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A Leakage-Resilient Approach to Fault-Tolerant Quantum Computing with Superconducting Elements[1] JOYDIP GHOSH, University of Calgary, AUSTIN FOWLER, University of California, Santa Barbara — Superconducting qubits, while promising for scalability and long coherence times, contain more than two energy levels, and therefore are susceptible to errors generated by the leakage of population outside of the computational subspace. Such leakage errors are currently considered to be a prominent roadblock towards fault-tolerant quantum computing with superconducting qubits. Fault-tolerant quantum computing using topological codes is based on sequential measurements of multi-qubit stabilizer operators. In this talk, I propose a leakage-resilient scheme to perform repetitive measurements of multi-qubit stabilizer operators, and then discuss how to use this scheme as an ingredient to develop a leakage-resilient approach for surface code quantum error correction with superconducting circuits. Our protocol is based on SWAP operations between data and ancilla qubits at the end of every cycle, requiring read-out and reset operations on every physical qubit in the system, and thereby preventing persistent leakage errors from occurring.

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