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**Decoherence of coupled spin qubits due to charge fluctuations**[1]
GUY RAMON, Department of Physics, Santa Clara University, XUEDONG HU, Department of Physics, University of Buffalo, SUNY — One of the significant advantages of using the spin of quantum dot electrons as a qubit rather than their charge is their relative insulation from the environment. A number of recent works have utilized two-spin singlet and unpolarized triplet states in biased configuration to encode a logical qubit, which offer better control and coherence properties as compared with single spin states. When spin states are exchange coupled, however, they are potentially vulnerable to environmental fluctuations affecting charge qubits, since exchange coupling is electrostatic in nature. Here we carry out a quantitative calculation of the coupling between a biased two-spin qubit and a nearby charge fluctuator represented by a two-level-system (TLS), utilizing a multipole expansion up to and including the Quadrupole-Quadrupole order. The resulting coupling terms are used in a master equation formalism to study the dynamics of the open system that is formed by the spontaneous emission of the TLS coupled to the vacuum. We are thus able to provide a reliable estimate of the decoherence effects during various gate operations on the spin qubit as a function of the geometry and other characteristics of the system. Possible ways to alleviate the sensitivity of coupled spin qubits to charge fluctuations are also discussed.

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