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Terahertz Systems – Novel Applications of Telecom Technology

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Abstract

Terahertz spectroscopy promises attractive applications in various fields. Commerical use requires compact, room temperature and cost effective THz systems. Mature InP technology and versatile fiber components here can pave the way. The paper gives an overview on recent developments on InP based optoelectronic THz components and 1.5µm operated systems.

Extended Abstract

The THz range is extending from 200GHz (0.8meV, <kT300K) to 10THz (40meV). It is often called the THz gap, because the frequencies are too high for conventional electronics and the photon energies are too small for classical semiconductor lasers and detectors. The realization of THz emitters and receivers thus is a challenge. In spite of these problems a lot of possible applications in security, medicine, biology, science, and non-destructive materials testing have been demonstrated already in the laboratory. THz spectra can indicate explosives or analyze complex pharmaceutical substances. THz radiation penetrates a lot of materials like paper, clothing and plastics, being at the same time completely harmless for human beings. Thus it is well suited for detection of weapons hidden under clothing. However, all the equipment presently in use is quite bulky, expensive, often needs cryogenic cooling, and thus prevents broader practical application and commercialization of Terahertz spectroscopy. Mature InP device and integration technology and versatile fibre components here can bring significant progress. In this paper recent developments on InP based optoelectronic THz emitters and receivers will be described. Fibre coupled THz systems are assembled, exploiting highly sensitive coherent detection, and their functionality is demonstrated in selected applications.

Bernd Sartorius

Bernd Sartorius received his PhD in phyiscs from the Technical University Berlin. At the Heinrich-Hertz-Institute he became head of projects developing multi-section lasers and amplifiers for applications in high speed signal processing. In collaboration with Alcatel the work was especially focussed on all-optical 3R regenerators for high speed communication systems.

The downturn of the IT industry stimulated strong interest in non-telecom applications of InP components. Dr. Sartorius is now responsible for InP based THz devices and systems. As result of this work, the worldwide first all-fibre THz spectrometer operated at the telecom wavelength 1.5 µm has been developed.