatic torques. The correct electron drift speed turns out to be the speed of the frame, and is v = $P^*j/(n^*q)$ where n and q are the carrier density and charge. It is related to the ordinary Hall constant R_0 by v $P^*R_0^*j$. After substituting v for u in the expression of the non-adiabatic torque, we find that beta = alpha holds now. Because v is larger than u in Permalloy, it can explain better the large current-induced DW speeds found [4] experimentally. In materials where $R_0 > 0$ and the carriers are dominantly hole-like, v and u have opposite signs, leading to different predictions for the sense of DW motion. We discuss examples of such materials. 1. G. Tatara and H. Kohno, Phys. Rev. Lett. 92, 086601 (2004). 2. H. Kohno et al., J. Phys. Soc. Japan, 75, 113706 (2006). 3. L. Berger, Phys. Rev. B 75, 174401 (2007). 4. M. Hayashi et al., Phys. Rev. Lett. 98, 037204 (2007).

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