PERFORMANCE OF A LOW-NOISE 600 GHz -635 GHz S1S RECEIVER AT THE CALTECH SUBMILLIMETER OBSERVATORY (HAWAII)

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The need for observing rotational transitions of molecules at submillimeter wavelengths has prompted the development of sensitive heterodyne receivers, We have built a low-noise waveguide S1S heterodyne receiver in the frequency range 600 GHz - 635 GHz, for the study of HCl in planetary atmospheres and interstellar molecular clouds. The mixer employs a single 0.25 -μm^2 Nb/AlO_x/Nb junction integrated with an Nb/SiO/Nb microstrip tuning circuit. We have measured double sideband receiver noise temperatures as low as 245 K ± 15 K at 600 GHz -610 GHz, and close to 300" K over most of the tunable bandwidth, presently fixed by the LO source.

This receiver has been used at the Cal tech Submillimeter Observatory in Hawaii. System noise temperatures, dominated by the atmospheric attenuation, varied between 2000 K and 8000 K. $H^{35}Cl$ was detected in several molecular clouds, and an isotopic ratio $H^{35}Cl/H^{37}Cl$ could be tentatively derived in the Orion KL region for the first time.

We also discuss problems related to the optimization of the receiver at frequencies near the gap frequency of niobium. Photon steps from opposite voltage regions overlap, degrading the performance at some bias by up to 40%, and the bias point for optimum mixing is very close to the second Shapiro step. This requires a careful suppression of the AC Josephson effect by a magnetic field.

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