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Optically-pumped dynamic nuclear polarization under ambient conditions via nitrogen-vacancy centers in diamond

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A broad effort is underway to improve the sensitivity of nuclear magnetic resonance through the use of dynamic nuclear polarization (DNP). Nitrogen-vacancy (NV) centers in diamond offer an appealing platform because these paramagnetic defects show efficient optical pumping at room temperature. This presentation focuses on the spin dynamics of NVs coupled to substitutional nitrogen (the so called P1 center) as a platform for DNP, with emphasis on recent schemes designed for powder geometries and optimal polarization transfer across the diamond surface. I will also discuss new phenomenology under NV-P1 cross-relaxation conditions revealing record fast nuclear spin diffusion constants as well as quick, homogeneous thermalization between bulk and strongly hyperfine-coupled nuclei. These observations highlight the need for DNP descriptions beyond classical models based on spin diffusion barriers.

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