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Scaleable two and four qubit parity measurement with a photon counter LUKE C.G. GOVIA, Univ des Saarlandes, EMILY J. PRITCHETT, HRL Laboratories, R. MCDERMOTT, University of Wisconsin-Madison, FRANK K. WILHELM, Univ des Saarlandes — Multi-qubit parity readout is a central ingredient to quantum information processing, with applications ranging from quantum error correction to entanglement generation. As the physical implementation of QIP technologies grows in size, so too does the need for scalable readout protocols. Here we present a scalable, high-fidelity, quantum non-demolition readout protocol for the parity of two or four qubits using a single dispersively coupled cavity and a photon counter. By selectively populating the cavity dependent on the qubit parity, it is possible to non-destructively read out the qubit parity using a phase insensitive photon counter, without gaining any further qubit-state resolving information. We describe our protocol in the context of superconducting integrated circuits, where the cavity is a microwave resonator, and as an example photon counter we choose the Josephson photomultiplier (PRL 107, 217401 (2011)).

Luke Govia
Univ des Saarlandes

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