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Improving Fidelity in Superconducting Xmon Qubits: Decreasing 1/f Flux Noise PETER O'MALLEY, RAMI BARENDS, BEN CHIARO, YU CHEN, EVAN JEFFREY, JULIAN KELLEY, ANTHONY MEGRANT, JOSH MUTUS, CHARLES NEILL, PEDRAM ROUSHAN, DANIEL SANK, JAMES WENNER, THEODORE WHITE, ANDREW CLELAND, JOHN MARTINIS, University of California, Santa Barbara — Two qubit CZ gate fidelity in our superconducting Xmon qubits is currently 99.4%. To achieve 99.9% fidelity, experiments indicate that we need to reduce 1/f flux noise. We present measurements of 1/f flux noise on the Xmon from sub-Hz to MHz frequencies. At low frequencies we measure an $f^{-1.0}$ frequency dependence, which is in agreement with previous phase qubit measurements but significantly different from the $f^{-0.7}$ dependence seen in SQUIDs. We also see a dependence on geometry that agrees with a theory of magnetic defects; this points toward a qubit design that will minimize dephasing.

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