Squeezing generation in a flux-tunable Josephson Traveling-Wave Parametric Amplifier

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Abstract: A flux-tunable Josephson traveling-wave parametric amplifier enables single- and two-mode squeezing with flux-controlled nonlinearities. We present a comparative study at two flux-bias points, highlighting the critical role of the operating point in optimizing squeezing-generation performance.

Squeezed states of light are non-classical states of electromagnetic radiation, which have a wide range of applications in the context of quantum technologies. Specifically, in the microwave regime, squeezed microwaves can be employed in quantum sensing, in quantum communication, and in quantum information, such as entanglement distribution between superconducting qubits [1]. I will present our last experimental results on the generation of single-mode and two-mode squeezing in a flux-tunable Josephson traveling-wave parametric amplifier via residual three-wave mixing (3WM) [2]. The adopted device is a JTWPA based on Superconducting Nonlinear Asymmetric Inductive eLements (SNAILs) [3], and it is designed with alternating flux polarity to ideally suppress the overall 3WM nonlinearity [4,5]. By comparing the squeezing generation performances at two different external flux working points, we find that the external magnetic flux is a crucial parameter for squeezing generation in the residual 3WM regime. This study provides valuable insights into flux-controlled squeezing generation with TWPAs, possibly extending the range of applications in the framework of microwave photonics.

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