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Spin-orbit effects on nuclear state preparation at the $S-T_+$ anti-crossing in double quantum dots[1] MARKO RANCIC, GUIDO BURKARD, University Konstanz — We explore the interplay of spin-orbit and hyperfine effects on the nuclear preparation schemes in two-electron double quantum dots, e.g. in GaAs. The quantity of utmost interest is the electron spin decoherence time T_2^* in dependence of the number of sweeps through the electron spin singlet S triplet T_+ anti-crossing. Decoherence of the electron spin is caused by the difference field induced by the nuclear spins. We study the case where a singlet $S(2,0)$ is initialized, in which both electrons are in the left dot. Subsequently, the system is driven repeatedly through the anti-crossing and back using linear electrical bias sweeps. Our model describes the passage through the anti-crossing with a large number of equally spaced, step-like parameter increments. We develop a numerical method describing the nuclear spins fully quantum mechanically, which allows us to track their dynamics. Both Rashba and Dresselhaus spin-orbit terms do depend on the angle θ between the [110] crystallographic and the inter-dot axis. Our results show that the suppression of decoherence (and therefore the enhancement of T_2^*) is inversely proportional to the strength of the spin-orbit interaction, which is tuned by varying the angle θ.

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