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Parity detection of multiple superconducting qubits CALEB HOWINGTON, Syracuse University, ALEX OPREMCAK, IVAN PECHENEZHSKIY, University of Wisconsin, Madison, MARIUS SCHNDORF, FRANK WILHELM, Saarland University, R. MCDERMOTT, University of Wisconsin, Madison, B.L.T. PLOURDE, Syracuse University — We present schemes for detecting two-qubit parity. One involves preparing two qubits coupled to a common cavity such that the χ shifts representing odd parities overlap. Driving the cavity at this odd frequency then generates either a high photon occupation (for odd parity) or an oscillating photon occupation (for even parity) in the cavity, which can be discriminated with phase-insensitive photon detection. A second readout scheme involves taking advantage of cavity nonlinearity at high drive powers. In this strongly driven dispersive regime, we can perform a similar mapping of qubit parity to photon occupation, using a frequency-offset cavity drive during readout. Experimental results to realize both readout protocols using a Josephson Photomultiplier are discussed.

Caleb Howington
Syracuse University

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