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Single-shot readout of an electron spin in silicon ANDREA MORELLO, JARRYD PLA, FLORIS ZWANENBURG, KOK WAI CHAN, HANS HUEBL, CHRISTOPHER NUGROHO, University of New South Wales, CHANGYI YANG, JESSICA VAN DONKELAAR, ANDREW ALVES, DAVID JAMIESON, University of Melbourne, CHRISTOPHER ESCOTT, University of New South Wales, LLOYD HOLLENBERG, University of Melbourne, ROBERT CLARK, ANDREW DZURAK, University of New South Wales — The electron spin of a donor in silicon is an excellent candidate for a solid-state qubit. It is known to have very long coherence and relaxation times in bulk, and several architectures have been proposed to integrate donor spin qubits with classical silicon microelectronics. Here we show the first experimental proof of single-shot readout of an electron spin in silicon. This breakthrough has been obtained with a device consisting of implanted phosphorus donors, tunnel-coupled to a silicon Single-Electron Transistor (Si-SET), where the SET island is used as a reservoir for spin-to-charge conversion. The charge transfer signals are exceptionally large, and allow time-resolved measurements of spin-dependent tunneling on a $\sim$10 μs scale. By measuring the occurrence of excited spin states as a function of wait time, we find spin lifetimes up to $\sim$1 s at B=1.75 T. Further experiments are underway to integrate this readout method with coherent spin control.

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