GAIN AND NOISE SPECTRA FOR $YBa_2Cu_3O_7$ HOT-ELECTRON BOLOMETER MIXERS

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The conversion gain and output noise spectra for YBCO hot-electron bolometer (HEB) mixers will be presented. Devices were formed from a small area of YBCO thin film, with nominal physical dimensions of 1 μm (wide) × 2 μm (long) × 1000 Å (thick), coupled to planar log-periodic antennas. Two tunable Gunn oscillators, providing several mW radiation from 75 to 106 GHz, were used. One acted as the LO, the other one as the RF. Both signals were combined first with a 3 dB directional coupler before emerging from a corrugated feedhorn. Measurements were performed quasi-optically, with the devices mounted on the back of a Si extended hemispherical lens, and coupling losses estimated 12 dB. Within the IF range (2-18 GHz, set by the amplifiers we were using), single Lorentzian roll-off bandwidths were observed for mixer conversion gain, with conversion efficiency close to -18 dB around 2 GHz, and 3 dB bandwidth ~ 6 GHz.

A broadband amplifier chain, connected with a tunable band-pass filter and microwave power detector, was used to measure the output noise up to 12 GHz. To cancel Johnson noise contributions from the HEB, circulator matched load, and lossy transmission lines, we also measured the noise using a 50 Ω thin-film resistor in place of HEB. The mixer input noise temperature, not taking into account the coupling loss, was estimated of the order of 10,000 K. A tungsten lamp with 3200 K color temperature will be used as the hot load to implement the hot/cold load experiment.