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Superconducting Parametric Amplifiers

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Parametric amplifiers continue to be vital components in solid state quantum readout at cryogenic temperatures. Various flavors of parametric amplifiers are carving their place in a number of different readout architectures. Josephson junction (JJ) based amplifiers are the natural progression when these readout architectures are at deep cryogenic temperatures. Josephson traveling wave parametric amplifiers (JTWPA) and Josephson parametric amplifiers (JPA) are the two main contenders of JJ based amplifiers. These types are further divided into current pumped and flux pumped operating modes. Current pumped designs require a directional coupler at the input to combine the signal tone with the pump tone. Whereas a flux pump designs mutually couples the pump tone over the entire amplifier as the signal tone travels through it. JTWPA's have a wider bandwidth than their JPA counterparts. The JTWPA acts as a non-linear transmission line which requires dispersion engineering. The JPAs are narrowband amplifiers, but can be tuned to a desired frequency.

We have designed flux pumped JTWPA and JPA devices with MIT-LL's SFQ5ee process. The JTWPA was designed to operate from 4-12 GHz at 6dB of power gain. Our JPA's are designed to operate at 7.5 GHz with 20db of power gain. We will report on the design while we prepare for packaging and testing ahead of the prototype delivery in November of 2023.

Early Career

No

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