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Characterization of SLUG microwave amplifiers I.-C. HOI, University of California, Santa Barbara, S. ZHU, T. THORBECK, R. MCDERMOTT, Department of Physics, University of Wisconsin, J. MUTUS, E. JEFFREY, R. BARENDS, Y. CHEN, P. ROUSHAN, A. FOWLER, D. SANK, Google, Santa Barbara, T. WHITE, B. CAMPBELL, Z. CHEN, B. CHIARO, A. DUNSWORTH, J. KELLY, A. MEGRANT, C. NEILL, P.J.J. O'MALLEY, C. QUINTANA, A. VAINSENCHER, J. WENNER, University of California, Santa Barbara, J.M. MARTINIS, University of California and Google, Santa Barbara — With the rapid growth of superconducting circuits quantum technology, a near quantum-limited amplifier at GHz frequency is needed to enable high fidelity measurements. We describe such an amplifier, the SQUID based, superconducting low inductance undulatory galvanometer (SLUG) amplifier. We measure the full scattering matrix of the SLUG. In particular, we measure both forward and reverse gain, as well as reflection. We see 15dB forward gain with added noise from one quanta to several quanta. The -1 dB compression point is around -95 dBm, about two orders of magnitude higher than that of typical Josephson parametric amplifiers. With these properties, SLUG is well suited for the high fidelity, simultaneous multiplexed readout of superconducting qubits.

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