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Ultrafast magnetization reversal by induced orbital moment[1]
ANIRBAN KUNDU, SHUFENG ZHANG, University of Arizona — Recent experiments have shown that magnetization switching of rare-earth/transition-metal magnetic compounds can be achieved by intense circularly polarized laser beams. The role of the laser beams is two folds: to heat the sample to a temperature close to the transition temperature and to transfer the angular momentum of the laser beam to the orbital moment. With an induced orbital moment, it might be possible to achieve the magnetization reversal via spin-orbit coupling. Here we quantitatively examine such scenario by estimating the magnitude of the induced orbital moment. The polarized photons interact with itinerant band electrons in two distinct forms: resonant and non-resonant transitions. By using time-dependent perturbation approach, we have obtained the explicit dependence of the induced orbital moment on the characteristics of the underlying band structure after we have properly treated seemingly divergent terms in the perturbation theory. By placing the parameters from experiments in our formalism, we find that the induced orbital momentum is too small to fully account the observed magnetization switching. Other possible switching mechanism are discussed. This work was supported by NSF-ECCS-1404542.

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