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Quantum-limited Amplification via Dissipation in Superconducting Circuits A. METELMANN, A.A. CLERK, McGill University, Department of Physics — The development of parametric amplifiers based on superconducting circuits has led to an impressive improvement in the precision and sensitivity of measurements in the quantum regime. However, standard cavity-based parametric amplifiers suffer from a fixed gain-bandwidth product. Moreover they are reciprocal devices, i.e., they amplify in both directions, leading to the requirement of additional noisy elements as circulators in the measurement chain. In our recent work we discussed a phase-insensitive quantum amplifier which utilizes dissipative interactions in a parametrically-coupled three-mode bosonic system [PRL 112, 133904 (2014)]. The use of dissipative interactions provides a fundamental advantage over standard cavity-based parametric amplifiers: large photon number gains are possible with quantum-limited added noise, with no limitation on the gain-bandwidth product. In this talk we present how this can be extended to phase-sensitive amplifiers and discuss the possibilities of making the amplifier directional.

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