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Microwave Parametric Down Conversion and Squeezing Using Circuit QED K. MOON, Dept. of Physics and IPAP, Yonsei Univ., Seoul 120-749, Korea & Dept. of Physics and Applied Physics, Yale Univ., New Haven, CT 06520, S.M. GIRVIN, A. BLAIS, J. GAMBETTA, Dept. of Physics and Applied Physics, Yale Univ., New Haven, CT 06520 — We study theoretically the parametric down conversion and squeezing of microwaves using cavity quantum electrodynamics of a superconducting Cooper pair box (CPB) qubit located inside a transmission line resonator. The non-linear susceptibility χ_2 can be tuned by dc gate voltage applied to the CPB and vanishes at the charge degeneracy point. We show that the coherent coupling of different cavity modes through the qubit can generate a squeezed state, whose quadrature angle changes by $\pi/2$ depending on the state of the qubit. We will present estimates of parametric down conversion rate and squeezing efficiency based on realistic parameters obtained in recent successful circuit QED experiments[1,2,3].

[1] A. Wallraff et al., Nature (London) 431, 162-167 (2004).
[2] A. Blais et al., Phys. Rev. A, 69, 062320 (2004).
[3] D.I. Schuster et al., Phys. Rev. Lett., in press.

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