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Microwave response and photon emission of a voltage baised Josephson junction SALHA JEBARI, ALEXANDER GRIMM, DIBYENDU HAZRA, MAX HOFHEINZ, CEA Grenoble — The readout of superconducting qubits requires amplifiers combining noise close to the quantum limit, high gain, large bandwidth, and sufficient dynamic range. Josephson parametric amplifiers using Josephson junctions in the 0-voltage state, driven by a large microwave signals, begin to perform sufficiently well in all 4 of these aspects to be of practical use, but remain difficult to optimize and use. Recent experiments with superconducting circuits consisting of a DC voltage-biased Josephson junction in series with a resonator, showed that a tunneling Cooper pair can emit one or several photons with a total energy of 2e times the applied voltage. We present microwave reflection measurements on this device indicating that amplification is possible with a simple DC voltage-biased Josephson junction. We compare these measurements with the noise power emitted by the junction and show that, for low Josephson energy, transmission and noise emission can be explained within the framework of P(E) theory of inelastic Cooper pair tunneling. Combined with a theoretical model, our results indicate that voltage-biased Josephson junctions might be useful for amplification near the quantum limit, offering simpler design and a different trade-off between gain, bandwidth and dynamic range.

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