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Back-action and self-oscillation in the Double Pump Josephson Parametric Amplifier (DPA) ARCHANA KAMAL, ADAM MARBLESTONE, MICHEL H. DEVORET, Yale University — Josephson Parametric amplifiers are the most promising candidates for reaching the quantum limit of amplification at RF frequencies. The DPA employs 2 pumps. The dual pumps ensure separation between the signal and the pump frequencies, which is necessary to observe delicate effects, such as self-oscillations. We present the model of the DPA. Our calculations are based on Input-Output Theory, and can easily be generalized to any coupled system involving parametric interactions. We analyze the operation of the device, taking into account the feedback introduced by the reaction of the signal amplification on the pump power and we compute various response functions - signal/idler gain, internal gain, and steady state signal response. To account for this back-action between signal and pump, we adopt a mean-field approach and self-consistently explore the boundary between amplification and self-oscillation. The potential of the DPA for quantum-limited measurements and as a squeezer is also discussed.

Archana Kamal
Yale University

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