Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Non-Linear, DC-Biased, Vacuum-Gap Capacitor LC Oscillators
M.S. ALLMAN, NIST, Boulder, K. CICAK, K.D. OSBORN, J.A. STRONG, R.W. SIMMONDS — We have observed non-linear behavior at higher powers in vacuum-gap capacitor LC resonators. These non-linear effects are a result of electrostatic forces on the vacuum capacitors. Electrostatic forces cause the distance between the capacitor plates to contract, resulting in a power-dependent resonant frequency. In an effort to characterize these non-linear effects, we have incorporated a bias T on chip allowing us to apply a DC voltage-bias to a fabricated vacuum-gap LC resonator. We then measure the resonant frequency of the circuit as a function of applied bias-voltage or equivalently, applied force on the vacuum-gap capacitor. This information allows us to predict the non-linear effects in our LC resonators as well as gives insight into the structural integrity of the vacuum-gap capacitors. These devices can lead to future applications of DC-biased vacuum-gap capacitors as tuneable superconducting phase qubit couplers.

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Date submitted: 20 Nov 2006 Electronic form version 1.4