Towards Measurements of the Optical Coherence of the SnV in Diamond

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Recently the tin-vacancy (SnV) centre in diamond was demonstrated as a competitive spin-qubit with a spin-coherence time of 0.33ms and MHz Rabi rates [1]. This is particularly promising as these demonstrations were achieved in nanostructured diamonds, without any surface passivation engineering, in standard closed-cycle He cryostats; overcoming the charge instability and phonon-limited dephasing at these temperatures inherent to the other major defect centres in diamond: the nitrogen and silicon vacancies respectively.

However, despite this promise, in order to realise quantum-networking applications the intrinsic, optical, coherence of the SnV is yet to be shown through Hong-Ou-Mandel (HOM) spectroscopy. In this work, we report on the excited state coherence of the SnV and show that the $T_2 = 2T_1$ limit is easily reached given simple Hahn-Echo rephasing protocols. This result further highlights that the SnV is a promising candidate for quantum-networking applications as the maximum achievable HOM visibility is not intrinsically limited. Furthermore, we describe steps towards measuring the HOM visibility to confirm these findings. As such, these preliminary results highlight that the SnV is a realistic platform on which to build photonic cluster states, and similar photonics-based quantum resources, for high fidelity, error-tolerant, quantum communication.

References

[1] Debroux, R., Michaels, C.P., Purser, C.M., Wan, N., Trusheim, M.E., Martínez, J.A., Parker, R.A., Stramma, A.M., Chen, K.C., de Santis, L. and Alexeev, E.M., 2021. Quantum control of the tin-vacancy spin qubit in diamond. arXiv preprint arXiv:2106.00723.

Figures

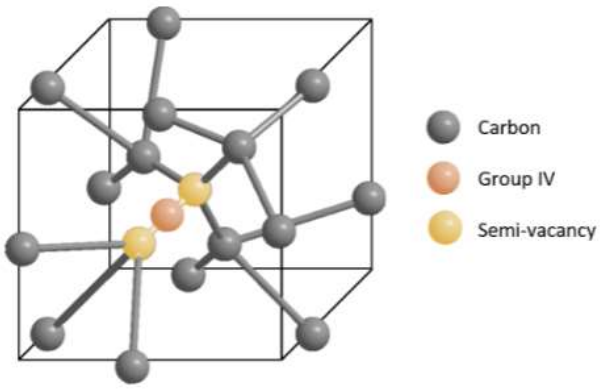

Figure 1: The inversion symmetric SnV centre in diamond