

Components and Systems for Terahertz Applications

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For more than last forty years, terahertz components and instruments have primarily been developed for space science applications in radio astronomy and planetary sciences. However, in recent years, terahertz waves are increasingly being used in commercial applications such as high speed communications, security imaging, autonomous landing and refueling of airplanes, and medicines. In spite of all these fascinating scientific and commercial potential, the terahertz frequency range (loosely defined as $300 \text{ GHz} < \nu < 10 \text{ THz}$) still remains one of the least utilized electromagnetic bands because of the unavailability of commercial source and sensor components, and sub-systems.

Recent progress in CMOS technology as well as availability of InP HEMT based amplifiers in terahertz frequency band has caught the imagination of researchers for developing terahertz instruments for commercial applications. Rapid progress in multiple fronts, such as commercial software for component and device modeling, low-loss waveguide circuits and interconnect technologies, silicon micromachining for highly integrated and compact packaging, and submicron scale lithographic techniques, is making it an exciting time for terahertz engineers and scientists.

In this presentation, an overview of the state of the terahertz technology will be presented. The talk will detail the science and other applications that specifically require technology at terahertz frequencies. The challenges of the future generation instruments and detectors at these frequencies in addressing the needs for critical scientific and commercial applications will also be discussed.

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