3 Level Control of NV–Centers for Advanced Sensing Applications

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Abstract

The negatively charged nitrogen-vacancy (NV) defect in diamond has established itself as a promising quantum sensing platform with applications in nuclear magnetic resonance at the nanoscale. Still, control protocols are not yet optimized to work in all imaginable regimes. We present the NV-ERC technique, which has demonstrated efficient initialization and readout of the double quantum transition with no leakage to any third level thanks to an effective Raman coupling. The protocol is especially useful in the low-field regime and for high-frequency sensing applications. Based on this insight, we propose a scheme to perform fast single qubit gates in the double quantum transition. We study its robustness with respect to pulse-timing errors resulting from faulty identification of system parameters or phase-control limitations. We demonstrate that the technique can also be implemented in the presence of unknown electric or strain fields.

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