

Supplementary Information

Cooperative dynamic polaronic picture of diamond color centers

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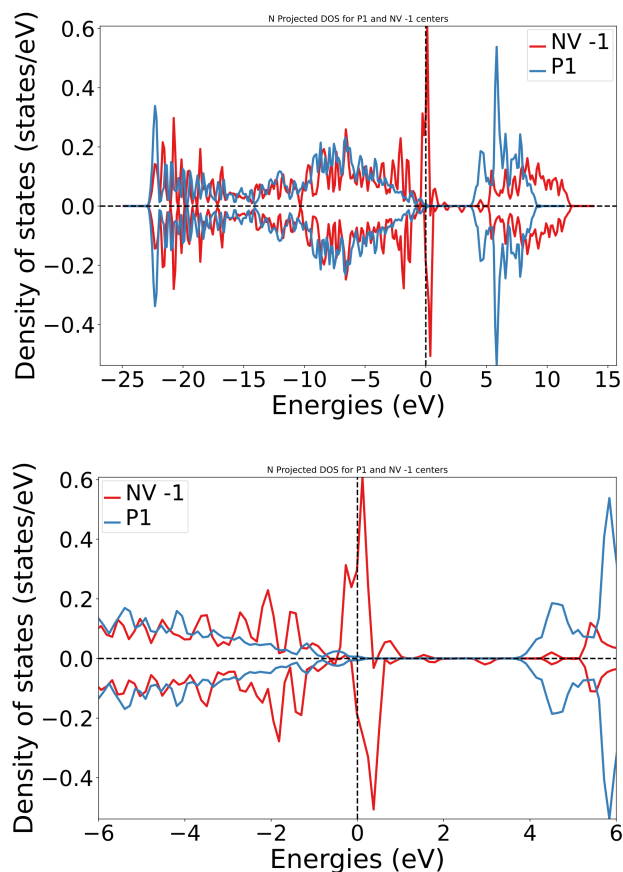


Figure S1: DFT calculations of the density of states (DOS) for NV diamond using VASP 6.4 code with a 64 atoms supercell. The top panel presents a wider energy range, while the bottom panel focuses on the vicinity of the band gap. NV-1 represents the DOS for NV⁻ center and P1 represents the DOS for the P1 center.

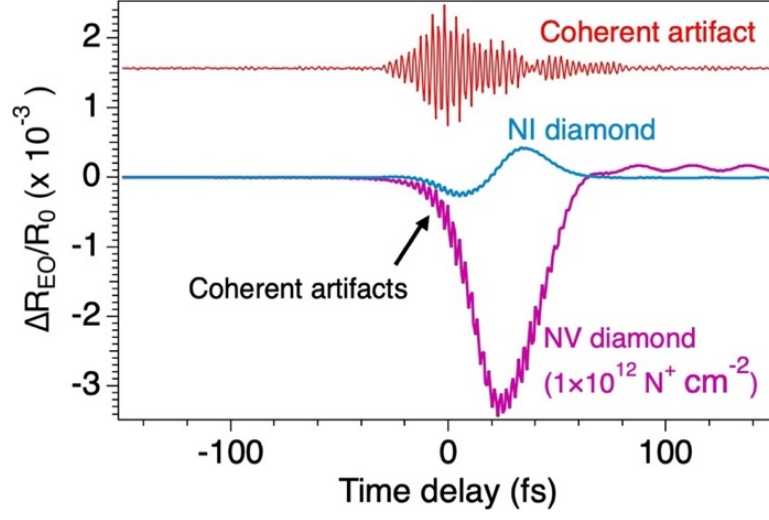


Figure S2: Time-resolved EO response around $\tau = 0$, demonstrating the appearance of coherent artifacts at $\tau = 0$. The top fringe-like coherent artifacts were extracted from the EO response for the NI diamond.

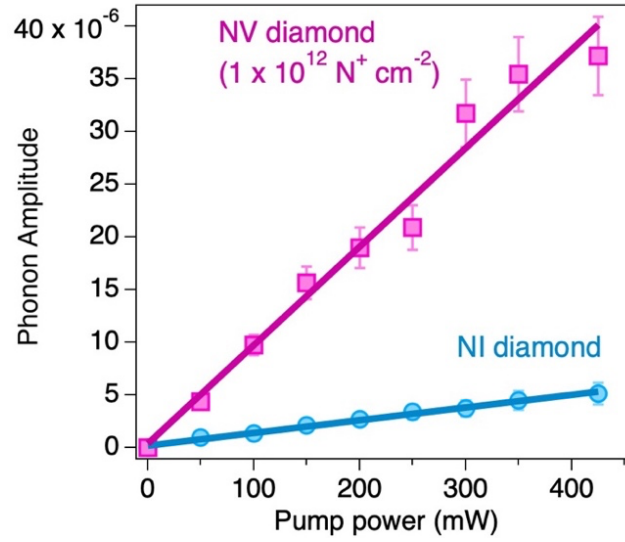


Figure S3: The amplitude of coherent LO phonons as a function of the pump power for the NI and NV ($1 \times 10^{12} \text{ N}^+ \text{ cm}^{-2}$) diamonds. The solid lines are the fit using a linear function. The maximum power in the additional measurements was 430 mW, slightly below that of the main text due to the laser conditions.

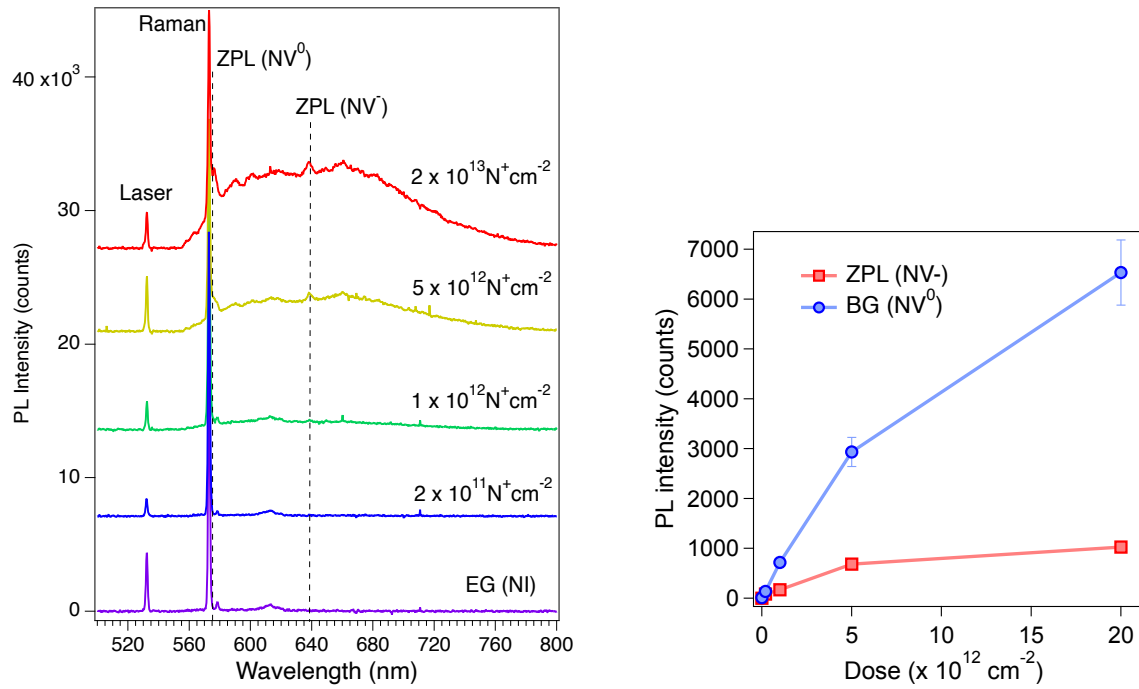


Figure S4: (Left) Photoluminescence spectra obtained for the diamond samples using a 532 nm CW laser and a fiber coupled visible spectrometer. (Right) PL intensity as the function of N^+ dose for zero phonon line (ZPL) at 638 nm of NV^- center and background component at 600 nm reflecting the NV^0 center.

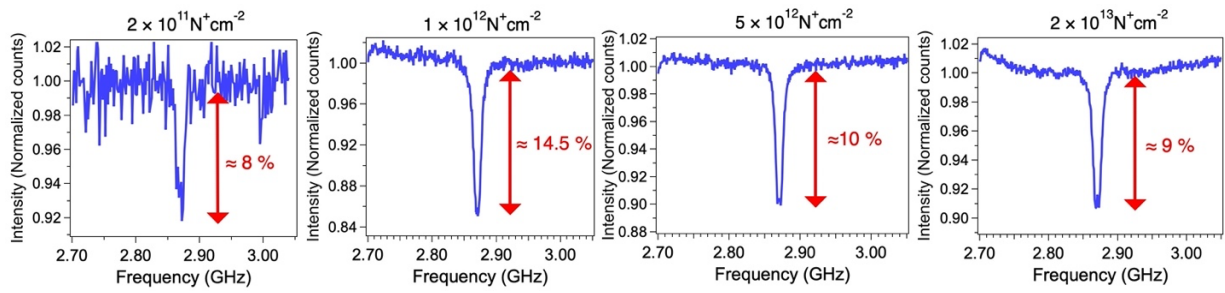


Figure S5: Optically detected magnetic resonance (ODMR) spectra obtained at room temperature for the NV diamond samples using 532 nm cw laser.