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Spin pumping efficiency in room temperature CdSe nanocrystal quantum dots[1] AHMAD KHASTEHDEL FUMANI, JESSE BEREZOVSKY, Case Western Reserve University — To understand and optimize optical spin initialization in room temperature CdSe nanocrystal quantum dots (QDs) we studied the dependence of the pump energy E on the time-resolved Faraday rotation signal in a series of QD samples with different sizes. In 6.1-nm-diameter QDs, we observe two peaks in the spin signal vs. E. The first peak occurs on resonance at 1.95eV, with the second peak $\sim$ 0.17eV higher in energy before the spin signal falls off to near zero. We calculate the spin-dependent oscillator strengths of optical transitions using an 8-band effective mass model to understand these results. The observed E dependence of the spin pumping efficiency (SPE) arises from the competition between the heavy hole (hh), light hole (lh) and split-off (so) band contributions to transitions to the conduction band. The two latter contributions lead to an electron spin polarization in the opposite direction from the former. At lower E the transitions mainly involve the hh band, giving rise to the two main peaks. At higher E, the increasing contributions from the lh and so bands lead to a reduction in SPE. In smaller QDs, both peaks merge while moving to higher E, and the overall SPE is reduced.

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