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Coherent Control and Manipulation of Three Spin States in a Triple Quantum Dot[1]

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The triple quantum dot energy level spectrum is far more complex than its double quantum dot counterpart. As a result it is a challenge to cleanly manipulate only the two required qubit states without invoking more complex multi- state coherent evolution. In this talk I will describe experiments and modeling of lateral triple quantum dot devices where by suitable device gate (i.e. energy level spectrum) tuning and pulse characteristics we were able to characterize and manipulate various three spin qubit species. In particular I will describe measurements where the Landau-Zener –Stückelberg approach previously demonstrated in double dots is extended to three- interacting spin states permitting us to demonstrate phenomena such as pairwise exchange control. I will also demonstrate how by tuning the experimental parameters one can controllably switch to coherent oscillations originating from alternative potentially useful qubit states and how to distinguish them.

[1] "Coherent Control of Three Spin States in a Triple Quantum Dot," L. Gaudreau et al. Nature Physics 89, 54-58 (2012)
[2] "Coherent Exchange and Double Beam Splitter Oscillations in a Triple Quantum Dot," G.C.Aers et al. PRB 86 (2012) 045316
[3] "Quantum Interference Between Three Two Spin States in a Double Quantum Dot," Studenikin et al. Phys. Rev. Lett. 108 (2012) 22608

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