

The CUNY Center for Advanced Technology In Photonics Applications (CUNY CAT)  
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## Time-Resolved Terahertz Spectroscopy

With the advent of generating high power THz pulses using femtosecond laser sources with nonlinear optical rectification, the "TERAHERTZ" region of electromagnetic spectrum has become an active area of scientific research because of its wide range of applications in biology, medicine, semiconductors, and chemistry.

### Potential Applications

- THz time-resolved spectroscopy of materials
- Dielectric relaxation properties
- THz imaging techniques
- Remote detection of biological, and chemical agents
- Pump-probe THz- fsec spectroscopy to measure relaxation parameters

### Benefits

- Can detect large molecule rotational and vibrational energy levels.
- Can be used to detect subsurface substructures beneath coating.
- Efficient way to communicate in optically opaque media.

### Technology

Terahertz time-resolved spectroscopy (THz-TRS) is a noncontact method yielding important results in solids, liquids and gases. The system can be used to make important measurements of biological materials (DNA, tryptophan, and bacteria), liquids (CS<sub>2</sub>), and gases (CH<sub>3</sub>OH, H<sub>2</sub>O and D<sub>2</sub>O) shown in Figs. 1 and 2.

These results demonstrate that the ultrafast laser THz pulses can be used to produce the spectral fingerprints of materials using time-resolved pump-probe methods in:

Biological materials

Tissues

Communications

Low frequency modes in condensed matters and chemical system; and

Detection of corrosion and cracks beneath coating of surface.

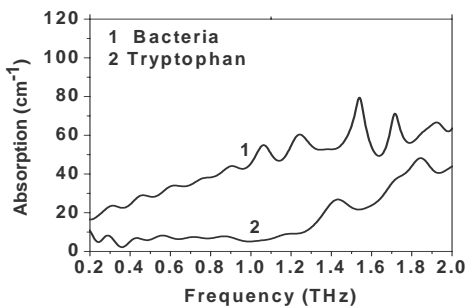


Fig. 1. THz absorption spectrum of bacteria and tryptophan.

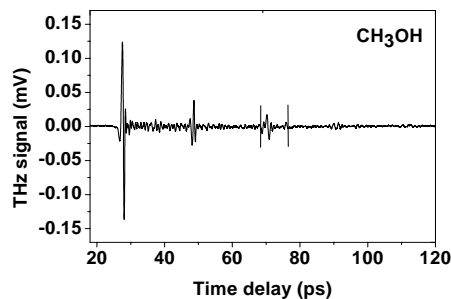


Fig. 2. Measured THz pulse profile of methanol

This technology opportunity sheet describes continuing efforts in this area. Several patents may have been issued or are pending and which may be available for licensing.

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