

A SUBMILLIMETER WAVE S1S RECEIVER FOR 547 GHz

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The most sensitive heterodyne receivers used for millimeter wave and submillimeter wave radioastronomy employ superconductor-insulator-superconductor (S1S) tunnel junctions as the nonlinear mixing element. In general, however, very few S1S mixers have been demonstrated at frequencies above 500 GHz. We have developed a submillimeter wave S1S heterodyne receiver for radio astronomy applications around 550 GHz. This receiver is based on a waveguide mixer with an adjustable backshort and E-plane tuner. The mixer uses a high current density, submicron area Nb-AlO_x-Nb tunnel junction. The large capacitive susceptance of the junction at high frequencies will shunt the signal away from the nonlinear conductance and hence must be properly tuned for optimum performance. This is accomplished using a 3-section superconductive microstrip transformer to match the complex impedance of the junction to the available tuning range of the waveguide mount. The receiver performance has been measured over the frequency range 520 GHz -550 GHz. A DSB receiver noise temperature as low as 370 K has been achieved at 521.5 GHz. This waveguide receiver design has also been scaled for use near 630 GHz and is currently being tested. In addition, improved techniques for designing superconductive microstripline will be discussed.