

Terahertz Measurements and their Applications

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This short course discusses several of the most commonly used techniques for performing measurements in the terahertz (THz) region of the electromagnetic spectrum. This spectral range has received heightened attention in recent years, due to the many promising applications ranging from fundamental spectroscopic measurements of materials to imaging and sensing for security, quality control, and process monitoring. Many different systems have been developed for accessing the THz range based on a wide range of different technology platforms, each with its own capabilities and challenges.

In this course, we will review the fundamentals of common source, detector, and system technologies. This will include both electronics-based approaches such as mixers and frequency multipliers, as well as photonics-based approaches such as time-domain spectroscopy, photomixing, and THz quantum cascade lasers. We will consider various figures of merit for each technology, which will provide a framework for selecting a particular THz system for any given application. Although it is not possible to cover all THz technologies at an exhaustive level of detail, we will discuss the most commonly used systems as well as a few of the more exciting new research developments. Application examples will be provided throughout, to illustrate the strengths and weaknesses of existing systems.