Probing spin relaxation time in bilayer graphene quantum dots using pulsed-gate spectroscopy

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Electrostatically defined quantum dots (QDs) in bilayer graphene [1] offer a promising platform for spin qubits with presumably long coherence times due to low spin-orbit coupling and low nuclear spin density. Experimentally, the spin excited state lifetime T1 was estimated with a lower bound of 0.5 µs using two level pulsed-gate spectroscopy [2]. The transport measurements are limited by signal strength and blocking processes of direct tunneling of charge carriers from the leads into unoccupied states below the bias window rather than relaxation processes withing the QD. By including a load phase in the pulsing scheme prohibiting direct tunneling into the ground state we can extend the measurement time scale and find a lower bound of 16 µs for T1 at an applied magnetic field of 1.9 T. Furthermore, progress in fabrication technology has allowed the realization of a fully gate-defined device featuring a quantum dot with a nearby charge detector [3] which is sensitive to individual charging events. The charge sensor allows us to perform time-resolved measurements and further study the time dynamics of the excited state using Elzerman readout [4].

References

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