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Measuring the Effects of SQUID Geometry on Transmon Qubit Coherence[1] A. DUNSWORTH, Z. CHEN, C. QUINTANA, B. CAMPBELL, B. CHIARO, C. NEILL, J. WENNER, UC Santa Barbara, J.M. MARTINIS, University of California and Google, Santa Barbara, GOOGLE QUANTUM HARDWARE TEAM — Superconducting qubits have energy relaxation times that are commonly limited by lossy dielectrics near superconducting surfaces. Furthermore, flux tunable qubits often show 'holes' in their energy relaxation spectrum due to resonant coupling with two level states (TLS's) present in these amorphous dielectrics. There are also evidences that fluctuating surface spins near the SQUID loop are a dominant source of phase noise. All three of these features are intimately tied to the distribution of electric and magnetic fields in these circuits which in turn depend on their geometry . Using Xmon transmon qubits we investigated the effect of changing the SQUID loop geometry on phase noise and TLS resonances. Using various noise measurement techniques we extract phase noise spectra nearly continuously over nine orders of magnitude in frequency, while T_1 spectra are measured in the qubits' transition frequency range of 3 to 6 GHz.

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Andrew Dunsworth
UC Santa Barbara

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