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Review of spin and orbital relaxation in silicon quantum dot qubits CHARLES TAHAN, Laboratory for Physical Sciences, ROBERT JOYNT, University of Wisconsin-Madison — We give updated results for orbital and spin relaxation times in single-spin, silicon quantum dots. We find marked differences from donor-confined electrons and GaAs quantum dots. The dominant spin qubit 1/T1 relaxation rates are due to inversion asymmetry-induced spin-orbit mixing and are found to have a dependence proportional to the seventh power of the magnetic field, in contrast to both the P:Si donor qubit and GaAs quantum dot situations (for different reasons). Recent results have suggested that a Dresselhaus-like spin-orbit mixing contribution is nonzero and indeed can exceed that of the Rashba contribution for parameter regimes of interest. We include contributions from both terms to the spin relaxation rate with the latest estimates of their quantitative contributions. Other relaxation mechanisms, including those inherited from the bulk and from spin-valley mixing, are calculated to be smaller in most situations. Results for relaxation rates of other excited states are also given. We relate our results to current and future experiments and discuss implications for future quantum computer architectures in silicon.

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