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Spin and energy relaxation of excitons in GaAs coupled quantum wells[1] CHIH-WEI LAI, KYAW ZIN LATT, Michigan State University, WERNER DIETSCHE, Max Planck Institute for Solid State Research — We report sub-100ps exciton spin relaxation and transient splitting attributed to exchange interaction for intra-well excitons. The spin splitting and relaxation are analyzed in terms of inter-exciton and intra-exciton exchange interaction. For inter-well excitons where intra-exciton change interaction is suppressed, a spin decay-time >1-ns is observed at low densities. Transient exciton spin splitting and relaxation are determined from time-resolved photoluminescence (TRPL) spectroscopy and polarimetry with a streak camera system. In contrast to standard TRPL measurements based on up-conversion and pump-probe techniques, the streak-camera setup allows for speedy spectroscopy and Stokes polarimetry measurements as a function of the exciton density, and magnetic and electric fields. For 6- nm GaAs/AlGaAs quantum wells at intermediate density (a few 10^{10} cm^{-2}), a spin splitting of 2-meV with a decay time of $\sim$50 ps appeared instantly under a near-resonant ps pulsed excitation. For long-lived (>1ns) inter-well spatially indirect excitons under a cross-well electric field, intra- exciton exchange interaction is suppressed and the inter-exciton interaction is dominantly dipolar. Transient exciton energy shift and spin relaxation are characterized versus the exciton density and applied electric field under an excitation near the intra-well direct exciton transition.

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