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Spin decoherence of a single NV center in its orbital excited state[1]

V. V. DOBROVITSKI, Ames Laboratory, US DOE, G. D. FUCHS, D. M. TOYLI, F. J. HEREMANS, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA, C. D. WEISS, T. SCHENKEL, Lawrence Berkeley National Laboratory, Berkeley, CA, D. D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California, Santa Barbara, CA — Nitrogen vacancy (NV) centers in diamond are promising candidates for quantum information processing at room temperature. Due to the peculiar structure of their excited state [1,2], the spin of a single NV center can be initialized and read out by optical means. Theoretical descriptions are provided for the spin decoherence in the excited state of NV centers caused by orbital coupling to phonons. We explain the shortened decay times seen in recent experiments on the excited-state Rabi oscillations and Ramsey fringes. Spin decoherence is found to be governed by the Raman processes, which also determine orbital decoherence [3]. This theory explains the appearance and positions of the excited-state ESR lines. [1] G. D. Fuchs et al., Phys. Rev. Lett. 101, 117601 (2008). [2] L. J. Rogers et al., New J. Phys. 11, 063007 (2009); A. Batalov et al., Phys. Rev. Lett. 102, 195506 (2009). [3] K.-M. C. Fu et al., arXiv:0910.0494.

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