While the optimal density of NV centers is generally thought in term of a compromise between sensitivity and the spins coherent time T_2^*, other more exotic effects start to appear when the spin density reaches a critical point.

For concentration higher than $\sim$ 1 ppm (corresponding to a mean distance between spins of $\approx$ 15 nm or a dipolar coupling strength of $\approx$ 15 KHz), the dipolar coupling between the NV spins starts to play an important role. One effect of importance is the modification of the spin lifetime T_1 through dipolar coupling with other NV centers [3, 5, 2]. This particular effect has been used with a levitating diamond in a Paul trap to observe a resonant change in the spins magnetic susceptibility [7].

Other collective effects between NV centers include the cooperative enhancement of the dipole force of the NV centers, a phenomenon similar to that of supperradiance described in [1, 6, 8], and observed with a levitating diamond in an optical tweezer by Juan et al. [4].

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