

First mixer prototype results for Band L (455-495 GHz) of CHAI

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The Cerro-Chajnantor-Atacama-Telescope (CCAT) Heterodyne Array Instrument (CHAI) is a focal plane instrument containing 2 cartridges of heterodyne mixers at 2 frequency bands (Band L and Band H) that will be developed as a mapping instrument for the future CCAT telescope. Each of sub-arrays will consist of 64 (goal 128) pixels. In the current baseline design the arrays will be populated with balanced waveguide SIS mixers with a lateral pixel-footprint of 10mm x 10mm.

We will report measurements of a prototype mixer for 455-495GHz that fits the array footprint, with a balanced Si-chip that contains a RF 90°-hybrid and the 2 SIS mixers, integrated in one block with an IF Wilkinson power combiner and 2 bias T's on an alumina substrate. To suppress the Cooper pair tunneling in the SIS mixers, small (1mm³) permanent magnets are implemented. The GPPO IF mixer output connector is connected via a short coaxial cable with the GPPO input of a miniature (13.7 x 5 x 22.4 mm³) LNA based on SiGe MMIC technology with a bandwidth of 1-8 GHz and a noise temperature of approximately 8K, at a dissipation of 10mW of DC-power.

Measured noise temperatures, using a 92% transmission HDPE windows and a Gunn-multiplier local oscillator source, are around 100K at an operating temperature of 4.5K over an IF bandwidth of 1-6 GHz. We will present a detailed evaluation of the usefulness of this mixer as an array pixel