A Quasiparticle S1S Heterodyne Receiver at 600 GHz -635 GHz—M. SALEZ, P. FEBVRE-, W. R. MCGRATH, B. BUMBLE, H. G. LEDUC, Jet Propulsion Laboratory, Pasadena, CA USA, -DEMIRM-Observatoire de Paris-Meudon, FRANCE — We have built an S1S heterodyne receiver operating in the frequency range 600 GHz - 635 GHz using a 0.25-μm^2 $Nb/AlO_x/Nb$ junction integrated with a superconductive Nb/SiO/Nb microstrip tuning circuit. A detailed model has been developed to design the microstrip circuits at submillimeter wave frequencies. This receiver has a double sideband noise temperature below 300 K over most of the LO bandwidth, and was used at the Caltech Submillimeter Observatory to detect HC1 and other molecules in several interstellar clouds. The optimization of a Nb-based mixer operating near the gap frequency is limited by the overlap of photon steps from opposite voltage regions. This overlap is observed as a current drop in the I-V characteristic and as a sharp dip in the IF output power for the voltage $V = 2\hbar\omega/e - Vg$. We have investigated this effect on receiver performance and measured an increase of the receiver noise by up to 40% in the bias region where the overlap occurs. We compare these results with theoretical calculations using Tucker's theory. The bias range for best performance is restricted to the vicinity of the second Shapiro step, making the cancellation of the AC Josephson effect with a magnetic field without reducing the gap essential.

* This research was supported by NASA/OACT, BMDO/ISTO

Presort Category:	E-5 (Mixers)
Registrant:	M. Salez, W.R. McGrath
Correspondence Author:	Morvan Salez Mail Stop 168-314 Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, CA 91109
Tel:	(8 18)354-6082
Fax:	(8 18)393-4683
Telex:	.
E-mail:	msalez@jplsp.jpl.nasa.gov
Preference:	Oral presentation