Abstract Submitted
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Understanding the effects of leakage in superconducting quantum error detection circuits[1] JOYDIP GHOSH, Institute for Quantum Science and Technology, University of Calgary, Calgary, Alberta T2N 1N4, Canada, AUSTIN FOWLER, JOHN MARTINIS, Department of Physics, University of California, Santa Barbara, California 93106, USA, MICHAEL GELLER, Department of Physics and Astronomy, University of Georgia, Athens, Georgia 30602, USA — The majority of quantum error detection and correction protocols assume that the population in a qubit does not leak outside of its computational subspace. For many existing approaches, however, the physical qubits do possess more than two energy levels and consequently are prone to such leakage events. Analyzing the effects of leakage is therefore essential to devise optimal protocols for quantum gates, measurement, and error correction. In this talk, I discuss the role of leakage in a two-qubit superconducting quantum error detection circuit. We simulate the repeated ancilla-assisted measurement of a single σ^z operator for a data qubit, record the outcome at the end of each measurement cycle, and explore the signature of leakage events in the obtained readout statistics. An analytic model is also developed that closely approximates the results of our numerical simulations. We find that leakage leads to destructive features in the quantum error detection scheme, making additional hardware and software protocols necessary.

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