Optical-helicity-driven magnetization dynamics in metallic ferromagnets

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We experimentally study magnetization dynamics of metallic ferromagnets (Co, Fe, Ni) driven by angular momentum of light. With a thin film ferromagnet/Au or ferromagnet/oxide structure, circularly polarized light imparts instantaneous torque on magnetization primarily into the direction of the cross product of magnetization and the angular momentum of photons. When the ferromagnetic layer is capped with a thin layer of Pt, there is additional torque into the direction of the angular momentum of photons. We interpret these different behaviors in terms of inverse Faraday effect and optical spin transfer torque. Inverse Faraday effect is relatively insensitive to the composition of the ferromagnetic material or capping layer; the coefficient that relates the optomagnetic field to the intensity of the optical electric field is on the order of 10^{-18} T m^2 V^{-2}. The optical spin transfer torque mostly comes from the Pt capping layer, which produces a spin polarization per photon of 0.03.