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Spin-orbit control of magnetization and electrical detection of current-induced spin polarization. MASON OVERBY, ALEX CHERNYSHOV, LEONID ROKHINSON, Purdue University, XINYU LIU, JACEK FURDYNA, Notre Dame University — The success of future spintronic devices relies on the efficient control and detection of spin polarization. Extrinsically polarized currents, injected from ferromagnetic materials, can interact with magnetic domains and initiate domain rotation. Alternatively, spin polarization can be generated intrinsically via relativistic coupling of spin to the momentum of charge carriers, known as spin-orbit interaction (SO). While the use of SO for electrostatic control of polarization forms the basis of various theoretical device concepts, SO control of magnetization has not been realized experimentally. Here we demonstrate that magnetization can be reversibly manipulated by intrinsically polarized currents in ferromagnetic semiconductors with strong SO coupling. Magnetization direction is repeatedly switched between two orthogonal easy axes by SO effective magnetic field generated by the injection of unpolarized currents with densities $<10^6$ A/cm^2. We also show that current-induced SO field can be detected electrically. By monitoring magnetization direction in small external magnetic field we can measure both magnitude and direction of the SO field.

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