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Complete characterization of linear amplifiers including the quantum limits for nongaussian noise[1] SHASHANK PANDEY, ZHANG JIANG, JOSHUA COMBES, CARLTON CAVES, Center for Quantum Information and Control, University of New Mexico — We characterize the quantum limitations on the entire probability distribution of added noise in a phase-preserving linear amplifier. Previously the quantum limits on amplifiers have been given entirely in terms of second moments, i.e., noise power or noise temperature [1]. As Josephson parametric amplifiers approach fundamental quantum limits on noise temperature [2,3,4], it becomes important to investigate the limits on higher moments of the amplifier noise. We prove that all phase-preserving linear amplifiers with arbitrary noise are formally equivalent to a parametric amplifier: $\rho_{out} = \mathrm{tr}[S(r)\,\rho_{in} \otimes \sigma\, S^{\dagger}(r)]$, where the gain is $g^2 = \cosh^2(r)$, S is a two-mode squeeze operator, and σ is a physical state of an ancillary mode whose quantum noise determines the noise properties of the amplifier. We discuss generalization of these limits to the nondeterministic linear amplifiers proposed by Ralph and Lund [5]. [1] C. M. Caves, Phys. Rev. D **26**, 1817 (1982). [2] A. A. Clerk et al., Rev. Mod. Phys. **82**, 1155-1208 (2010). [3] N. Bergeal et al., Nature 465, 64–68 (2010). [4] D. Kinion and John Clarke Appl. Phys. Lett. 98, 202503 (2011). [5] T. C. Ralph and A. P. Lund, in QCMC Vol. 1110 of AIP Conf. Proc. (2009).

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