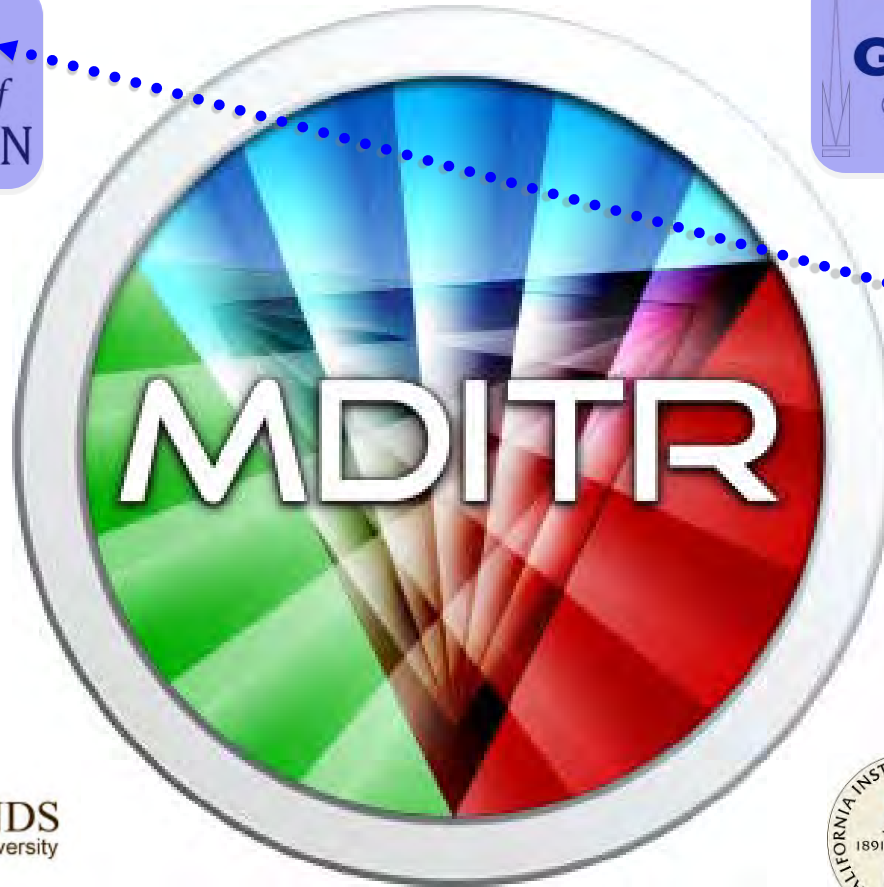




# CMDITR 101: Project 1.2

## THz generation, detection, and spectroscopy

Michael Hayden

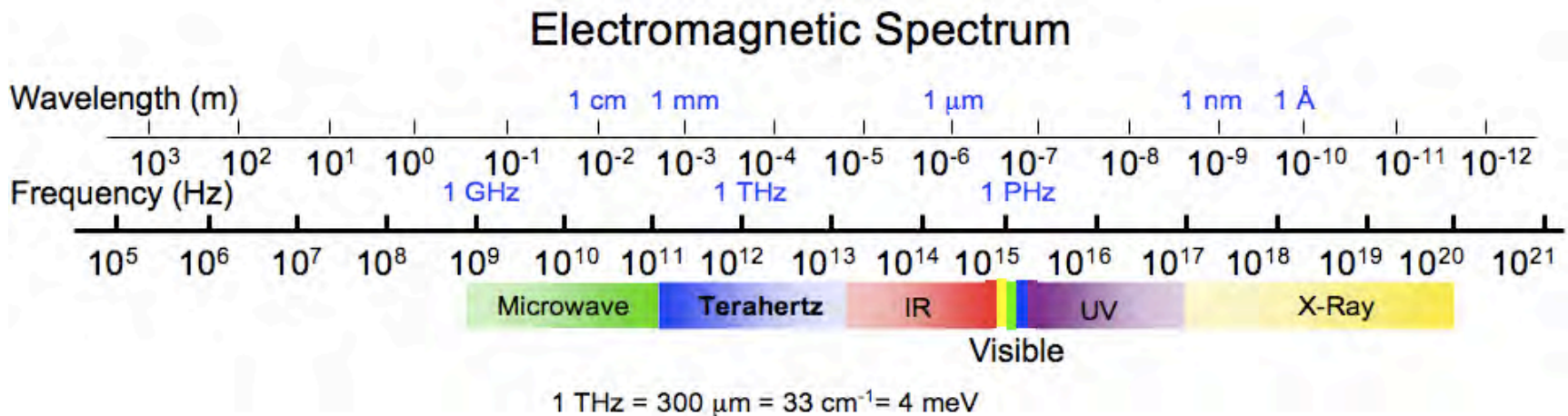




# Key Vocabulary Words



- Terahertz (THz) frequency radiation
  - Between the microwave and visible

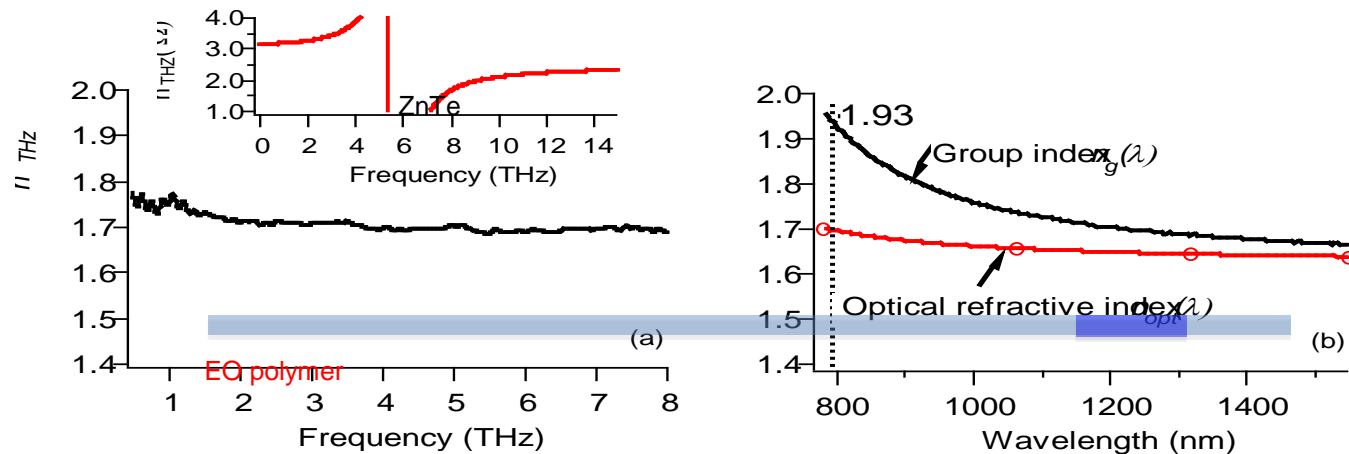




# Key Vocabulary Words



- Phase matching and coherence length in THz emitters/sensors
  - Optical pumping beam and THz beam must travel at the same speed



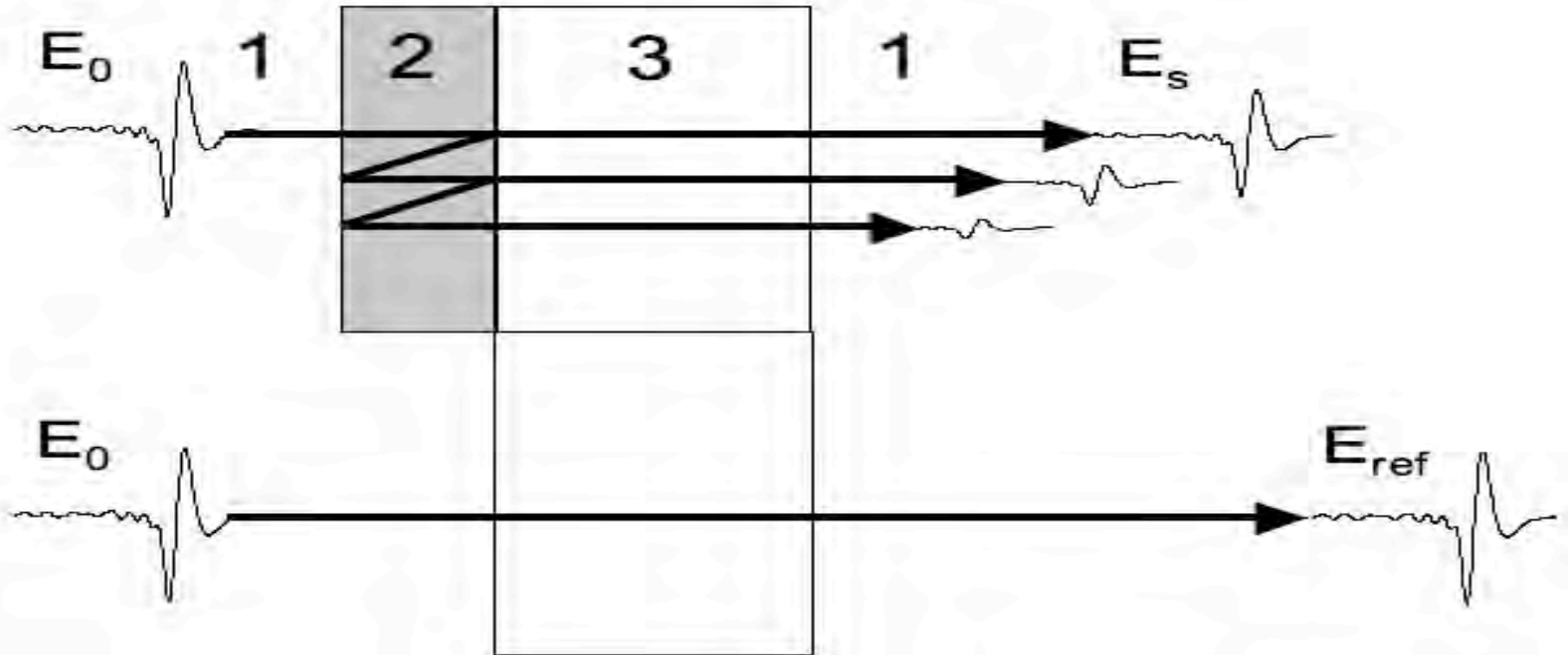
$$l_c = \frac{\pi c}{\omega |n_{group} - n_{THz}|}$$



# Key Vocabulary Words



- Time-domain spectroscopy, (THz-TDS)
  - Coherent (phase and amplitude) measurements of THz electric fields

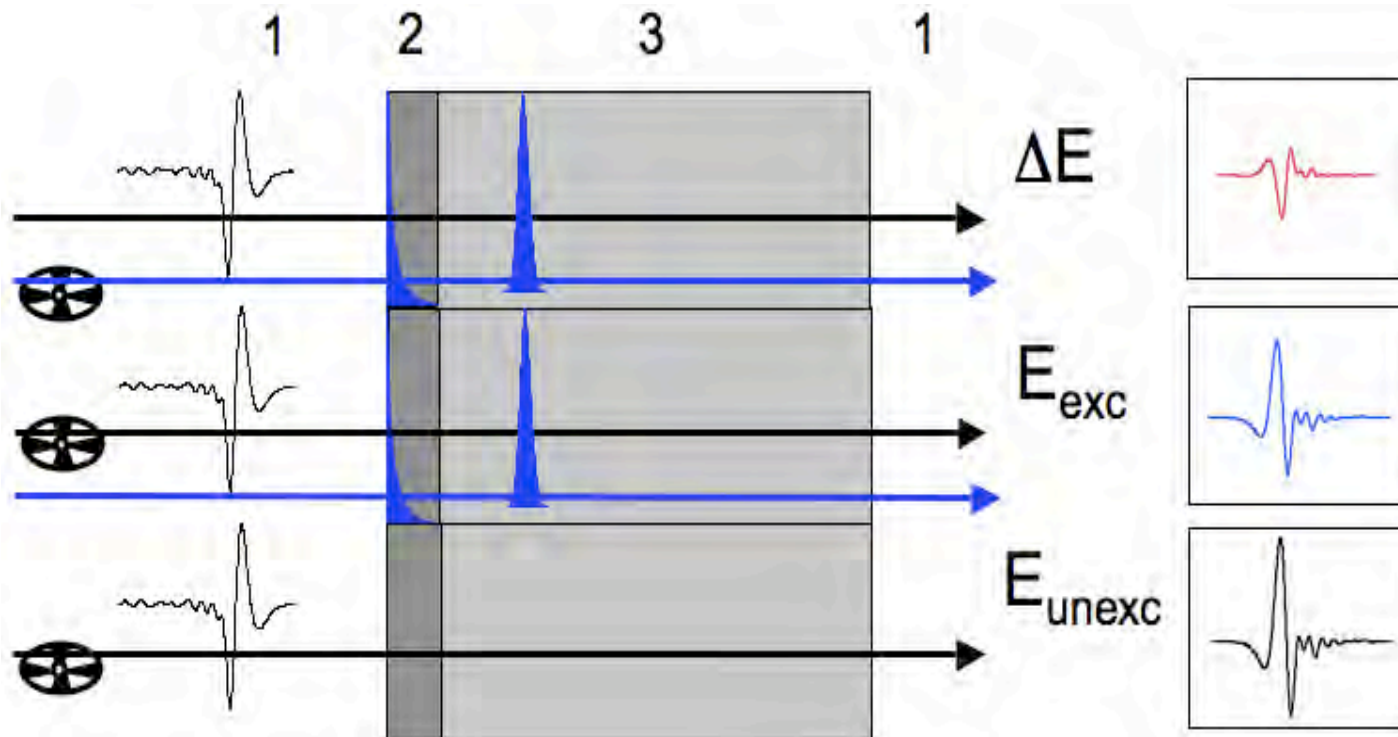




# Key Vocabulary Words



- Optical-pump THz-probe spectroscopy, (OPTP)
  - Creation of photoexcited charge carriers with a visible laser and probing the dynamics of the charge density with a THz pulse

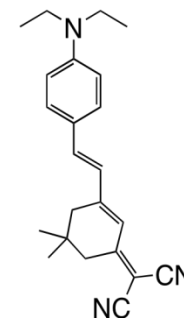
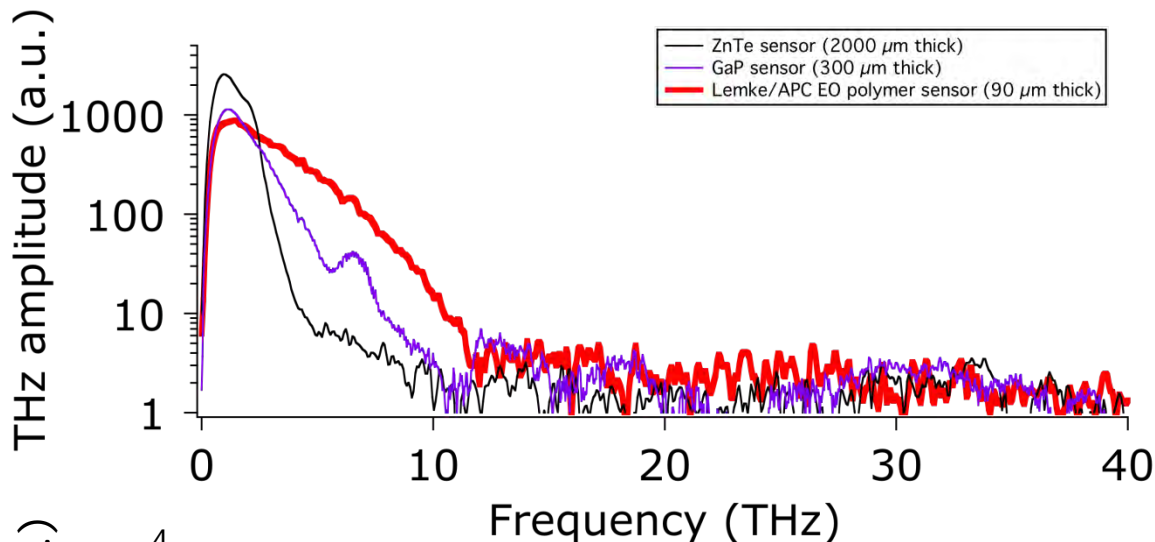




# Wide bandwidth THz generation and detection

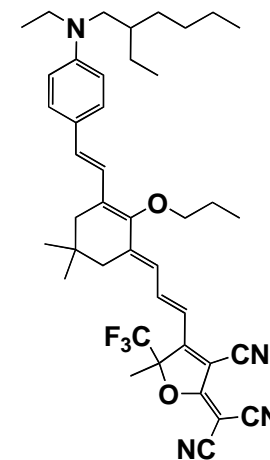
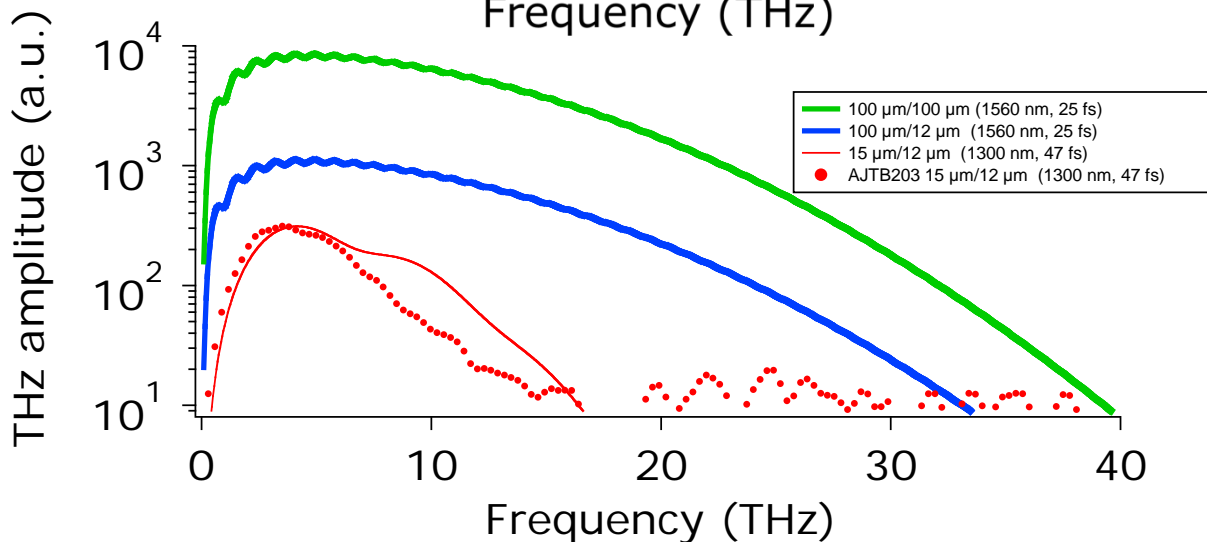


800 nm  
pump laser



Lemke

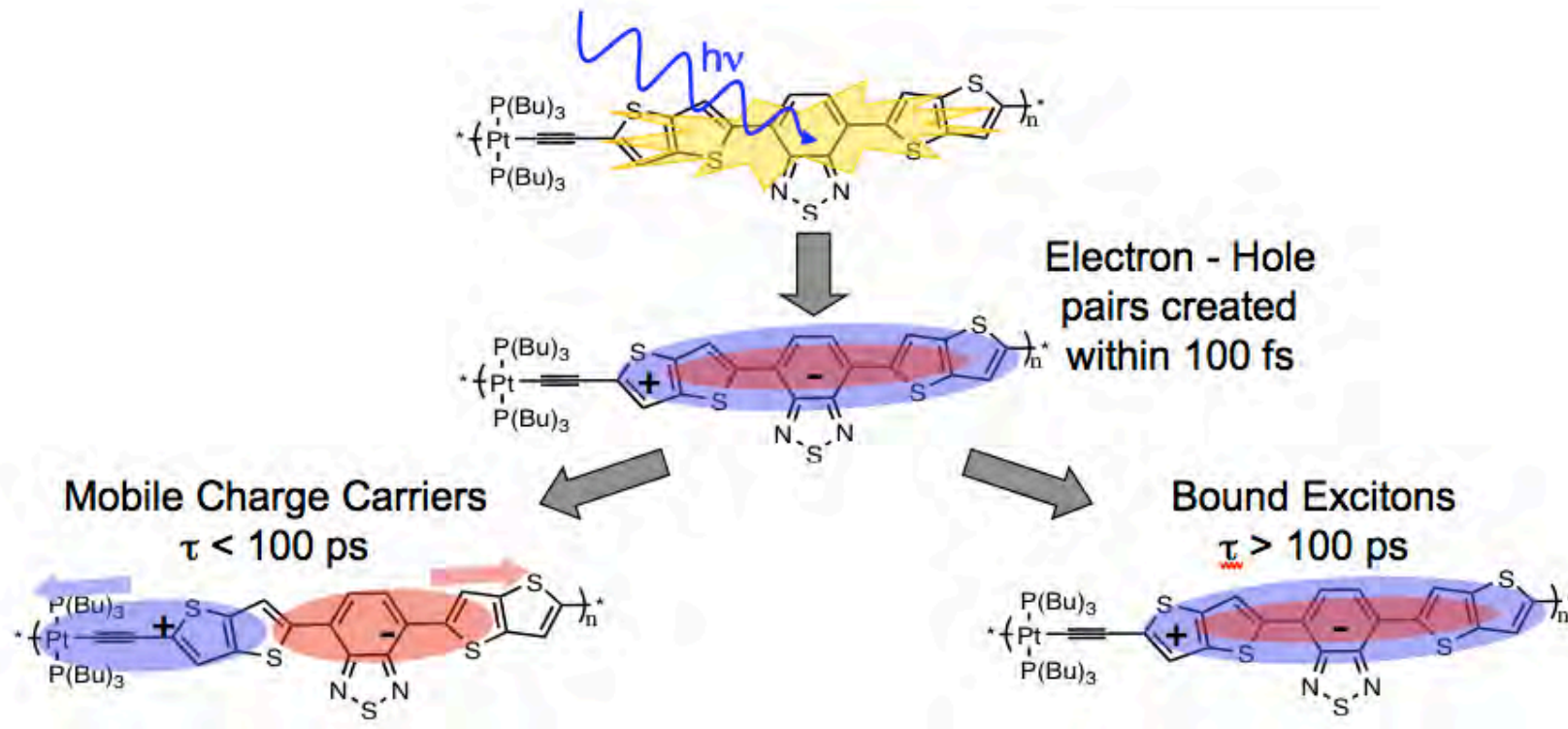
1300 nm  
pump laser



AJTB203



# Ultra-fast charge carrier dynamics in OPV materials





# Societal Impacts of Project 1.2

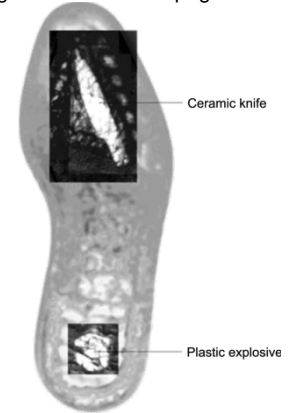
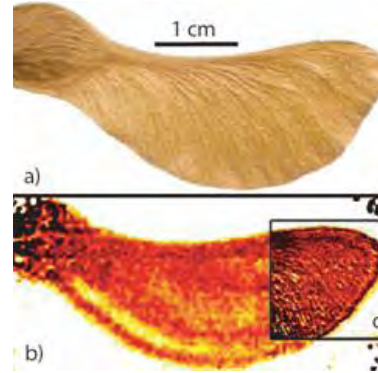


- Imaging and security

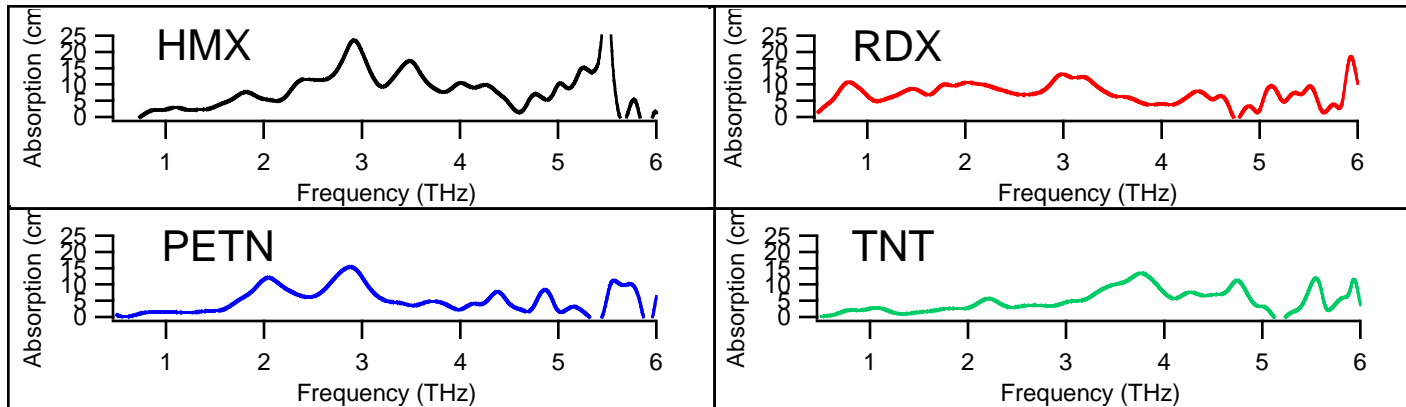


CThU3, "Real Time, Transmission-Mode Terahertz Imaging Over a 25-Meter Distance," Lee *et al.*,

<http://www.emeraldinsight.com/fig/0870260404010.png>



- Biohazard/chemical threat detection



- Improvements in organic charge transport materials