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Kerr rotation studies of single electron spin dynamics in a quantum dot[1] M.H. MIKKELSEN, J. BEREZOVSKY, O. GYWAT, N.G. STOLTZ, L.A. COLDREN, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA 93106 — Kerr rotation measurements are used to directly and non-destructively probe the dynamics of a single electron spin in a charge-tunable quantum dot [2]. The dot is formed by interface fluctuations of a GaAs quantum well and embedded in a vertical optical cavity. Using Hanle techniques, we perform single electron Kerr rotation measurements at $T = 10$K in order to monitor the depolarization of an optically pumped electron spin within an applied transverse magnetic field. This reveals information about the time averaged transverse spin lifetime, T_2^*. At gate voltages for which the charging rate of the dot is relatively low, the results yield a T_2^* in agreement with values expected from the hyperfine interaction in these materials. In contrast, at larger charging rates, we find that T_2^* is strongly reduced, indicating the importance of additional decoherence mechanisms in that regime.

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[2]J. Berezovsky, M. H. Mikkelsen, O. Gywat, N. G. Stoltz, L. A. Coldren, and D. D. Awschalom,*Science Express*, 9 November 2006, (10.1126/science.1133862)

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