High-precision measurement system for terahertz frequencies

Development of superconducting heterodyne receiver and its application to gas spectroscopy

We developed a heterodyne receiver based on an SIS (Superconductor-Insulator-Superconductor) mixer followed by an FFT (Fast Fourier Transform) spectrometer, aiming to realize a highly sensitive, broadband, and precise measurement system at terahertz frequencies. The receiver noise level is 10-20 times of the quantum limit in the frequency range of 0.23-0.44 THz, which is as wide as 63 % of the center frequency. We also confirmed that this receiver is applicable to spectroscopy of gas molecules, such as HCN, with the frequency resolution of 60 kHz.

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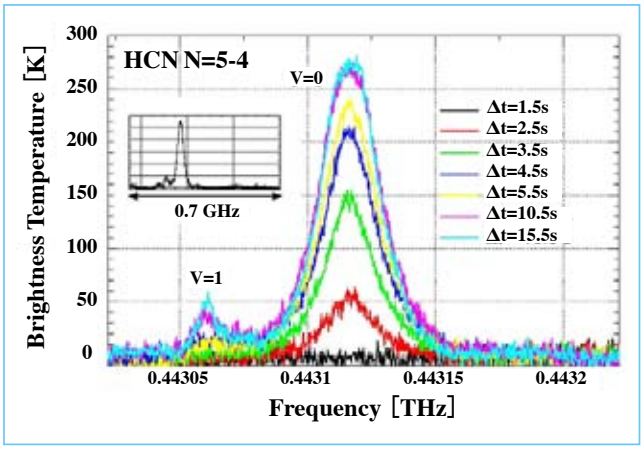

Example of measured spectra. Tarahertz emissions from HCN (N=5-4), produced by electric discharge of CH_3CN, in ground (v=0) and vibration-excitation state (v=1) were observed continuously with 1-second integration. Inset shows the instantaneous bandwidth of the receiver system.

Development of true 3D display using laser plasma in the air

AIST with Burton Inc. and Hamamatsu Photonics has revealed a new "true 3D display using laser plasma in the air" capable of projecting 1000 dots in every second in a 50x50x50cm free space. To achieve this new level of projection, we used the newly developed laser source (repetition rate: 1kHz, average power: 200 W) and improved the 3D scanning system as well as the optical system. This 3D display made it possible to draw animations more smoothly than that released last year. We believe our technology may provide the answer for a real 3D TV in the future.

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A symbol in the Japanese syllabary, "イ [i]" projected in the air. (size: approximately 40 cm)

Butterflies projected in the air.