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Spin-orbit current-induced torques in (Ga,Mn)As ERIN K. VEHSTEDT, Texas A&M University, USA; Institute of Physics, ASCR, CZ, LIVIU P. ZARBO, Institute of Physics, ASCR, CZ, KAREL VYBORNY, SUNY Buffalo, USA; Institute of Physics, ASCR, CZ, HIDEKAZU KUREBAYASHI, University of Cambridge, UK, PIERRE ROY, Hitachi Cambridge Laboratory, UK, JOERG WUNDERLICH, Hitachi Cambridge Laboratory, UK; Institute of Physics, ASCR, CZ, ANDREW J. FERGUSON, University of Cambridge, UK, TOMAS JUNGWIRTH, Institue of Physics, ASCR, CZ; University of Nottingham, UK, JAIRO SINOVA, Texas A&M University, USA; Institute of Physics, ASCR, CZ — Electrical control of magnetic domains has the potential to overcome key challenges to the development of new non-volatile and down-scalable logic and memory devices. We study the spin-orbit torque induced by an unpolarized electric current in the dilute ferromagnetic semiconductor, (Ga,Mn)As. The current-induced torque (CIT) is modeled as the interaction between the uniform magnetization and an effective magnetic field representing the non-equilibrium carrier spin-polarization. We calculate the current-induced field (CIF) using the Kubo linear-response formalism for a broad range of material parameters. We find that the CIF is composed of a dominant term due to the inverse spin galvanic effect and a small component which is dependent on the relative orientation of the current, magnetization, and crystal axes. In conjunction with experimental studies, we investigate the magnetization dynamics using the phenomenological Landau-Lifschitz-Gilbert equation. The study of (Ga,Mn)As opens the door to a comprehensive theory of CITs in uniform magnetic semiconductors.

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