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Anisotropy and quadrupolar effects on dephasing in two-electron spin qubits in GaAs TIM BOTZEM, ROBERT MCNEIL, HENDRIK BLUHM, JARA-Institute for Quantum Information, RWTH Aachen University, D-52074 Aachen, Germany — Understanding the dynamics of nuclear spins causing decoherence of gate-defined two-electron spin qubits in GaAs is a crucial prerequisite for a potential use in quantum computation. We present B-field dependent Hahn echo measurements giving new insight on the mechanism causing dephasing due to the nuclear spin bath of the host material GaAs. By rotating the magnetic field inplane we discover two effects ultimately limiting coherence times. We find that quadrupolar interaction between nuclear spins and electrical fields contributes to broadening of the nuclear Lamor frequencies, which in turn degrades electron coherence. By rotation the magnetic field towards the [100] direction, we can minimize this effect, but an additional envelope modulation that can be attributed to a electron g-factor anisotropy occurs.

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