**THz air-biased-coherent-detection spectrometer for material sensing**

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- **Compact** THz platform
- **Broad bandwidth** 0.5~35 THz in 32 fs laser
- **High peak THz field** >100 kV/cm
- **High dynamic range** >2000
- **Time-resolved spectroscopy**
- **Absorption-free** material measurement

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**Abstract**

Terahertz (THz) wave sensing and imaging have been the focus of considerable attention within standoff detection in explosives, weapons as well as non-destructive evaluation of products. However, the broad-bandwidth and high-electric field for THz wave sensing and imaging are lagging behind the compelling needs for this technology. We designed a reflective THz air-biased-coherent-detection (ABCD) spectrometer with a pulsed femtosecond laser amplifier.

A usable, continuous bandwidth from 0.5 THz to over 35 THz and a peak THz electrical field greater than 100 kV/cm are demonstrated. In addition, the compact and table-top THz-ABCD spectrometer provides an alternative tool to compete with the Fourier transform infrared (FTIR) spectrometer, which has been a major commercial product for several decades.

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**Fig. 1.** (a) The schematic setup of R-THz-ABCD spectrometer. (b) Measured time-domain waveforms via conventional ZnTe sensor and via THz-ABCD sensor. (c) The Fourier transform spectra according to Fig. 1(b). Our group has successfully demonstrated ultra broadband THz spectroscopic measurements, covering a frequency range from 0.5 THz to 35 THz. This is one order of bandwidth improvement in comparison with conventional and commonly-used ZnTe sensor.

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**Fig. 2.** The absorption spectrum of 2,4-DNT explosive.

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**Fig. 3.** The reflection spectrum of an n-doped $10^{17}$/cm$^3$ InAs crystal and the reference measured with an 85 fs pulse laser amplifier.

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**References**