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Approach to Dark Spins Initialization in Nanodiamond ABDELGHANI LARAOUI, CAROS MERILES, Department of Physics, City College of New York, CUNY — Diamond nanoparticles host a number of paramagnetic point defects and impurities–many of them adjacent to the surface–whose response to external stimuli could help probe the complex dynamics of the particle and its local, nanoscale environment. Here we use a Hartman-Hahn protocol to demonstrate spin polarization transfer from a single, optically-polarized nitrogen-vacancy (NV) center to the ensemble of paramagnetic defects hosted by an individual diamond nanocrystal (30 nm in diameter). Owing to the strong NV-bath coupling, the transfer takes place on a short, microsecond time scale. Upon fast repetition of the pulse sequence we observe strong polarization transfer blockade, which we interpret as an indication of spin bath cooling. Numerical simulations indicate that the spin bath polarization is non-uniform throughout the nanoparticle averaging approximately 2% over the crystal volume, but reaching up to 20% in the immediate vicinity of the NV. These observations may prove relevant to the planning of future bath-assisted magnetometry tests.

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