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Ferromagnetic Relaxation by Magnon Induced Currents ARKAJYOTI MISRA, RANDALL VICTORA, University of Minnesota — A theory for calculating spin wave relaxation times based on the magnon-electron interaction is developed. In a conducting ferromagnet the interaction between the conduction electrons and the magnons is important. The magnetic field generated by the spin wave is time dependent and therefore it creates an electric field in the system. In a metallic system, the fields drive the conduction electrons. These magnon induced currents help dissipate the energy of the system by Joule heating. Our study incorporates a thin film geometry and explores relaxation time for a wide range of magnon wave vectors spanning both the magnetostatic and exchange regimes. The relaxation time is calculated directly from the ratio of the energy density of the system and the power loss by magnon induced currents. We propose a wave vector dependent damping constant which approaches values as high as 0.2 for high conductivity metals such as permalloy, showing the large magnitude of the effect. The theory compares reasonably well with spin wave resonance experiments for lower modes. We propose the following picture of ferromagnetic relaxation in switching experiments. The initial rapid approach of magnetization direction to equilibrium is enabled by magnon-magnon scattering that converts the energy into the higher spin wave modes. These modes then decay at a slower pace via the magnon-electron interaction investigated in this work or by the trditionally invoked mechanisms in less pure, lower conductivity films.

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