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Sensitive Detection of Weak Dynamic Nuclear Polarization¹ CHARLES F. DE LAS CASAS, PAOLO ANDRICH, DAVID D. AWSCHALOM. Institute for Molecular Engineering, University of Chicago — Capable of detecting nanotesla magnetic fields with nanometer resolution, shallow NV centers in diamond have recently been investigated as NMR sensors that can distinguish different biological molecules at the single molecule level. While NV centers closer to the diamond surface are generally more sensitive to a smaller number of molecular nuclear spins, NV centers shallower than about 2 nm are unstable and eventually become insensitive to the nuclear magnetic fields of nearby molecules. This places a significant limit on the strength of dipolar coupling between molecular spins and NV centers. The challenge in distinguishing between different molecules is in obtaining a strong structure dependent signal despite this weak coupling. One such signature could potentially be obtained by using the NV center as both a detector of nuclear magnetic fields and a source of dynamic nuclear polarization. However, the weak dipolar coupling significantly limits the amount of dynamic nuclear polarization the NV can impart to external molecules. Here we introduce a measurement scheme to sensitively detect weak levels of dynamic nuclear polarization even when greatly exceeded by the statistical polarization of nearby nuclei.

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