RECENT DEVELOPMENTS OF HOT ELECTRON BOLOMETER TECHNOLOGY RELEVANT FOR THZ ASTRONOMY RECEIVERS

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Development of Hot Electron Bolometer heterodyne detectors for terahertz astronomy applications commenced in the early 1990s. At this stage, receivers with double sideband receiver noise temperatures of close to ten times hf/k have been demonstrated in the frequency range of 1 THz to 2.5 THz. HEB receiver systems have been installed on ground-based telescopes at the lower THz frequencies, and are ready to be launched on Herschel in 2007. This talk will review some new developments in the following areas:

The first Focal Plane Array (FPA) for a frequency above 1 THz (1.6 THz) was recently demonstrated (Rodriguez-Morales et al, IEEE Microw. Wireless Comp. Lett., 15, 191 (2005)). This FPA integrated three HEB elements and broadband MMIC IF amplifiers in a single block. The modeling of such receivers and the potential for extension of FPAs to larger numbers of elements and higher terahertz frequencies will be discussed.

Gain stability is a crucial issue for terahertz receivers as they are being employed in systems. We have performed new Alan variance and other measurements on HEB receivers with and without active stabilization of the local oscillator (a gas laser in this case), and will discuss these results and their relevance to the operation of HEB receiver systems.

Relatively few measurements have been performed on HEB receivers for frequencies above 2.5 THz, and the few that exist indicate a rather rapid increase of the noise temperature with frequency. This talk will review predictions for the HEB receiver noise temperature based on recent theoretical work (Kollberg and Yngvesson, submitted to IEEE Trans. Microw. Theory Techniques, September, 2005). The theory models quantum noise effects in HEB receivers at high terahertz frequencies, and it is shown that quantum noise will contribute more than half of the receiver noise temperature above about 3 THz.

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2. J - Radio Astronomy

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4. I - Invited Paper, Program chair: Simon Radford

5. No special instructions