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Time dependence of spin currents in noncollinear magnetic multilayers:the diffusion equation approach JIANWEI ZHANG, Department of Physics, New York University, PETER LEVY, Department of Physics, New York University — We used the time dependent diffusion equations to study the time evolution of spin torque in noncollinear magnetic multilayers. For 3d transition-metal ferromagnetic layers we find this torque build up in femtoseconds; it reach its steady state in about 75 femtoseconds after undergoing damped oscillations with a period of about 5 femtoseconds. In our approach the initial discontinuity of the spin current at the interface between noncollinear magnetic layers does not directly create spin torque; rather it is the source term that creates transverse spin accumulation and thereby removes the discontinuity in the spin current when steady state is achieved. In this view the spin torque comes from the transverse spin accumulation. We find the dependence of the spin torque on the angle between the magnetizations predicted by the diffusion equation is close to that found by using the Boltzmann equation [1]. Work supported by the National Science Foundation, Grant DMR 0131883. [1] Jianwei Zhang and P.M. Levy, Phys. Rev. B70, 184442(2004).

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