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Transient Exciton Spin Splitting in GaAs Quantum Wells under Near-Resonant Excitation KYAW ZIN LATT, CHIH-WEI LAI, Michigan State University — We investigated spin dependent exciton-exciton interaction and energy relaxation under near-resonant circularly polarized ps pulsed excitation in single, multiple, or double coupled GaAs/AlGaAs quantum wells. Transient exciton spin splitting and relaxation were 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/electric field under near -resonant excitation ($\sim$3 to 10 meV from the exciton resonance). For 6-nm and 14-nm GaAs/AlGaAs quantum wells at intermediate density (a few 10^{10} cm^{-2}), a spin splitting of 2 and 1 meV appeared instantly within 10 ps after excitation and exhibited a decay time constant of $\sim$100 and 500 ps, respectively. In the presence of magnetic fields, the spin splitting and relaxation dynamics became non-exponential and exhibited asymmetric and nonlinear dependence on the direction and magnitude of the field up to 10 Tesla. We analyzed the spin splitting and relaxation dynamics in terms of inter-exciton and intra-exciton exchange interaction and exciton-carrier interaction.

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