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Enhanced hyperfine-induced spin dephasing in a magnetic field gradient[1] FELIX BEAUDOIN, WILLIAM A. COISH, McGill University — Magnetic field gradients are important for single-site addressability and electric-dipole spin resonance of electrons in quantum dots or in donor impurities. We show that these advantages are offset by a potential reduction in coherence time. Although the magnetic field appears uniform to the electron, it provides a non-uniform field for the nuclear-spin bath. This leads to a finite bath correlation time, preventing the full recovery of electron-spin coherence. We apply our model to single electron spins in quantum dots and single donor impurities, singlet-triplet spin qubits, and consider both free-induction decay and spin-echo. This mechanism can dominate over known dephasing sources due to nuclear dipole-dipole interactions and hyperfine flip-flops. This result is especially important for systems requiring large magnetic field gradients, including spin qubits coupled to superconducting stripline resonators.

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