Investigation of the precession damping in rare-earth doped Co films using femtosecond light pulses

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One of the key parameters characterizing the ultrafast response of magnetic materials is the damping of the magnetization precession. It is important, for example, in switching considerations because it is related to the time that the magnetization takes to settle down after a perturbation. Here we have used femtosecond laser pulses to start a precession of the magnetization in rare-earth doped-doped Co films and used another probe laser to study the damping parameter as a function of the laser pump power (Figure1). We investigated this precession damping as a function of the rare-earth dopant concentration and also as a function of the laser pump power. The striking feature of our results is the observation of a decreasing damping of the induced magnetization precession as the pump laser power is increased in the experiments so that the damping decreases with the increase of the initial electron temperature. This means that the thermal excitations do not contribute to an enhanced damping of the magnetization precession, and is contrary to what is expected in the context of an Elliott-Yafet scattering theory for the spin scattering in ferromagnetic metals.
Keywords: ultrafast magnetization dynamics, sputtering, spin precession, femtosecond lasers.

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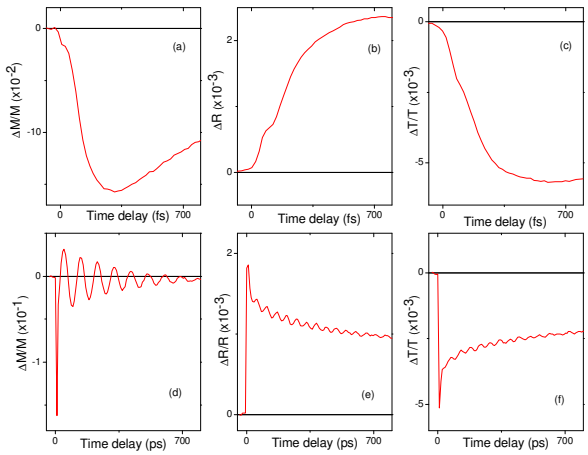

Figure 1:Ultrafast magnetization, reflectivity and transmission dynamics in a $Co_{95}Sm_5$ film displayed for time delays until 800 fs (a,b,c) and time delays until 800 ps (d, e, f).