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Operation of quasi-optical a THz detectors in heterodyne regime

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Abstract

In recent years Schottky-diode technologies gain influence in THz systems because of their large sensitivity, wide range, high power capability and room-temperature operation. Schottky diodes rectify the RF signal directly and therefore change their current-voltage characteristic. Considering the square-law detection for low-power and linear detection for high power, dynamic ranges of typically 90dB can be achieved. Direct detectors with quasi-optical interface have been developed, as an alternative to nearly frequency-independent Golay-Cell THz detectors with a great advantage of very short response time [1, 2]. Such detectors may be extremely sensitive[3] or provide a ultra-wide operation range from about 50GHz up to beyond 2THz in a single device[4], which facilitate emerging of new application areas for THz technology [5, 6]. Nevertheless, main drawback of direct detectors for many applications is the luck of frequency and phase information of detected signal. A commonly-used approach to get this information is the comparison of the incident RF-signal with a reference one. For this reason homodyne or heterodyne regime is commonly used. Operation of quasi-optical detectors in homodyne regime has already been demonstrated [7]. Room temperature heterodyne receivers achieved excellent performance up to THz frequencies [8] but still limited for different applications due to high requirements for rather complicated and expensive electronic Local Oscillator (LO) sources. On another hand, near-infrared lasers and optical mixing approach offers a good alternative to full electronic sources to generate LO-signal. This talk reports on results of driving a quasi-optical THz detector in a heterodyne regime using beat

frequency of two near-infrared lasers as a photonic LO-source. Figure below illustrates some of preliminary results of this experiment. The beating optical signal of two near-infrared lasers (Δf) is mixed by the Schottky diode with a RF signal from a W-band source. In result we obviously got an IF-signal, which is a difference between the RF-signal and Af lasers beat frequency. Further details will be described in the full abstract.