The identification of stable dark states of a single nitrogen vacancy (NV) center surrounded by several ^{13}C atoms in a diamond lattice

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Initially the spin Hamiltonian method [1,2] is applied for a system composed of a single nitrogen-vacancy (NV) center in a diamond and several ^{13}C atoms at nearby lattice sites. The NV centers have spin $S = 1$, whereas the ^{13}C atoms have spin $S = 1/2$. The eigenvalues and eigenfunctions of the ground state of said system are calculated.

Then those eigenfunctions that could be related to a Λ scheme formed by a two-photon resonance excited by a single microwave source are identified.

Afterwards we examine whether the two-photon resonance criterion remains valid as the magnetic field value is changed by the interaction of ^{13}C atoms located at more distant lattice sites. If so, a stable dark state is identified. Finally we evaluate if the dark state's position with respect to the microwave frequency remains stable as the magnetic field is changed. Thus we attempt to explain certain characteristics of the ODMR spectra obtained from a ^{13}C isotopically enriched diamond crystal.

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References

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