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Anomalous Polarization Behavior of a Zeeman Doublet in CdSe Nanocrystal Quantum Dots H. HTOON, Chemistry Divisioin, Los Alamos Natioinal Laboratory, M. FURIS, S. A. CROOKER, National High Magnetic Field Laboratory, Los Alamos, AL. L. EFROS, Center for Computational Material Science, Naval Research Laboratory, S. JEONG, V. I. KLIMOV, Chemistry Divisioin, Los Alamos Natioinal Laboratory — It is well known that a Zeeman doublet observed in emission spectra of a degenerate quantum state in the case of detection along an applied magnetic field (B field) is characterized by left and right circular polarizations. However, our single nanocrystal quantum dot (NQD) studies conducted in B-fields up to 5 T indicate that the Zeeman doublet of some of the CdSe NQDs exhibits a completely different polarization behavior. Specifically, we observe that the lower-energy state of the doublet becomes increasingly circularly polarized with increasing B field, while the higher-energy state shows a zero degree of circular polarization (i.e remains linearly polarized). We explain this anomalous polarization behavior in terms of mixing between the Zeeman split levels derived from the low- and high-energy bright exciton states. This mixing relies on strong long-range electron-hole exchange interactions that are unique to ultrasmall nanocrystals.

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