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 \( v = P*R_0^*j \).