Mapping Spin-Orbit Splitting in Strained (In,Ga)As Epilayers

B.M. NORMAN, C.J. TROWBRIDGE, V. SIH, Department of Physics, University of Michigan, Ann Arbor, MI 48109, J. STEPHENS, A.C. GOSSARD, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA 93106 — Time-resolved and spatially resolved Faraday rotation spectroscopy is used to measure the magnitude and direction of the momentum-dependent spin splitting in strained InGaAs epilayers. The epilayers are lattice-matched to the GaAs substrate and designed to reduce inhomogeneous effects related to strain relaxation. Measurements of momentum-dependent spin splitting as a function of electron spin drift velocity along [100], [010], [110] and [1T0] directions enable separation of isotropic and anisotropic effective magnetic fields that arise from uniaxial and biaxial strain along ⟨110⟩. Such electrically induced effective magnetic fields can be used for spin generation and manipulation in spintronics devices. We find that anisotropic and isotropic strain-induced effective magnetic fields are comparable in magnitude. ¹