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Correlated charge noise in Si/SiGe quantum dot spin qubits

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Electron spin qubits in silicon quantum dots are particularly promising candidates for the implementation of a large-scale quantum computer due to their small physical footprint. However, this compactness raises concerns on the existence of spatial noise correlations that can be severely detrimental for quantum error correction. In this talk, I will show our results on noise spectroscopy of two neighboring qubits in a device made of isotopically purified silicon, where we detect strong noise cross-correlations. These inter-qubit correlations arise from the dominant effect of charge noise in our system, verified by the presence of noise correlations between the bare qubit frequencies and exchange interaction. We devised a simple model of electric fields shifting the position of the qubits within a magnetic field gradient, that allows us to quantitatively reproduce the measured behavior. Our work shows that electrical noise not only limits single-qubit dephasing but can also be a source of correlated phase errors.

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