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Two-eletron spin relaxation in double quantum dots and P donors[1] CHIA-WEI HUANG, Department of Physics, Bar-Ilan University, Ramat Gan, 52900, Israel, MASSOUD BORHANI, XUEDONG HU, Department of Physics, University at Buffalo, SUNY, Buffalo, NY 14260-1500, USA — We study singlet-triplet relaxation of two electrons confined in a double quantum dot or bound to P donors in Silicon. Hyperfine interaction of the electrons with the host/phosphorus nuclei, in combination with the electron-phonon interaction, leads to relaxation of the triplet states. We calculate the triplet relaxation rates in the presence of an applied magnetic field. This relaxation mechanism affects, for example, the resonance peaks in current Electron Spin Resonance (ESR) experiments on P-dimers. Moreover, the estimated time scales for the spin decay put an upper bound on the gate pulses needed to perform fault-tolerant two-qubit operations in spin-based quantum computers. We have found the optimal regimes, which mitigate this relaxation mechanism, yet permit sufficiently fast two-qubit operations.

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Chia-Wei Huang
Dept of Physics, Bar-Ilan University, Ramat Gan, 52900, Israel

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