

Generation, Guidance, and Detection of Terahertz Waves and their Applications in Science and Technology

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Terahertz waves offer unique properties for a variety of critical applications, such as biology and medicine, medical imaging, material spectroscopy and sensing, monitoring and spectroscopy in pharmaceutical industry, security, and high-data-rate short-range communications. Terahertz waves or so-called T-rays occupy the electromagnetic spectrum between infrared and mm-wave bands with the properties of both optical and microwave signals. T-rays can penetrate many materials and provide images with high spatial resolution. Many organic and inorganic materials and compositions have distinct fingerprints in the terahertz spectrum. This unique property of the terahertz waves makes them attractive for label-free and non-invasive sensing and spectroscopy applications. Unlike X-rays, T-rays are non-ionizing and can be safely used in medical imaging and disease diagnosis applications.

In this talk, some of the methods and techniques for generation, guidance, and detection of terahertz waves will be reviewed, and typical pulsed and continuous-wave (cw) terahertz imaging and spectroscopy systems will be introduced and compared against each other from the capability, performance, and system complexity viewpoints. Also, some applications of the terahertz waves in science and technology will be reviewed.