Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Theory of Spin Relaxation in Two-Electron Laterally Coupled GaAs and Si Quantum Dots[1] MARTIN RAITH, University of Regensburg, PETER STANO, University of Basel, JAROSLAV FABIAN, University of Regensburg — We present quantitative results of the phonon-induced spin relaxation in two-electron lateral double quantum dots for a wide range of tuning parameters. Both spin-orbit coupling and hyperfine coupling are taken into account. Our analysis of GaAs [1] and silicon [2] based dots includes the variation of the electric field (detuning), the exchange coupling, and the magnetic field strength and orientation. The focus is on experimentally important regimes. We find that even in strong magnetic fields, the hyperfine coupling can dominate the relaxation rate of the unpolarized triplet in a detuned double dot. Where the spin-orbit coupling dominates, the rate is strongly anisotropic and its maxima and minima are generated by an in-plane magnetic field either parallel or perpendicular to the dots' alignment dependent on specifics, such as spectral (anti-)crossings (spin hot spots), or the detuning strength. For all regimes, we give qualitative explanations of our observations. We emphasize the differences between GaAs and Si based dots. By understanding the spin lifetimes (T_1), this work marks a crucial step toward the realization of two-electron semiconductor qubits for quantum information processing.

[1] M. Raith et. al., PRL 108, 246602 (2012)
[2] M. Raith et. al., arXiv:1206.6906

[1]This work is supported by the DFG under grant SPP 1285.

Martin Raith
University of Regensburg

Date submitted: 31 Oct 2012 Electronic form version 1.4