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Hole spin coherence in coupled GaAs/AlAs quantum wells[1]
CHRISTIAN GRADL, MICHAEL KEMPF, JOHANNES HOLLER, DIETER SCHUH, DOMINIQUE BOUGEARD, CHRISTIAN SCHUELLER, TOBIAS KORN, University of Regensburg — Due to its p-like character, the valence band in GaAs-based heterostructures offers rich and complex spin-dependent phenomena. Especially for some low-symmetry growth directions, a strong anisotropy of the hole g factor with respect to the in-plane magnetic field direction is theoretically predicted. Therefore, we perform time-resolved Kerr rotation measurements on an undoped [113]-grown double quantum well (QW) structure to resolve the spin dynamics of hole ensembles at low temperatures. Our gated system consists of two QWs with different well widths, which we use for the spatial separation of the optically excited electron-hole pairs. Thus, we are able to create hole ensembles with spin lifetimes of several hundreds of picoseconds in the broader QW without any doping. This allows the observation of a strong hole g factor anisotropy by varying the magnetic field direction in the QW plane. The experimental g factor values are in very good agreement with theoretical predictions. Furthermore, we observe an unexpected additional non-precessing component in the Kerr signal for certain in-plane magnetic field directions. This might have its origin in a precession axis that is tilted relative to the magnetic field due to the crystal structure of this low-symmetry growth direction.

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