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Effect of Wall Width on Spin Torque in Ferromagnetic Domain Walls E.A. GOLOVATSKI, M.E. FLATTÉ, OSTC and Department of Physics and Astronomy, University of Iowa — The amount of spin torque exerted on a domain wall in a ferromagnetic semiconductor depends on the amount of spin flip that occurs during the transport process. Starting with a model Hamiltonian[1], we calculate the total amount of spin torque exerted on a π wall and a 2π wall for ballistic transport across the domain wall, and calculate the dependence of the torque on the width of the domain wall. In very thin 2π walls, transport occurs with almost no spin flip. As the wall width increases, spins precess more inside the domain wall, increasing the spin torque. In a π wall, where most spins will flip during transport through a thick wall, we find that the spin torque increases monotonically with wall width. In contrast, spins in a thick 2π wall will continue to precess back towards their original configuration, and there will be much less net spin flip. Thus there is very little spin torque in both very thin and very thick 2π walls, but significant spin torque is possible in a range of intermediate widths. This non-trivial dependence on the width of the domain wall leads to an optimal wall width for achieving a maximum amount of spin torque. For a 2π wall with an exchange-induced spin splitting of 100 meV, and an effective carrier mass equal to the electron mass, we calculate this optimal width to be $\sim$ 5nm. This work was supported by an ONR MURI. [1] G. Vignale and M.E. Flatté, PRL 89, 098302 (2002).

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