Abstract Submitted
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Robustness of optically-controlled Berry phase in a diamond spin qubit[1] BRIAN B. ZHOU, CHRISTOPHER G. YALE, F. JOSEPH HEREMANS, DAVID D. AWSCHALOM, Institute for Molecular Engineering, University of Chicago, Chicago, IL 60637, ADRIAN AUER, GUIDO BURKARD, Department of Physics, University of Konstanz, D-78457 Konstanz, Germany — The intrinsic noise resilience of geometric phases has motivated their application as an alternative protocol for realizing high fidelity quantum operations. Using stimulated Raman adiabatic passage (STIRAP) to cyclically evolve the dark state of a lambda system, we demonstrate all-optical control over Berry phase for a single spin in the solid state, the nitrogen vacancy center in diamond [1]. Here we introduce both phase and amplitude noise into the optical control fields for a class of 'tangerine slice' trajectories on the Bloch sphere. We examine the response of Berry phase to scaling of the noise amplitude and adiabatic cycle time, finding Berry phase to be unaffected by deviations parallel to the trajectory and to increase in robustness for long cycle times. Moreover, our noise resilience is independent of the value of the accumulated Berry phase, a property that differs from the behavior of circular trajectories investigated by prior microwave techniques. We also discuss potential improvements to our work.

[1] C. G. Yale*, F. J. Heremans*, B. B. Zhou,* A. Auer, G. Burkard, D. D. Awschalom, arXiv:1507.08993 (2015).

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