Characterization of spin-orbit fields in InGaAs quantum wells

GIAN SALIS, TOBIAS HENN, LUKAS CZORNOMAZ, IBM Research - Zurich — Narrow-gap semiconductors exhibit strong spin-orbit interaction and are therefore of interest for spin-based quantum devices and for Majorana zero modes. We investigate coherent electron-spin dynamics and the size and symmetry of spin-orbit interaction in InGaAs/InAlAs quantum wells from 10 K to room temperature using time-resolved Kerr rotation. The spin lifetime exceeds 1 ns at 10 K and decreases with temperature. By imprinting a diffusive velocity on the measured electron spins [1], the spin-orbit energy is measured as a change in spin precession frequency. A Rashba symmetry of the spin-orbit interaction is determined with a Rashba coefficient of $2 \times 10^{-12}$ eV m [2]. This technique can be applied to other narrow-gap semiconductors without the need to lithographically process the sample or to apply electrical signals.


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