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Dephasing Due to Shot Noise in the Strong Dispersive Limit of Circuit QED ADAM SEARS, ANDREI PETRENKO, GERHARD KIRCHMAIR, HANHEE PAIK, LUYAN SUN, GIANLUIGI CATELANI, LEONID GLAZMAN, ROBERT SCHOELKOPF, Yale University — The design parameters of superconducting qubits inside resonant cavities have evolved over time to minimize decoherence, allow fast pulses and enable high fidelity readout. The two are often coupled so strongly that the dispersive shift of the qubit due to a single photon in the cavity (or AC Stark shift) is much larger than a linewidth. In this strong dispersive regime, the passage of any photons can lead to an unintended and complete measurement of the qubit state. We study photon shot noise dephasing in this limit for a transmon and derive a simple relation between the dephasing rate and the product $\bar{n}\kappa$, where $\bar{n}$ is the average cavity occupancy and κ is the cavity decay rate. We find good experimental agreement for a large range of κ, varied *in situ* using a simple mechanism, and note several ways this can influence qubit experiments.

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