Coherent spin control of telecom single-photon emitters in Silicon

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Due to its highly mature CMOS technology, silicon is one on the most desired platforms for the development of next-generation quantum technologies. Driven by recent advances on T centers [1] and Erbium ions [2], a current challenge in silicon is to control the electron spin of individual optically-active defects to obtain spin qubits interfaced with telecom single photons. In this vein, the G center [3] could be another promising candidate since it features a telecom emission around 1.3 µm with an optically-detected magnetic resonance (ODMR) associated to a metastable spin triplet reported on ensemble measurements in the 80's [4].

In this work, we detect the ODMR of a single G center integrated inside a silicon Bull-eye cavity. We demonstrate the coherent control of its electron spin and investigate its coherence times. We evidence an ODMR fine structure that could be attributed to different spin orientations resulting from the motion of the defect center-of-mass. In a near future, the intrinsic nuclear spins of the G center (^{13}C or ^{29}Si) could be addressed using the electron spin. Similar to previous studies on ionized donors in ^{28}Si, the combination of an electron-spin free ground state with vacuum-like environment could promise record coherence times for the nuclear spin memory qubits [5].

References

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Figures

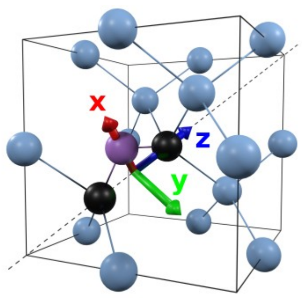

Figure 1: Micro-structure of the G center (blue: silicon, purple: interstitial silicon, black: carbon)