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A powerful and alternative model for all-optical spin switching[1]
GUOPING ZHANG, YIHUA BAI, Indiana State University, THOMAS F GEORGE, University of Missouri-St. Louis — All-optical spin switching (AOS) has attracted enormous attention. Its underlying mechanism has been under intense debate. A few promising mechanisms include pure heating, inverse Faraday effect, magnetic circular dichroism, sublattice exchange interactions and others. However, the laser only interacts with a magnetic medium within the laser pulse duration, and how the helicity is injected into the system is crucial to understanding AOS. Here we propose a far more powerful but much simpler model that is able to explain varieties of switching in both ferromagnets and ferrimagnets. We show that it is the laser-induced optical spin-orbit torque that leads to the spin reversal. The dynamics can be very long if a weak exchange interaction is used. This is the case in rare-earth transition metal alloys. Our theory opens a new door to understanding the intricate switching and may have some important impact in future magnetic storage technology. (1) G. P. Zhang, Y. H. Bai and T. F. George, Switching ferromagnetic spins by an ultrafast laser pulse: Emergence of giant optical spin-orbit torque, Europhys. Lett. 115, 57003 (2016). (2) G. P. Zhang , T. Latta, Z. Babyak, Y. H. Bai and T. F. George, Mod. Phys. Lett. B 30, 1630005 (2016) 1630005.

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