Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Theory of Spin Relaxation in Two-Electron Lateral Coupled Quantum Dots[1] MARTIN RAITH, Institute for Theoretical Physics, University of Regensburg, D-93040 Regensburg, Germany, PETER STANO, Institute of Physics, Slovak Academy of Sciences, 845 11 Bratislava, Slovakia, FABIO BARUFFA, German Research School for Simulation Sciences, Forschungszentrum Juelich, D-52425 Juelich, Germany, JAROSLAV FABIAN, Institute for Theoretical Physics, University of Regensburg, D-93040 Regensburg, Germany — We present a global picture of the phonon-induced spin relaxation of two-electron lateral double quantum dots. The analysis covers a wide range of tuning parameters, such as the magnetic field, the exchange coupling, and the electric field (detuning). Our examples cover experimentally important scenarios. Quantitative results were obtained with a highly accurate numerical technique for the two most relevant host materials–GaAs and silicon. We find that in the presence of spin-orbit coupling, the rate becomes anisotropic and its maxima and minima are generated with an in-plane magnetic field parellel 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. By understanding the spin lifetimes (T_1), this work marks a crucial step to the realization of two-electron semiconductor qubits.

[1]This work was supported by DFG under grant SPP 1285 and SFB 689, ERDF OP R&D "QUTE", and CE SAS QUTE.

Martin Raith
Institute for Theoretical Physics, University of Regensburg,
D-93040 Regensburg, Germany

Date submitted: 08 Nov 2011 Electronic form version 1.4