Polarization transfer to external nuclear spins using nitrogen-vacancy centers in diamond and surface electron reporter spins

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The use of nitrogen-vacancy (NV) centers in diamond as a non-invasive platform for hyperpolarizing nuclear spins in molecular samples is a promising area of research with the potential to enhance the sensitivity of nuclear magnetic resonance (NMR) experiments. Transferring NV polarization out of the diamond structure has been achieved on nanoscale targets using dynamical nuclear polarization (DNP) methods, but extending this to bulk samples used in standard NMR poses significant challenges. One major technical hurdle is the presence of paramagnetic defects in the form of sur face dangling bonds, which can interfere with polarization outflow. However, these defects can also be harnessed as intermediaries for the interaction between NVs and nuclear spins. We present a microwave sequence that transfers polarization efficiently and robustly using surface dangling bonds or other localized electron intermediaries via functionalized surfaces, with the potential to increase polarization rates under realistic conditions

References

[1] I. Schwartz, et al., Science Advances 4, eaat8978 (2018).

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[3] J.-P. Tetienne, et al., Phys. Rev. B 103, 014434 (2021).

Figures

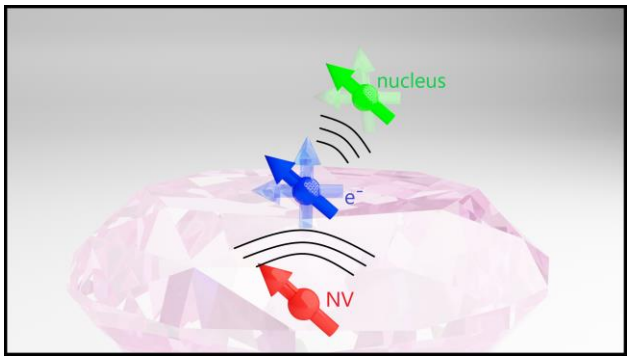

Figure 1: Schematics of the proposed protocol. The NV transfer its polarization state through an intermediate electron at the diamond surface.

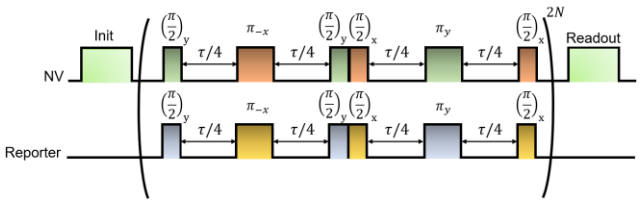

Figure 2: Schematics of the MW pulse sequence on the NV and the electron spin for pulsed polarization transfer.