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Spin transfer torques in magnetic bilayers with strong spin orbit coupling M.D. STILES, PAUL M. HANEY, Center for Nanoscale Science and Technology, NIST, Gaithersburg, USA, HYUN-WOO LEE, PCTP and Department of Physics, Pohang University of Science and Technology, Korea, KYUNG-JIN LEE, Korea University, Department of Material Science & Engineering, South Korea, AURELIEN MANCHON, King Abdullah University of Science and Technology, Saudi Arabia — Current driven magnetic dynamics in ferromagnetic thin films on top of non-magnetic films with strong spin orbit coupling show strong current-induced torques. Several theoretical models have been proposed to explain these torques. In one model, the current flowing through the non-magnetic layer gives rise to a spin Hall current, leading to a spin current incident on the interface between the two layers. This spin current causes spin transfer torques similar to those that are important in magnetic multilayers with current flowing perpendicular to the plane. Another model proposes a torque due to the spin-orbit coupling at the interface where the inversion symmetry found in the bulk materials is broken. We model the spin transport with a semiclassical Boltzmann equation approach. Both torques are present in this model and for reasonable parameter sets are largely independent of each other. We compute the dependence of the torques on the thickness of the layers and find that it is difficult to reproduce the large sensitivity to the thickness of the ferromagnetic layer as found in several experiments. This disagreement indicates that structural or electronic properties are probably changing with the thickness of the films studied in experiments.

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