Decoherence imaging of spin ensembles using a scanning single-electron spin in diamond

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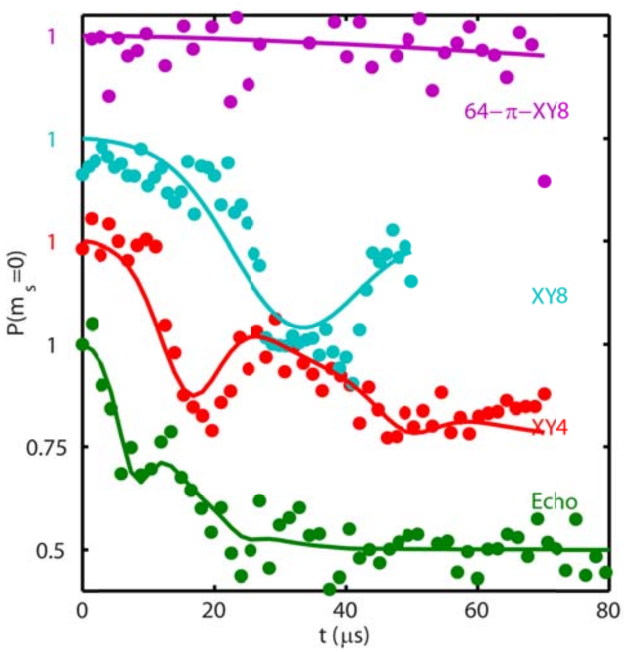
Supplementary Discussion: Extraction of the coherence time T_2 under dynamical decoupling sequences.

We measure the NV spin coherence under dynamical decoupling sequences when the scanning naopillar is contact with the sample surface. To extract the coherence time T_2, we fit the measurements by stretched exponential envelops multiplied by periodic Gaussian functions describing the collapses and revivals induced by nearby ^{13}C nuclear spins. The fit function is $C(t) = Exp(-(t/T_2(n))^p) \times (\sum_i Exp(-(t - i\tau_R(n))^2/\tau_{dev}(n)^2))$, where $C(t)$ is the coherence of the NV spin, exponent p is held the same for all curves, n is the number of π pulses in the sequences, $\tau_R(n) = \tau_R^{echo} \times n/2$ is determined by the ^{13}C nuclear Larmor frequency in the applied DC magnetic field, and $\tau_{dev}(n)$ describes the revival peak width. We obtain $p = 1.6 \pm 0.2$ and T_2 for Echo, XY4, XY8 and 64-π-pulse XY8 to be 14.8 ± 1.5 µs, 38.0 ± 2.4 µs, 68 ± 12 µs, and 290 ± 110 µs respectively. The data and the fits are plotted in the figure below.



Supplementary Figure: Extraction of T_2. The data are identical to Fig 2b in the main text, and each sequences are shifted vertically by 0, 0.25, 0.5, and 0.75, respectively, for clarity. The solid lines plot the fits as described above, from which we extract T_2.