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Nonlinearities and Parametric Amplification of Superconducting Coplanar Waveguide Resonators[1] DAVID HAVILAND, ERIK THOLÉN, ADEM ERGUL, Royal Institute of Technology KTH, NANOSTRUCTURE PHYSICS KTH TEAM — We have experimentally studied the nonlinear properties of superconducting coplanar stripline resonators fabricated from Al and Nb films with small transverse dimensions (gap size 1μm). Magnetic field penetration into the superconductor causes a current-dependant kinetic inductance, which gives an ideal Kerr nonlinearity. When the nonlinear oscillator is pumped very near its dynamic instability, it can be used to realize parametric amplification. We have achieved a gain of +22.4dB in a 5.8 GHz resonator cooled to 450 mK [E. Tholén et. al. Appl. Phys. Lett. 90, 253509 (2007)]. Parametric deamplification or squeezing of a signal has also been verified with squeezing of 30 dB. The later effect is interesting because it can be used to generate squeezed vacuum states of the electromagnetic field. We have modeled the data using a theory developed by Yurke and Buks [J. Lightwave Technol. **24**, 5054 (2006)]. Excellent fit of the model to the measured data can be achieved over a wide range of pump power, and the strength of the nonlinear terms can be obtained with high accuracy.

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