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Interface induced spin-orbit interaction in silicon quantum dots and prospects of scalability RIFAT FERDOUS, Purdue University, USA, KOK WAI, The University of New South Wales, Sydney, Australia, MENNO VELDHORST, Qutech, TU Delft, The Netherlands, JASON HWANG, HENRY YANG, The University of New South Wales, Sydney, Australia, GERHARD KLIMECK, Purdue University, USA, ANDREW DZURAK, The University of New South Wales, Sydney, Australia, RAJIB RAHMAN, Purdue University, USA — A scalable quantum computing architecture requires reproducibility over key qubit properties, like resonance frequency, coherence time etc. Randomness in these properties would necessitate individual knowledge of each qubit in a quantum computer. Spin qubits hosted in Silicon (Si) quantum dots (QD) is promising as a potential building block for a large-scale quantum computer, because of their longer coherence times. The Stark shift of the electron g-factor in these QDs has been used to selectively address multiple qubits. From atomistic tight-binding studies we investigated the effect of interface non-ideality on the Stark shift of the g-factor in a Si QD. We find that based on the location of a monoatomic step at the interface with respect to the dot center both the sign and magnitude of the Stark shift change. Thus the presence of interface steps in these devices will cause variability in electron g-factor and its Stark shift based on the location of the qubit. This behavior will also cause varying sensitivity to charge noise from one qubit to another, which will randomize the dephasing times T_2^*. This predicted device-to-device variability is experimentally observed recently in three qubits fabricated at a $Si/Si0_2$ interface, which validates the issues discussed.

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