Time-resolved studies of excited states in bilayer graphene quantum dots

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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. With recent advancements in fabrication technology, the quality of state-of-the-art BLG QDs has been raised to such a level that highly tunable QDs can now be fabricated.

Experimentally the 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. 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 the spin excited state lifetime T1 at an applied magnetic field of 1.8 T. Recent 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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