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Dispersive measurement of electron spin states in Coulomb-confined silicon double quantum dots MATTHEW HOUSE, TAKASHI KOBAYASHI, BENT WEBER, SAM HILE, SVEN ROGGE, MICHELLE SIMMONS, Centre for Quantum Computation and Communication Technology, University of New South Wales — We use radio frequency reflectometry with a resonant circuit to investigate a double quantum dot device patterned by the placement of phosphorus donors in silicon with scanning tunnelling microscope lithography. The circuit responds to electron tunnelling to and from the quantum dots, the complex admittance of which provides information about the tunnel coupling between the dots and the leads. With four electrons on two dots, the Pauli Exclusion Principle makes tunnelling of one electron between the two dots spin dependent, which we exploit to measure the electronic spin state. We map the ground state transition between singlet and triplet states as a function of electric and magnetic fields, which shows that the exchange energy can be tuned over an order of magnitude (about 10 to 100 μeV) or more in this device. We apply high frequency pulses to induce an excited spin state and observe that the dispersive measurement can detect the excited spin state in addition to the ground state.

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