Abstracts

Two-Junction Tuning Circuits for Submillimeter SIS Mixers

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The capacitance of superconducting tunnel junctions can seriously degrade the performance of quasiparticle (SIS) mixers operating in the submillimeter band, so it is essential to provide a circuit for tuning out this capacitance at the operating frequency. In this article, we present two new tuning circuits for SIS mixers which use a pair of SIS junctions connected by an inductance. Compared to previously proposed tuning circuits, ours have a broader bandwidth, are easier to scale to higher frequencies, and may be easier to fabricate. We have constructed quasi-optical mixers which employ these tuning circuits, using Nb/Al-Oxide/Nb SIS junctions defined by optical lithography. The performance of these devices is excellent, giving receiver noise temperatures of 113 K (DSB) at 490 GHz and 230 K DSB at 612 GHz. In addition to demonstrating the effectiveness of our tuning circuit, these results show that quasi-optical mixers can be competitive with or superior to waveguide mixers at submillimeter wavelengths. The mixers continue to perform well at frequencies up to 672 GHz, which is about 95% of the Nb gap frequency.

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