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Fast Exchange Oscillations in Quantum Dot Spin Qubits SHANNON HARVEY, MICHAEL SHULMAN, OLIVER DIAL, Harvard University, HENDRIK BLUHM, RWTH Aachen University, VLADIMIR UMANSKY, Weizmann Institute of Science, AMIR YACOBY, Harvard University — The exchange splitting, J, is an important tool in semiconductor spin qubits, as it can drive both single qubit rotations and two qubit entangling operations. However, qubits operating under exchange can be dephased by electrical noise, as J is a function of the local electrostatic environment. We investigate the exchange interaction in a singlet-triplet qubit created in double quantum dot by measuring exchange oscillations ranging in frequency over three orders of magnitude. In particular, we resolve exchange oscillations at frequencies up to 30GHz, where both electrons occupy the same quantum dot. Here, J saturates to approximately the singlet-triplet splitting, and no longer depends on the electrostatic environment. In this regime exchange oscillations are insensitive to electrical noise. Since semiconductor spin qubits are usually limited by dephasing, these potentially dephasing-free exchange oscillations offer a new regime for studying quantum control in spin qubits.

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