**Development and Applications of Josephson Parametric Amplifiers**

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Amplification is necessary for measuring small amplitude microwave signals. Although an amplifier can provide the required amplification, the amplifier device itself adds extra noise to the amplified signal and degrades the signal-to-noise ratio (SNR). A Josephson parametric amplifier (JPA), incorporating a resonator made of Josephson junctions to allow parametric modulation, can offer high gain in microwave frequencies with nearly quantum-limited noise performance to boost measurement SNR. Recent demands in measuring microwave signals of single-photon level from quantum circuits for quantum computing applications and detectors for elementary particle searches have driven intensive developments of JPAs. In this presentation, I will discuss the operating principle, the design considerations, and the device performance of JPAs. I will also describe their applications in superconducting qubit state readout and axion dark matter search in our group.