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Cavity Enhanced Faraday Rotation in Semiconductor Quantum Dots[1] D.W. STEUERMAN, Y.Q. LI, J. BEREZOVSKY, D.S. SEFEROS, G.C. BAZAN, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA 93106 — The promise of quantum computation is helping fuel the development of single spin manipulation and measurement techniques. Photonic cavities provide an intriguing platform to increase the sensitivity of optical measurements, as well as the possibility to explore emergent light-matter interactions. The flexibility of a dielectric vertical cavity is exploited to study the spin dynamics within molecularly self-assembled CdSe quantum dots (QDs). Through the integration of QDs in microcavities, a twenty-fold enhancement of Faraday rotation is observed, which scales with the quality factor of the cavity. In this weak coupling regime, the amplified rotation is attributed to optically generated excited spins and multiple passes of the probe photons in the cavity. By applying this general planar cavity motif to Faraday rotation, dynamical measurements are accessible at extremely low powers on relatively small numbers of quantum confined states. In CdSe QDs, low power measurements reveal that contributions from both exciton and electron spin precession are largely dependent upon the power of excitation. This scheme is amenable to both soft and hard systems as a means to increase detection sensitivity.

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