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Bright Exciton Fine Structure Observed in Single CdSe Nanocrystal Quantum Dots S.A. CROOKER, M. FURIS, National High Magnetic Field Laboratory, Los Alamos, NM, H. HTOON, M.A. PETRUSKA, V.I. KLIMOV, Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM — The fine structure splitting of bright excitons in epitaxial quantum dots provides a basis for many quantum computation and entanglement schemes. We demonstrate the existence of a similar splitting in single colloidal CdSe nanocrystals through high-resolution, polarization-resolved, low-temperature photoluminescence (PL) experiments. At 4K, single-dot spectra reveal emission from two distinct, linearly- (and orthogonally-) polarized bright exciton states. This splitting of the nominally degenerate spin ± 1 bright excitons ranges from 1 to 2 meV, depending on nanocrystal size. These values agree well with the splitting recently inferred from spin-polarized resonant PL of nanocrystal ensembles measured in high magnetic fields to 33 Tesla [1]. Similarly to epitaxially-grown quantum dots, the observed fine structure likely results from shape anisotropy of the nanocrystal (i.e. a reduction of axial symmetry), leading to a long-range, anisotropic electron-hole exchange. [1] M. Furis et al., cond-mat/0511567.

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