Robust control of nuclear spins in diamond

LILIAN CHILDRESS, BENJAMIN SMELTZER, Bates College — Isolated nuclear spins offer a promising building block for quantum information processing systems, but their weak interactions often impede preparation, manipulation, and detection. Hyperfine coupling to a proximal electronic spin can provide a polarization and readout mechanism and enhance manipulation and interaction speed. Using the electronic spin of the nitrogen-vacancy center as an intermediary, we demonstrate robust initialization, fast manipulation, and direct optical readout of $^{13}$C, $^{14}$N, and $^{15}$N nuclear spins in diamond. These results pave the way for nitrogen nuclear spin-based architectures in isotopically purified diamond.

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