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Superconducting Josephson Traveling-Wave Parametric Amplifiers

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***Abstract*—Josephson traveling wave parametric amplifiers (TWPA) have recently emerged as very promising platform for broadband quantum-limited amplification of microwave signals [1]. They are now widely used for high-fidelity readout of superconducting Qubits. We present here an overview of the state of the art for superconducting TWPA based on Josephson junction chains. We also discuss recent quantum optics experiments with TWPA, as well as the future directions to keep improving these devices. We specifically present here recent experimental results about the study of the compression properties of such an amplifier based on Superconducting Nonlinear Asymmetric Inductive eLement (SNAIL) operated in the so-called 'Reversed-Kerr' regime [2]. A novel experimental setup was implemented to monitor the pump transmission and study the effect of pump depletion. As shown in Fig. 1, pump depletion partially causing compression in Josephson TWPA was observed. This study provides insights to optimize them for high input power demanding applications such as multiplexed superconducting Qubit or spin-Qubit readout at cryogenic temperatures.**

***Keywords (Index Terms)*—Superconductivity, Josephson junction, Josephson meta-material, parametric amplification, traveling-wave parametric amplification, saturation, 1-dB compression, pump depletion**

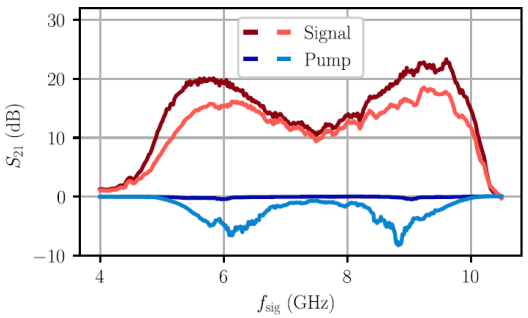

Fig. 1: *Experimental gain (red) and pump transmission (blue) profiles as a function of signal frequency, for two different input signal powers: -113.6 dBm (darker colors) and -99.1 dBm (lighter colors).*

References

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