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Strong Spin-Exchange Interactions in Magnetically Doped Colloidal Nanocrystals WILLIAM RICE, WENYONG LIU, THOMAS BAKER, GEN CHEN, JEFFREY PIETRYGA, VICTOR KLIMOV, SCOTT CROOKER, Los Alamos National Lab — Using magnetic circular dichroism, magneto-photoluminescence, and time-resolved Faraday rotation measurements, we study the spin-exchange interactions between excitons and embedded magnetic ions in Mn-doped colloidal nanocrystals. In contrast to undoped nanocrystals, the Mn-doped nanocrystals show giant Zeeman splittings of the nanocrystal conduction and valence bands and a very rapid dephasing of the optically created excitons (two orders of magnitude faster than undoped CdSe). Although the exciton spin coherence is short (less than 10 ps), the $sp-d$ spin exchange between the exciton and Mn moments induces a long-lived precession of the Mn^{2+} paramagnetic moments that persists out to nanosecond timescales. We study this induced Mn precession as a function of nanocrystal size, Mn doping density, temperature, and magnetic field.

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