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Intrinsic damping due to electron-magnon interactions in ferromagnetic metals[1] SHULEI ZHANG, SHUFENG ZHANG, Department of Physics, University of Arizona — Magnetic relaxation in ferromagnetic metals is usually ascribed to the interaction between conduction electrons and spin waves (or magnons). This interaction involves two types of physical processes. First, an electron absorbs or emits a magnon in a spin-flip electron-magnon scattering. At low temperature, this process is operative only for disordered ferromagnet; otherwise it is prohibited by energy and momentum conservation. The other process is that electrons are scattered by magnons without changing their spins, also known as spin-conversing electron-magnon scattering. We show that this latter process exists even at zero temperature without disorders. We calculated the damping parameters for both processes and found that the intrinsic damping in general has the same order of magnitude as extrinsic damping at low temperatures. We further apply our results to thin magnetic films with magnetization parallel and perpendicular to film planes respectively. The intrinsic damping parameter scales as square of temperature. A more interesting result is thickness dependence of the damping parameter. For an in-plane magnetized layer, the damping is inversely proportional to thickness whereas for the perpendicularly magnetized layer, it increases with thickness.

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