

A Monolithic Dual-Polarization Sideband-Separating SIS Mixer for Large-Format Heterodyne Focal Plane Arrays

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Large-format heterodyne focal-plane arrays demand receiver architectures with a high degree of integration while simultaneously preserving low noise performance and adequate sideband suppression. Achieving these requirements with superconducting SIS mixers at millimeter wavelengths remains a significant challenge. In this paper, we present the first demonstration of a monolithic dual-polarization sideband-separating (2SB) SIS mixer implemented on a silicon-on-insulator (SOI) substrate for operation in the 2 mm band (125–163 GHz). The developed mixer provides a sideband rejection ratio greater than 10 dB across most of the RF band within the 4–8 GHz intermediate-frequency (IF) range, while achieving a minimum single-sideband receiver noise temperature of approximately 60 K. As a fundamental component of the hybrid planar integration (HPI) concept, these results confirm the practicality of realizing highly integrated large-format heterodyne arrays and establish a viable route toward significantly increasing the field of view of millimeter- and submillimeter-wave astronomical receivers.