Abstract Submitted
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Ultrafast coherent optical manipulation of a single electron spin in a quantum dot[1] M.H. MIKKELSEN, J. BEREZOVSKY, N.G. STOLTZ, L.A. COLDREN, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA 93106 — A key ingredient for spin-based quantum information processing is the coherent rotation of a spin state on timescales much faster than the spin coherence time. By applying off-resonant, picosecond-scale optical pulses, we demonstrate the coherent rotation of a single electron spin in a GaAs quantum dot (QD) through arbitrary angles up to π rad.[2] We directly observe this spin manipulation using time-resolved Kerr rotation spectroscopy[3] at T=10K. Measurements of the spin rotation as a function of laser detuning and intensity confirm that the optical Stark effect is the operative mechanism and the results are well-predicted by a model including the electron-nuclear spin interaction. Using short tipping pulses and QDs with long spin coherence times, this technique enables one to perform a large number of operations within the coherence time.

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[2]J. Berezovsky, M.H. Mikkelsen, N.G. Stoltz, L.A. Coldren, D.D. Awschalom, *Submitted*, (2007)
[3]M.H. Mikkelsen, J. Berezovsky, N.G. Stoltz, L.A. Coldren, D.D. Awschalom, *Nature Physics* **3**, 770 (2007)

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