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Decoherence in double quantum qubits due to coupling with the electromagnetic environment DIEGO VALENTE, University of Central Florida, FRANK WILHELM, University of Waterloo, EDUARDO MUCCIOLO, University of Central Florida — Quantum dots are strong candidates for the physical realization of quantum computers due to their underlying semiconductor technology. Double quantum dot (DQD) setups can be used as qubits by manipulation of either the charge or spin degree of freedom of the excess electron inside the dots. These manipulations in turn make them vulnerable to coupling to environmental degrees of freedom, causing undesired decoherence effects that can potentially lead to errors in the quantum computation. The environment can be modeled as a bosonic bath, where the bath is the electromagnetic environment or phonons, for instance. In this work we study dissipative effects in lateral DQD systems due to electromagnetic fluctuations in the gate voltages that feed the dots. In the context of the fluctuation-dissipation theorem we model the noise source as a frequency dependent impedance and make use of effective circuit models to estimate decoherence parameters such as the quality (Q) factor of quantum oscillations and the energy (T_1) and phase (T_2) relaxation times in the system. We discuss the dependence of the Q factor with respect to physical parameters such as temperature and the capacitive coupling between the electrodes. We also comment on the effects of electromagnetic fluctuations induced decoherence in the context of spin qubits.

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