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Dephasing of two-spin qubits due to their charge and nuclear environments[1] GUY RAMON, Santa Clara University — We consider dephasing of qubits encoded in the singlet and unpolarized triplet states of pairs of spins localized in biased double quantum dots. The charge environment is modeled by both two-center charge traps in the insulator (where electrons tunnel between the two centers), and single charge traps located near the gate electrodes and QPCs (where electrons charge and empty the trap). The couplings of these trapped charges to the qubits are calculated by considering their charge distributions within a multipole expansion. It is demonstrated that the summation over these random telegraph processes in mesoscopic devices results in non-Markovian and non-Gaussian noise. For the nuclear environment we consider hyperfine-induced electron-spin dephasing in a nuclear spin bath with narrowed distribution. Nuclear state preparation using dynamical polarization cycles was experimentally achieved recently, and it is also essential to enable X-rotations for two-spin qubits. Our analysis is performed for both free induction and echo signals. The scaling of these dephasing mechanisms with the number of qubits is also discussed.

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