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Microscopic origin of the prolonged coherence in 4H-SiC divacancy spin qubits[1] HOSUNG SEO, ABRAM FALK, PAUL KLIMOV, DAVID CHRISTLE, DAVID AWSCHALOM, GIULIA GALLI, Institute for Molecular Engineering, University of Chicago — Long coherence times of quantum bits (qubits) is a key prerequisite for quantum computing and quantum metrology. Recently, electronic spin qubits localized to divacancies in 4H-SiC were found to have a long spin coherence time (T2) exceeding 1 ms, which is longer than that of the nitrogen-vacancy (NV) center in chemically but not isotopically purified diamond. In this talk, we discuss the microscopic origin behind the prolonged divacancy coherence. By using optically detected magnetic resonance (ODMR), we show that the divacancy T2 rapidly increases as a function of magnetic field, saturating at 1.3 ms at T = 20 K. We used a quantum-bath model combined with a cluster correlation expansion technique to calculate the divacancy coherence function and found an excellent agreement between theory and experiment. We show that an effective decoupling of the 29Si and 13C nuclear spins due to their gyromagnetic ratio difference is one of the key reasons responsible for suppressing the decoherence of the divacancy qubits in SiC under magnetic fields larger than 100G.

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