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Singlet-triplet dynamics in double quantum dots probed with single-shot readout[1]

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We report single-shot readout of a two-electron spin qubit in a GaAs double quantum dot. The readout scheme allows repeated single quantum measurements with a readout fidelity above 90%, extracted from a simple model of the measurement outcome. In contrast to measurements on single spins, this scheme does not rely on tunneling of electrons out of the quantum dot or on high magnetic fields, which are incompatible with the operating requirements of the qubit. The spin state is mapped to a charge state, which is subsequently measured by a rapidly switched quantum point contact (QPC). Single-shot readout is used to observe the precession of the electron spin qubit in the effective magnetic field due to the hyperfine interaction with the GaAs nuclei. All measurements are taken within the nuclear correlation time and the evolution of the nuclear spin bath is monitored continuously on a ms time scale. Finally the precession of the qubit is compared to the driven dynamics of the electron spin state at the resonance between singlet and a triplet with total spin one.

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