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Neutral and charged excitons in single GaAs-based interface quantum dots C.J. MEINING, V.R. WHITESIDE, B.D. MCCOMBE, University at Buffalo, The State University of New York, NY 14260, J.G. TISCHLER, A.S. BRACKER, D. GAMMON, Naval Research Laboratory, Washington, D.C. 20375-5347, A.B. DZYUBENKO, California State University at Bakersfield, CA 93311, M. BYSZEWSKI, M. POTEMSKI, Grenoble High Magnetic Field Laboratory, France
— We report circularly polarized photoluminescence (PL) in high magnetic fields ($<$ 28 T) and optically detected resonance (ODR) experiments of interface fluctuation quantum dots (IFQDs) in narrow GaAs/AlGaAs quantum wells (QWs) doped in the barriers with donors to allow creation of both neutral and negatively charged excitons. In the narrowest QW the diamagnetic shift of the trion is smaller than that of the neutral exciton. This is attributed to the larger spatial extent of the trion wavefunction in these ensembles of weakly confined QDs. Along with a careful study of the excitonic Zeeman splitting and complemented by a comparison of ensemble and single dot ODR measurements, this signature can be used to assign the narrow spectral lines observed in single dot PL studies as neutral and charged excitons. The PL of the trion is found to increase under resonant irradiation with far-infrared laser light, opposite to the behavior observed for wide QWs. Lateral carrier redistribution is believed to be the dominant mechanism that gives rise to the ODR signal in QWs with monolayer well width fluctuations.
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