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Room temperature spin decoherence and dephasing in CdSe nanocrystal quantum dots[1] AHMAD KHASTEHDEL FUMANI, Department of Physics, Case Western Reserve University, REZA SHARGHI-MOSHTAGHIN, Department of Materials Science and Engineering, Case Western Reserve University, JESSE BEREZOVSKY, Department of Physics, Case Western Reserve University — We combine transmission electron microscopy (TEM) and Faraday-rotation-based spin measurements to reveal the connection between coherent electron spin dynamics and the shape and size distribution of an ensemble of nanocrystal quantum dots. Optically pumped spins in CdSe nanocrystal quantum dots provide a platform for studying coherent dynamics and decoherence of spins of charge carriers in a complex, room-temperature environment. In a transverse magnetic field, decay of the ensemble spin signal is often ascribed to inhomogeneous dephasing caused by the distribution of nanocrystal sizes across the ensemble. In this work, we measure the size and shape distribution of an ensemble of nanocrystals using TEM, and compare the resulting calculated spin dynamics to those measured in a time-resolved Faraday rotation experiment. We find that the size inhomogeneity alone is insufficient to explain the measured dephasing times and decay envelopes. We propose an ensemble decoherence mechanism based on the distribution of nanocrystal shapes which can account for both the magnetic field dependence of the dephasing time and the shape of the decay envelope.

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