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Enhancing bandwidth of Josephson parametric amplifiers with impedance engineering TANAY ROY, VADIRAJ A M, SUMAN KUNDU, MEGHAN PATANKAR, RAJAMANI VIJAYARAGHAVAN, Tata Institute of Fundamental Research, Mumbai, India — Josephson parametric amplifiers (JPAs) are a crucial component of superconducting quantum information processing systems since they enable fast, high-fidelity measurement of qubits. However, JPAs based on a single SQUID oscillator suffer from two major drawbacks – narrow bandwidth and gain saturation at low signal powers, and are typically suited to single qubit experiments only. With the rapid development of multi-qubit systems, there is a practical need to develop an amplifier with larger bandwidth and signal handling capacity, while maintaining gain and noise performance. We will describe a new method to enhance the bandwidth by introducing a frequency dependent shunting impedance for the JPA. To prevent gain saturation, we also replace the single SQUID with a SQUID array. With an appropriate choice of device parameters, numerical calculations indicate the possibility of obtaining 20 dB gain with 700 MHz of bandwidth and near quantum limited noise performance. We will present experimental results demonstrating bandwidth enhancement and discuss strategies for optimizing overall amplifier performance.

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