# Single-shot spin readout in bilayer graphene quantum dots

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Electrostatically defined quantum dots 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. Important advances towards quantum information processing with graphene spin qubits include a good understanding of the excited state spectrum for one- and two-electron states in single and double quantum dots [2] as well as the demonstration of Pauli spin and valley blockade [3].

Here we demonstrate single-shot readout, an essential first step towards qubit manipulation and detection. Recent progress in fabrication technology has allowed the realization of a fully gate-defined device featuring a quantum dot with a nearby charge detector [4] which is sensitive to individual charging events. The charge sensor allows us to perform time-resolved measurements and study the time dynamics of the spin excited state using an Elzerman style [5] single-shot readout with a signal-to-noise ratio of about 7. We find spin-relaxation times $T_1$ up to 50ms with a strong magnetic field dependence, promising even longer $T_1$ times for smaller magnetic fields [6]. The spin relaxation time is a few orders of magnitude longer than typical spin qubit operation times and competes well with other group IV elements, like silicon.

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