A quadruple quantum dot for quantum computing

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Résumé

Quantum dots in AlGaAs/GaAs 2-dimensional electron gases are promising candidates for qubit systems to realize quantum computation or modeling quantum systems. The initialization, read-out and control of single electron spins in such structures is already well established. Still, the dominating source of decoherence is the dephasing of the spins due to the hyperfine interaction with the nuclei bath of the solid state environment. This severely limits their applications for computation. I will present our strategy to displace the electron in a closed loop to use the topological phase introduced by the spin orbit effect to manipulate two-electron spin states. For this purpose we fabricated a circular quadruple dot consisting of four quantum dots connected by tunnel barriers. Considering this system I will show that the coherence time for these spin manipulations is expected to increase compared to conventional manipulation strategies relying on nuclear field gradients and exchange interaction.

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