THz Wave Imaging

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Abstract

Terahertz waves (or T-rays), like infrared and microwaves in the adjacent bands of the electromagnetic spectrum, offer innovative imaging and sensing technologies for applications in material characterization, microelectronics, medical diagnosis, environmental control and chemical and biological identification. Recent advances in THz science and technology make it one of the most promising research areas in the 21st century for sensing and imaging, as well as in other interdisciplinary fields. Recently, governmental supported THz wave related fundamental research in science and application emphasized technology development has increased substantially. We believe new T-ray capabilities will impact a range of interdisciplinary fields and industrial companies, including: communications, imaging, medical diagnosis, health monitoring, environmental control, and chemical and biological identification.

While microwave and X-ray imaging modalities produce density pictures, T-ray imaging provides spectroscopic information within the THz frequency range. The unique rotational and vibrational responses of materials within the THz range provide information that is generally absent in optical, X-ray and NMR images. A THz wave can easily penetrate and inspect the insides of most dielectric materials, which are opaque to visible light and low contrast to X-rays, making T-rays a useful complementary imaging source in this context. Examples of imaging a long distance target (>100 meters) or a small scale device (nanometer) will be presented.

Author Biography

Dr. Zhang is the J. Erik Jonsson Professor of Science, a Professor of Physics, Applied Physics and Astronomy, and a Professor of Electrical, Computer, and Systems Engineering at Rensselaer Polytechnic Institute. He is the founding director of the Center for Terahertz Research at Rensselaer. Dr. Zhang is a Fellow of the American Physics Society and the Optical Society of America..