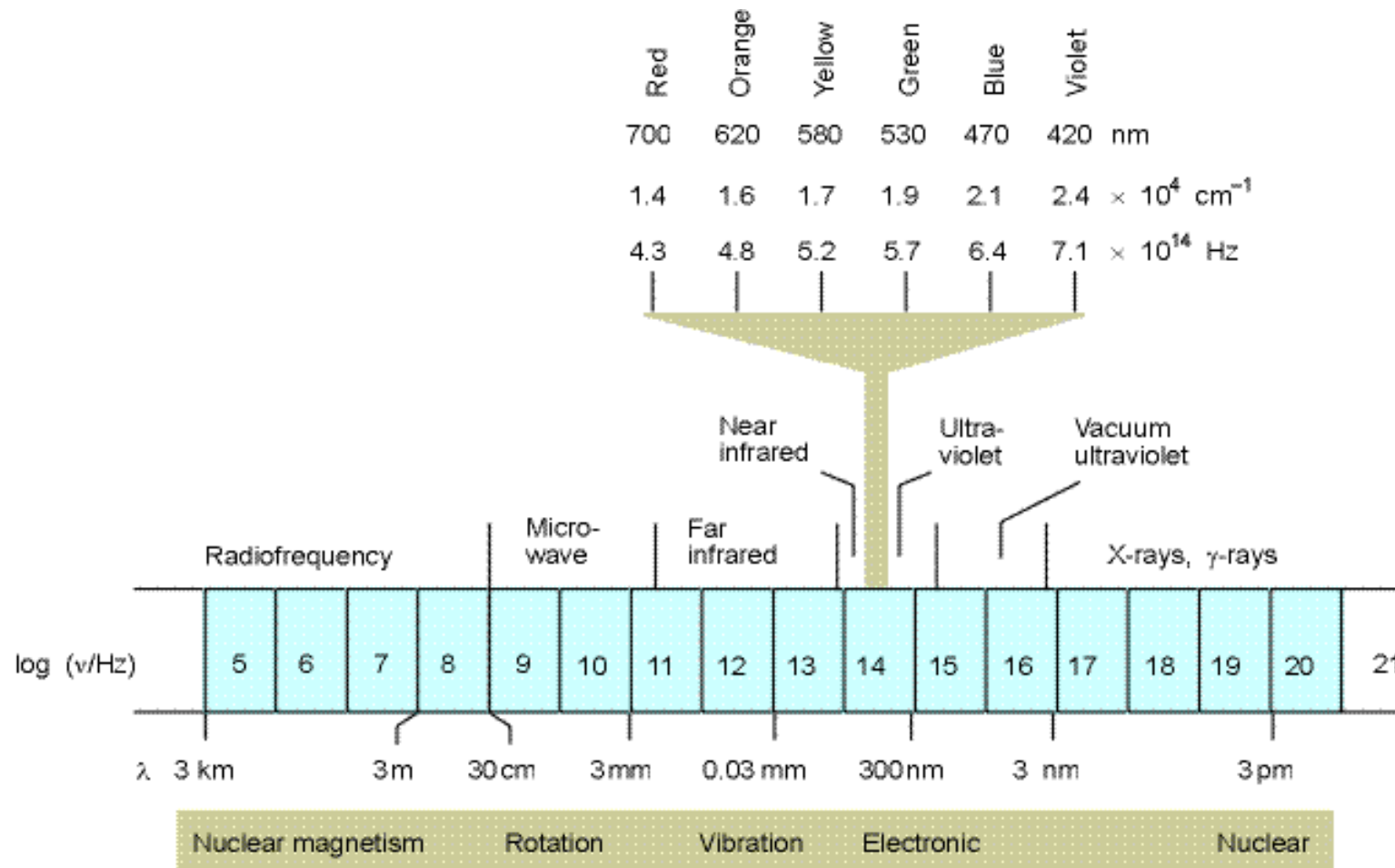
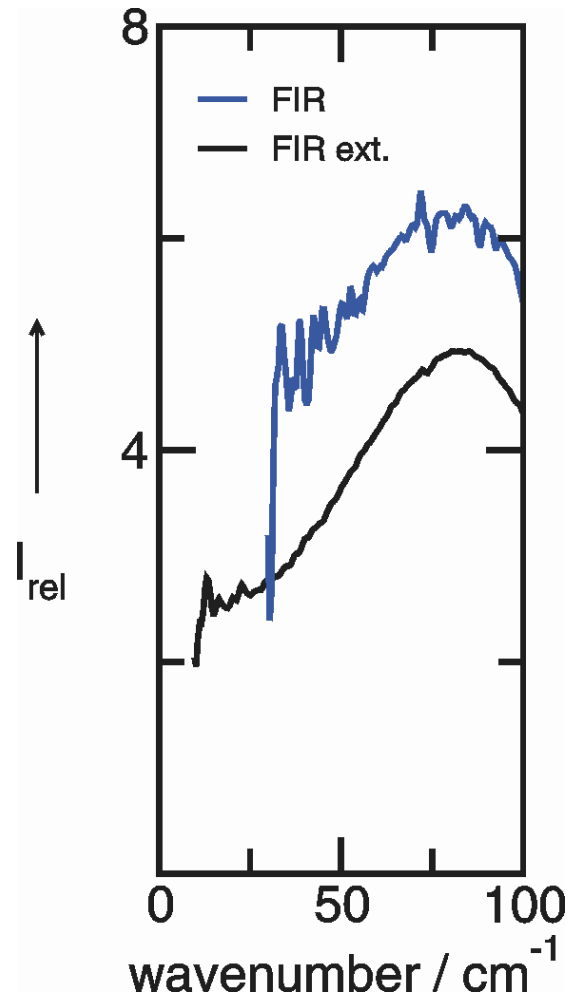


# Elektromagnetisches Spektrum



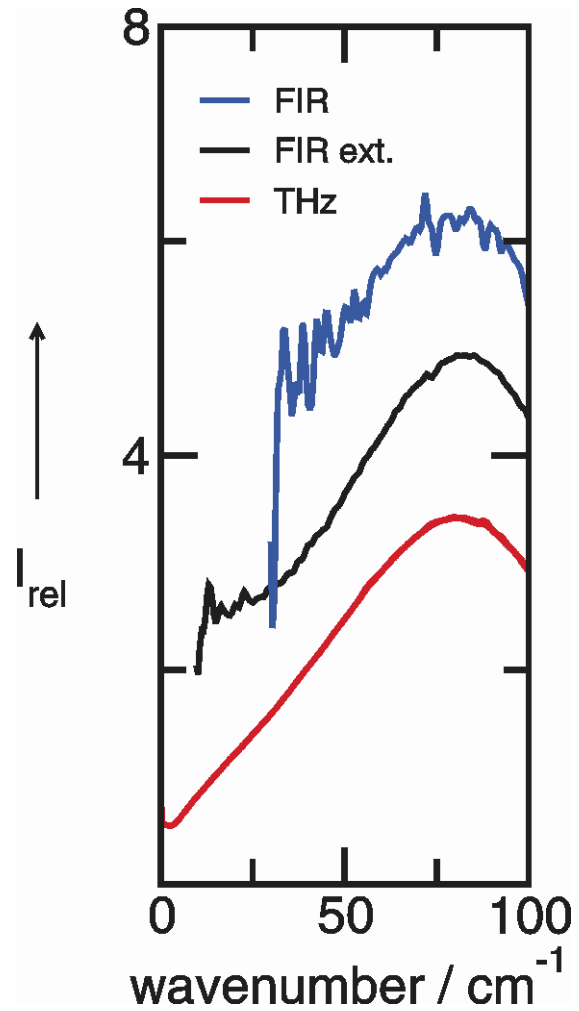
# Ferninfrarot

[C<sub>2</sub>mim][NTf<sub>2</sub>]



- from 30 down to 10  $\text{cm}^{-1}$
- better signal-to-noise
- no bolometer

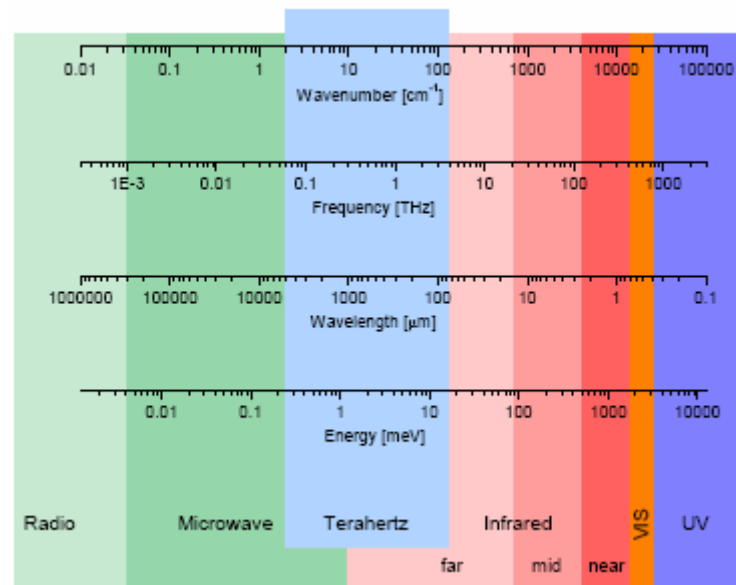
# Ferninfrarot/THz



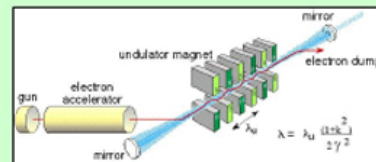
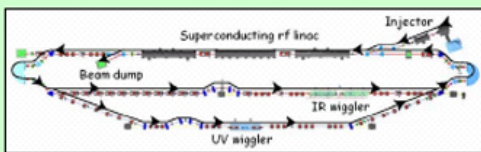
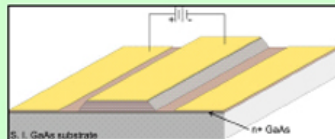
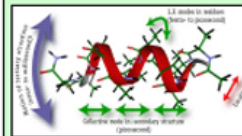
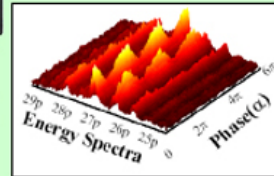
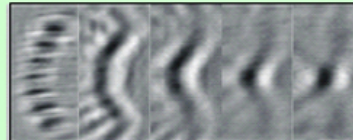
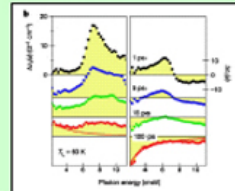
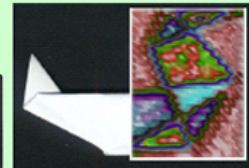
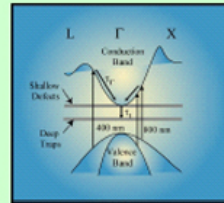
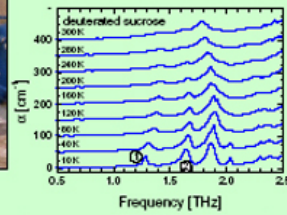
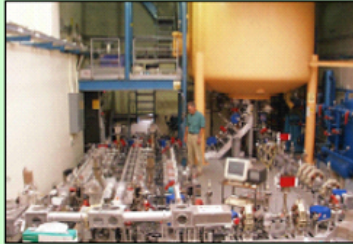
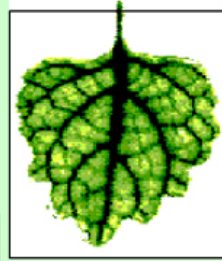
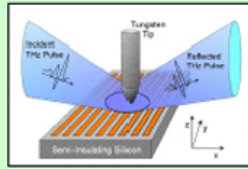
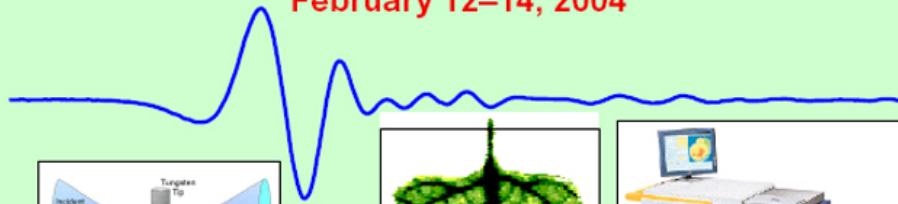
[C<sub>2</sub>mim][NTf<sub>2</sub>]

- from 30 down to 2  $\text{cm}^{-1}$
- better signal-to-noise
- no bolometer

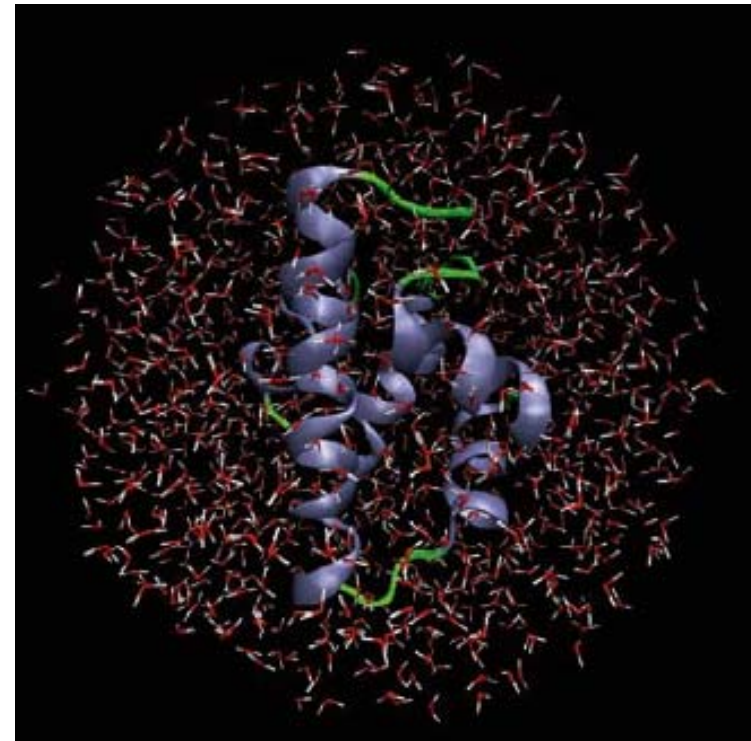
# Ferninfrarot/THz



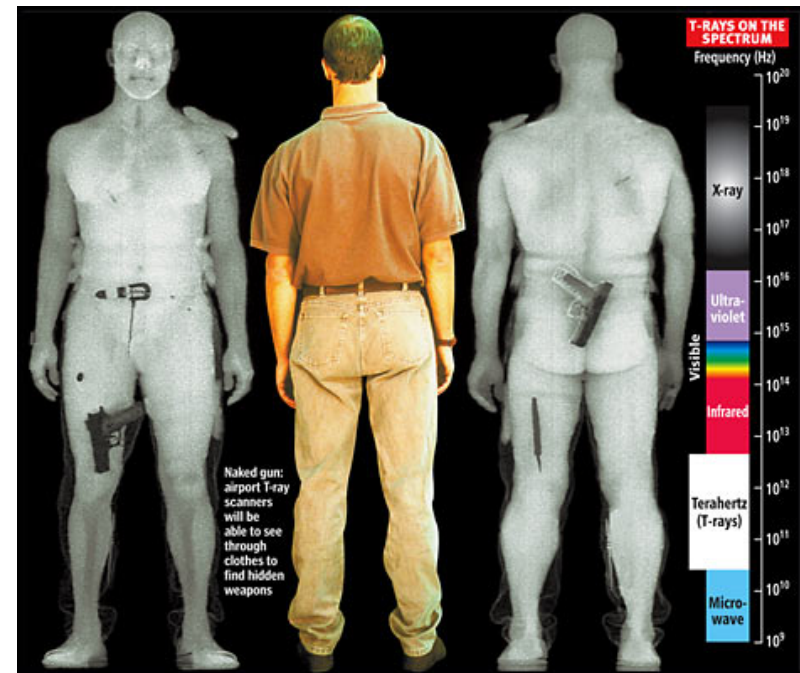
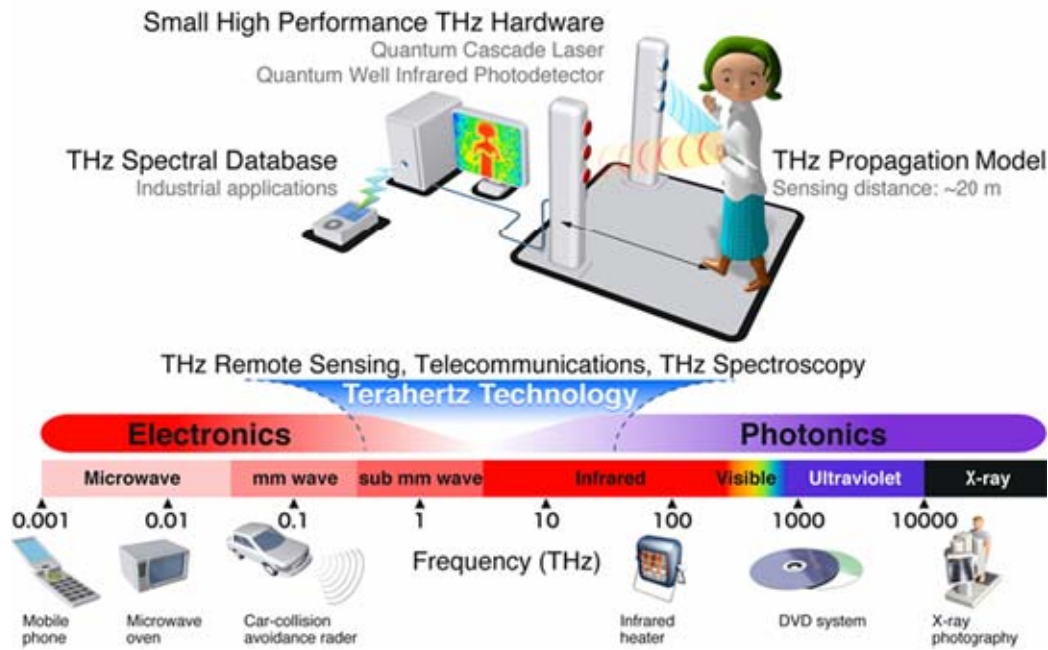
DOE-NSF-NIH Workshop on Opportunities in THz Science  
February 12–14, 2004



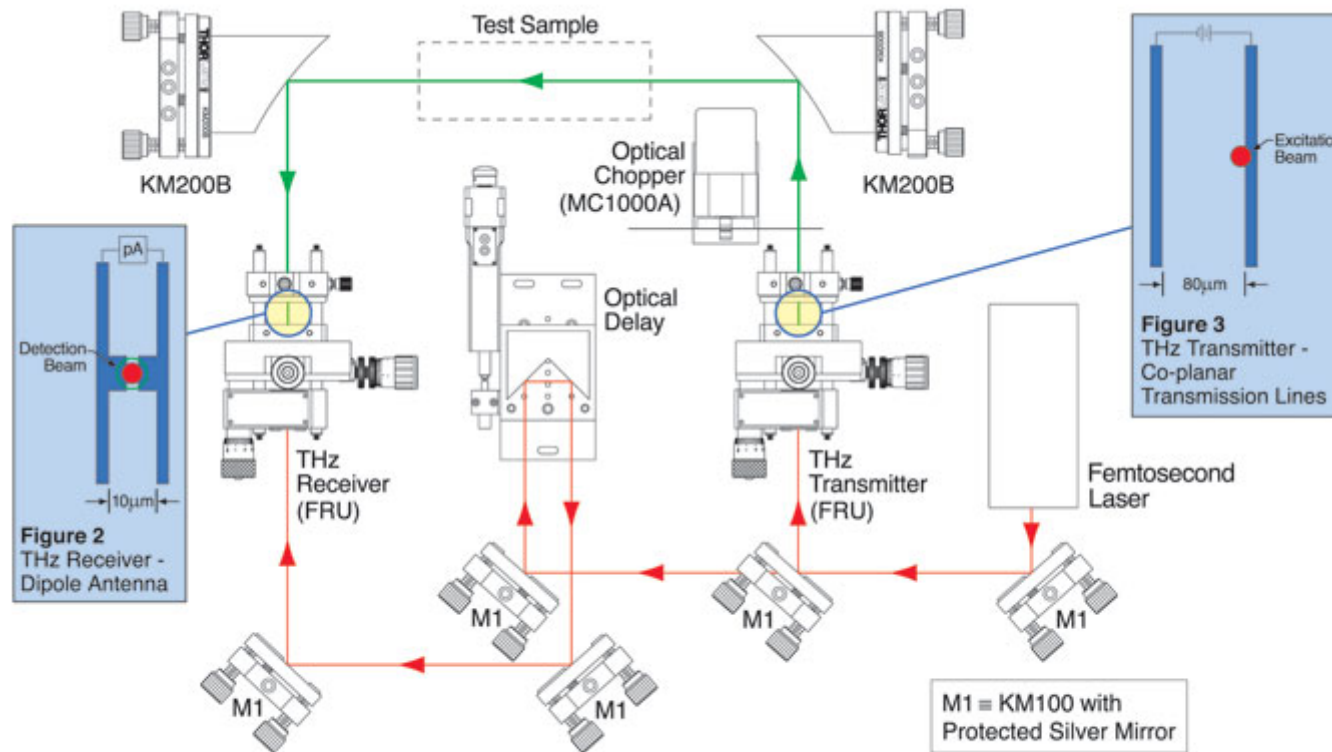
# THz-Spektroskopie



# THz-Spektroskopie

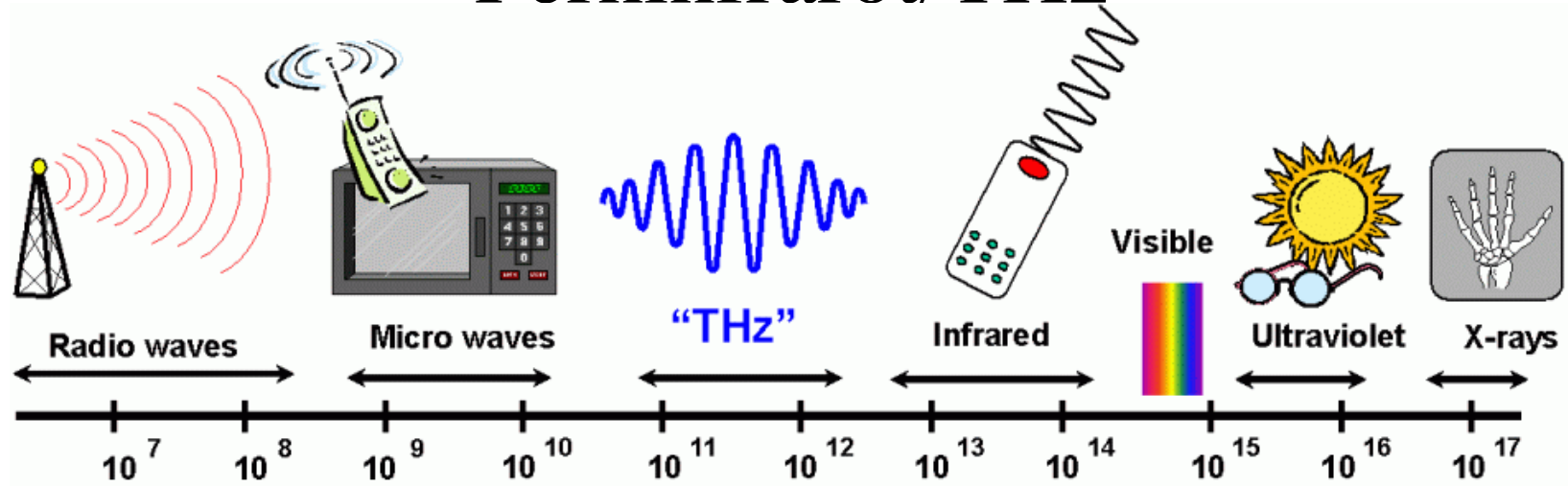


# THz-Spektrometer

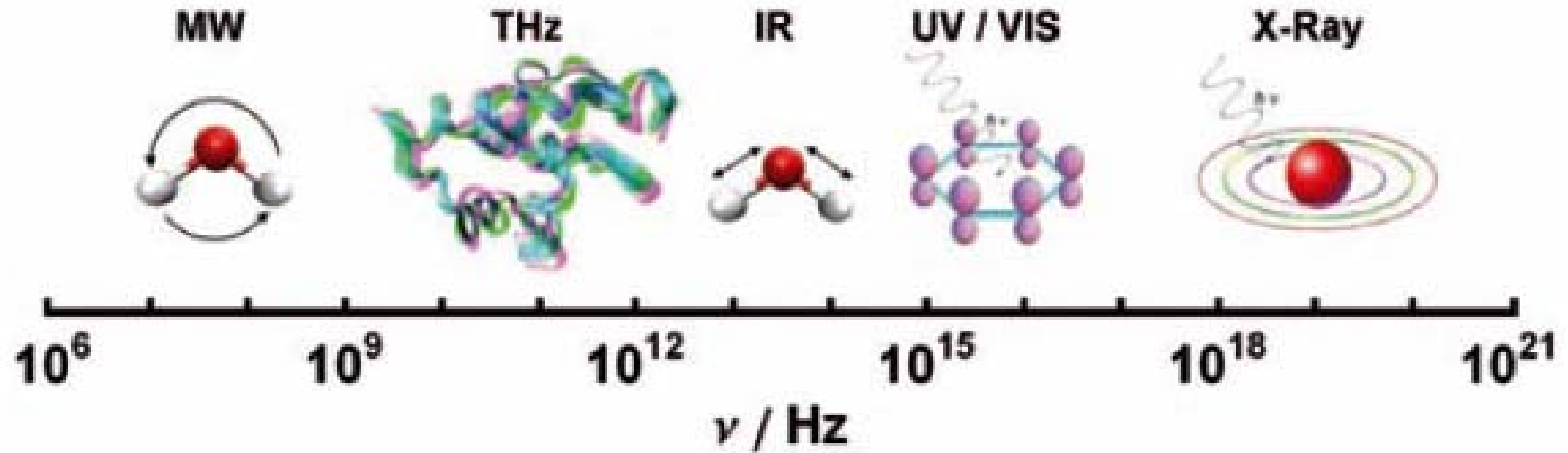


**Figure 1**  
THz-TDS System Based on Thorlabs' Standard Opto-Mechanical Components

# Ferninfrarot/THz



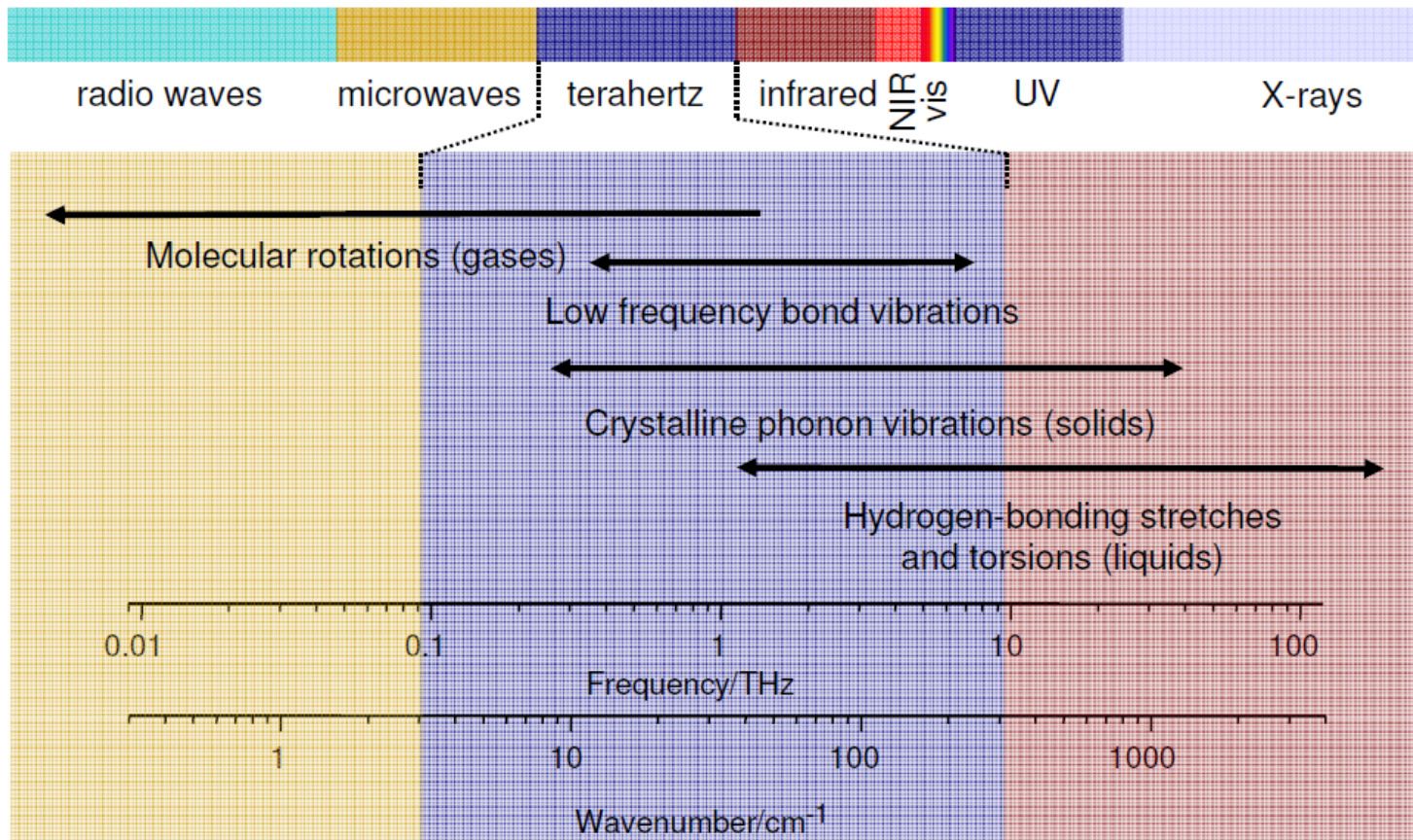
Frequency (Hz)



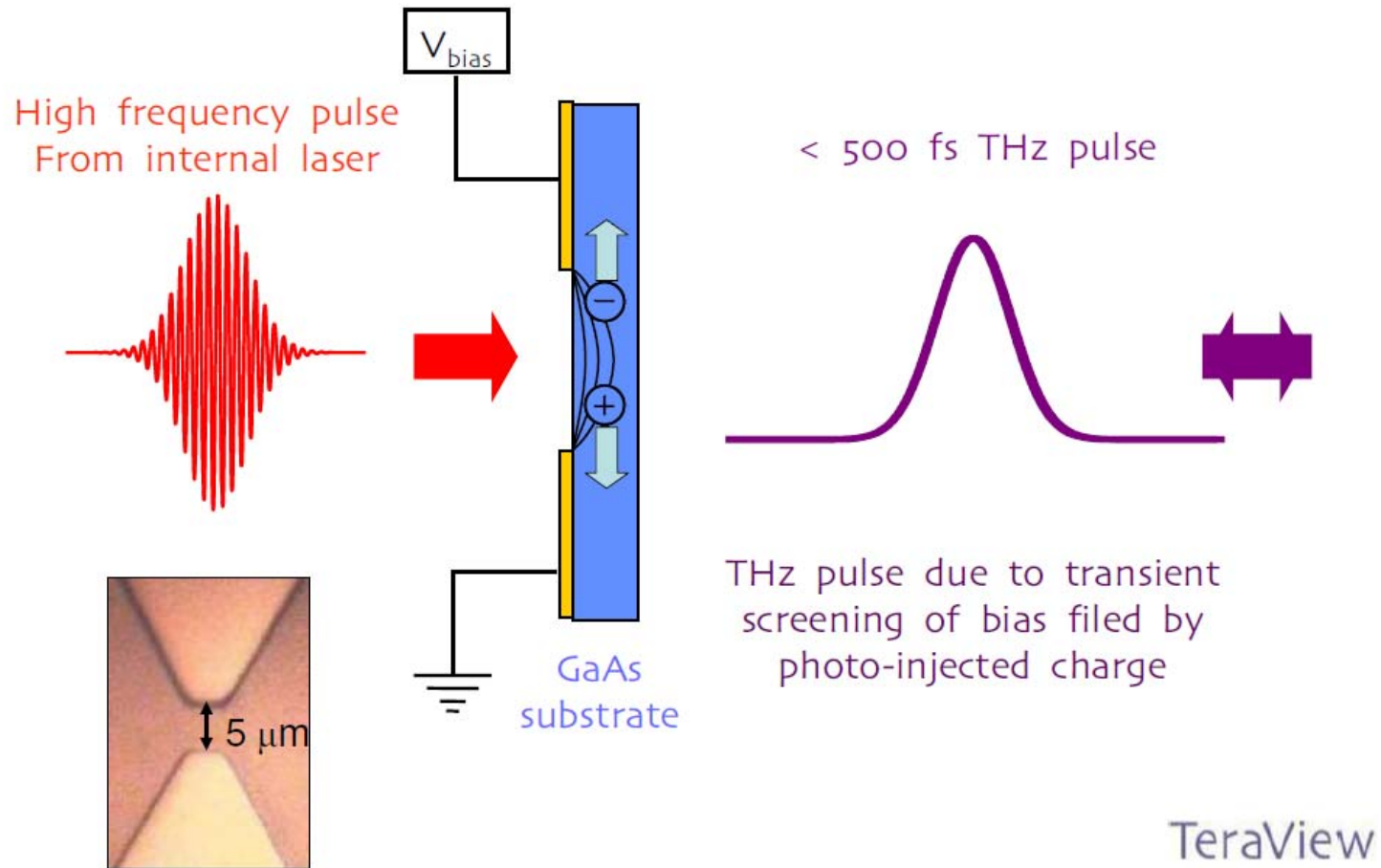
# Ferninfrarot/THz

## Technology - Terahertz spectral region

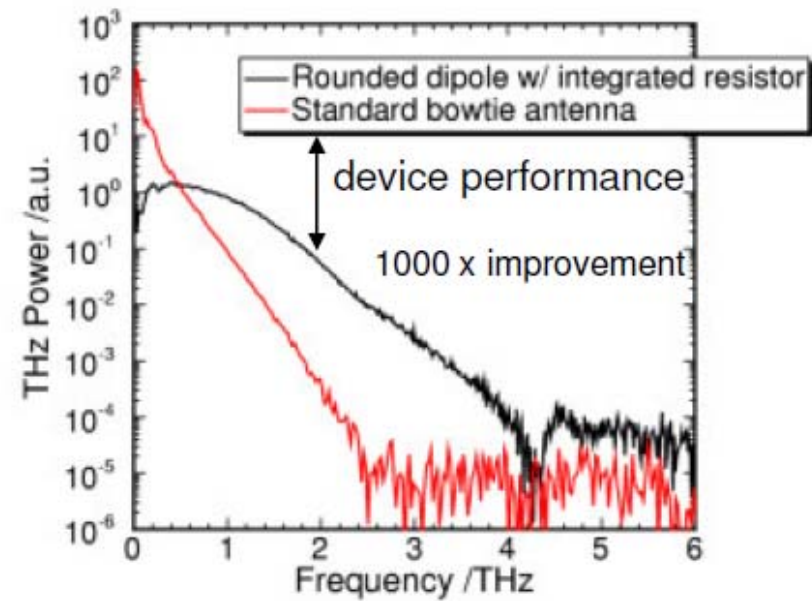
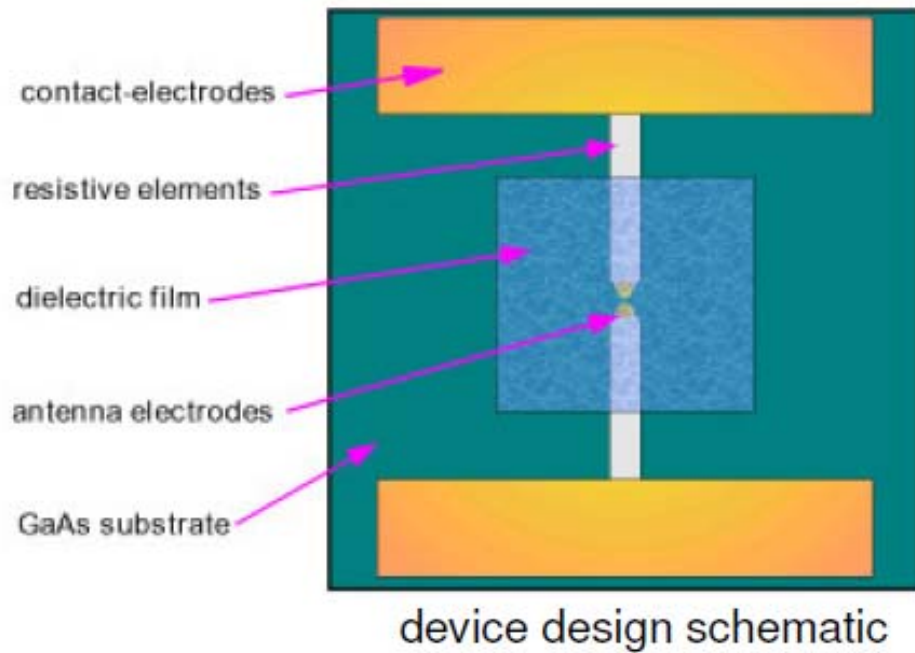
60 GHz – 10 THz or 2 cm<sup>-1</sup> – 300 cm<sup>-1</sup>



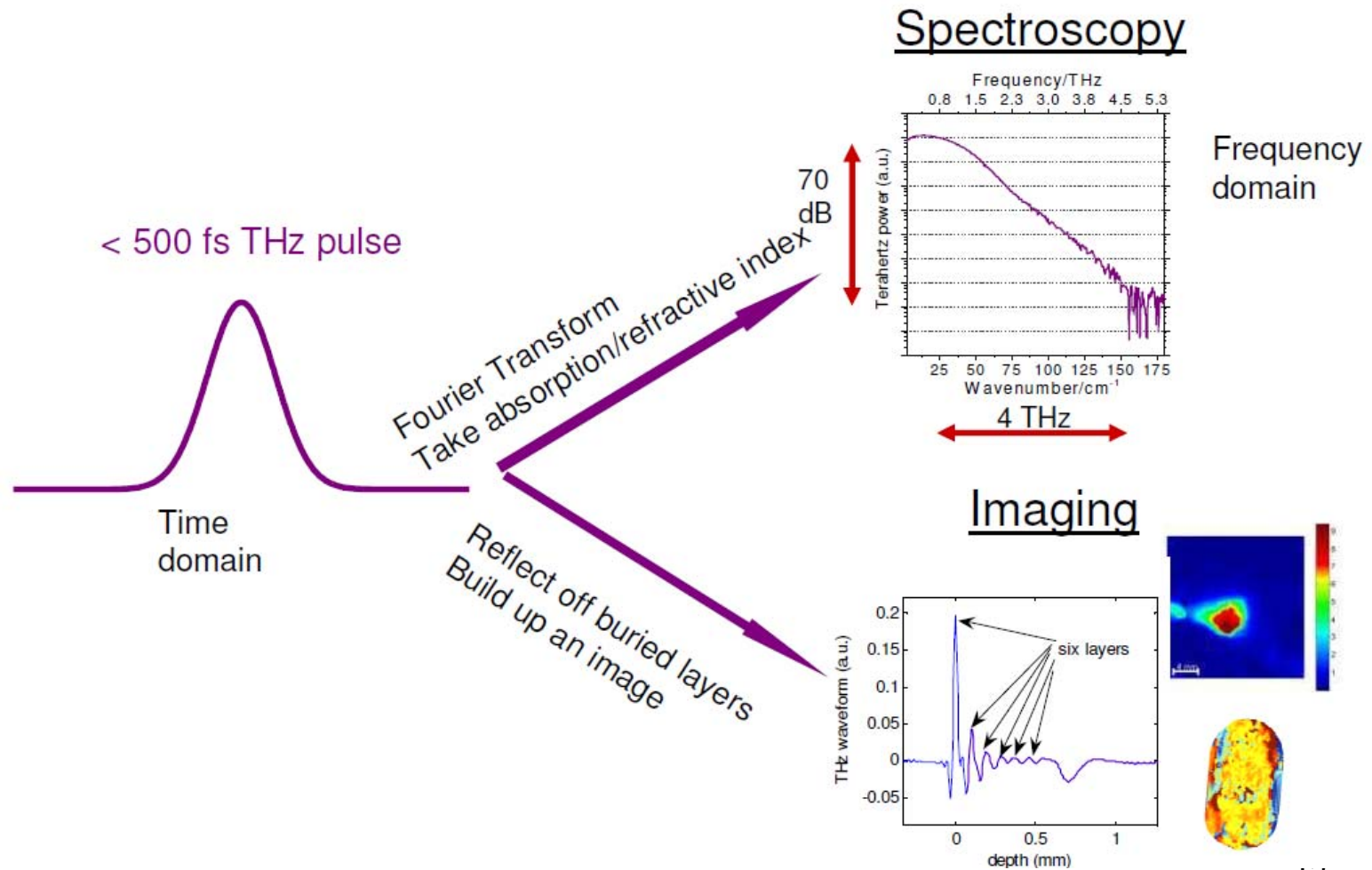
# THz-Strahlen



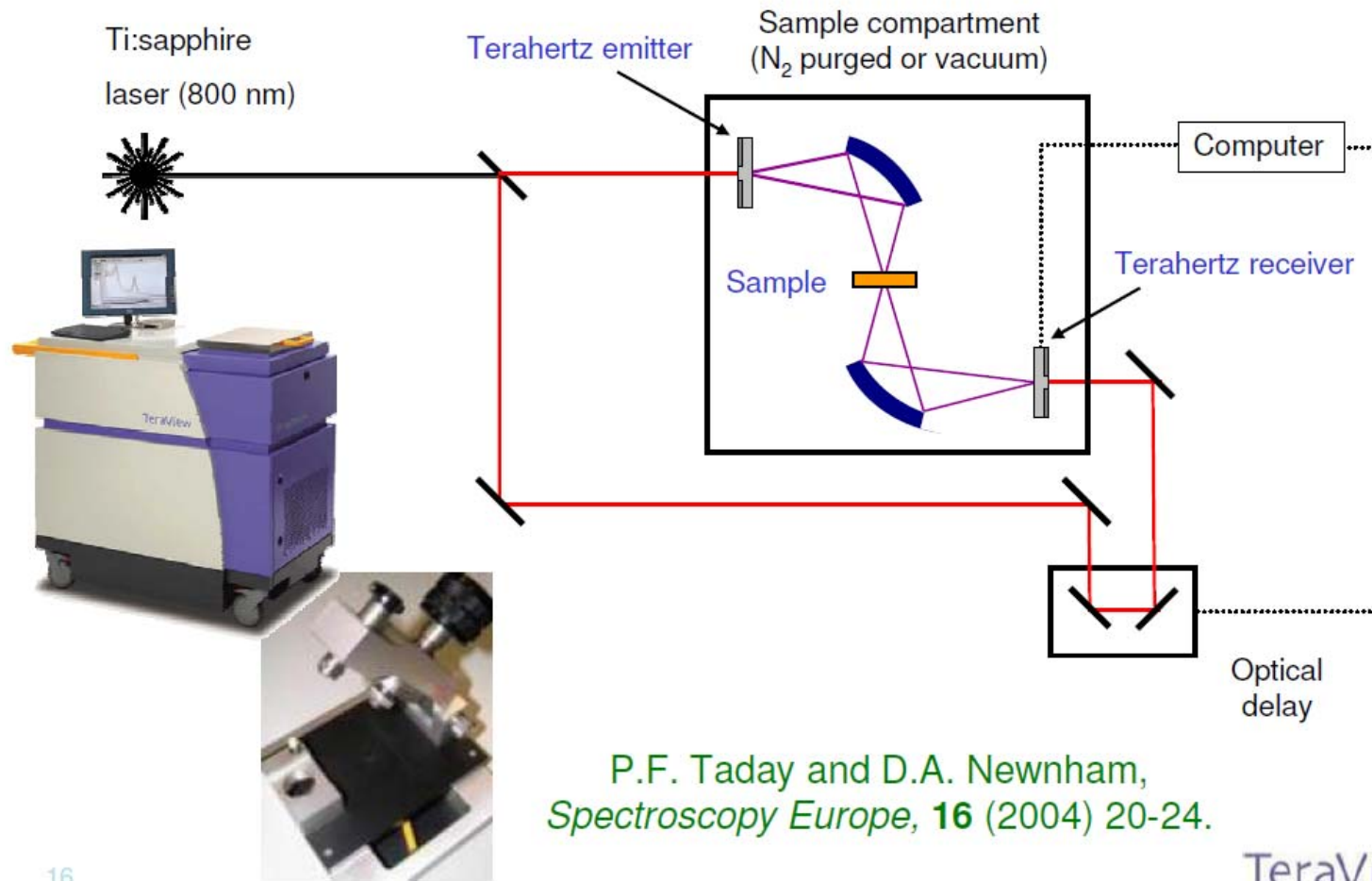
# THz-Intensität



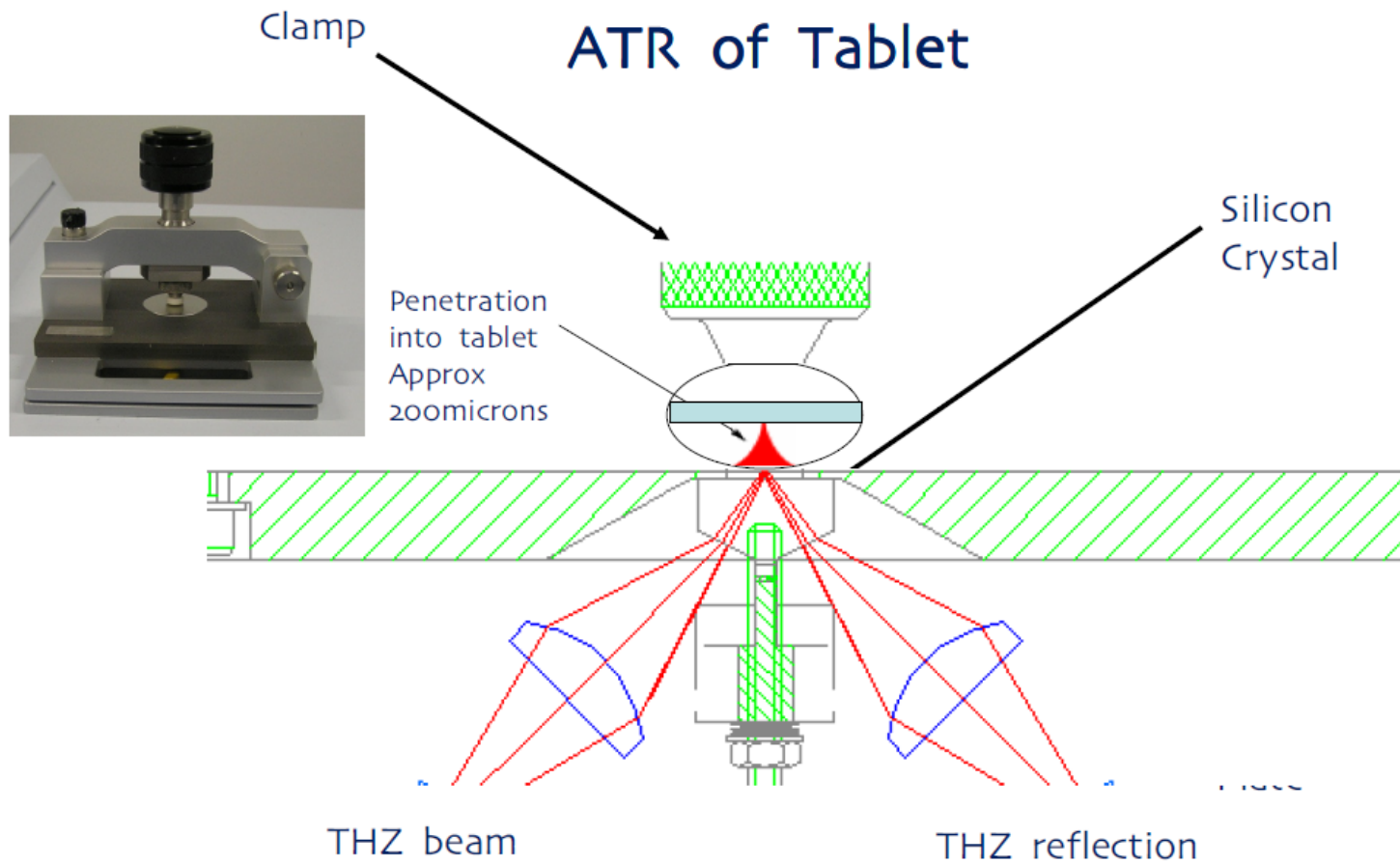
# THz: Spektroskopie und Bildgebung



# THz: TeraView

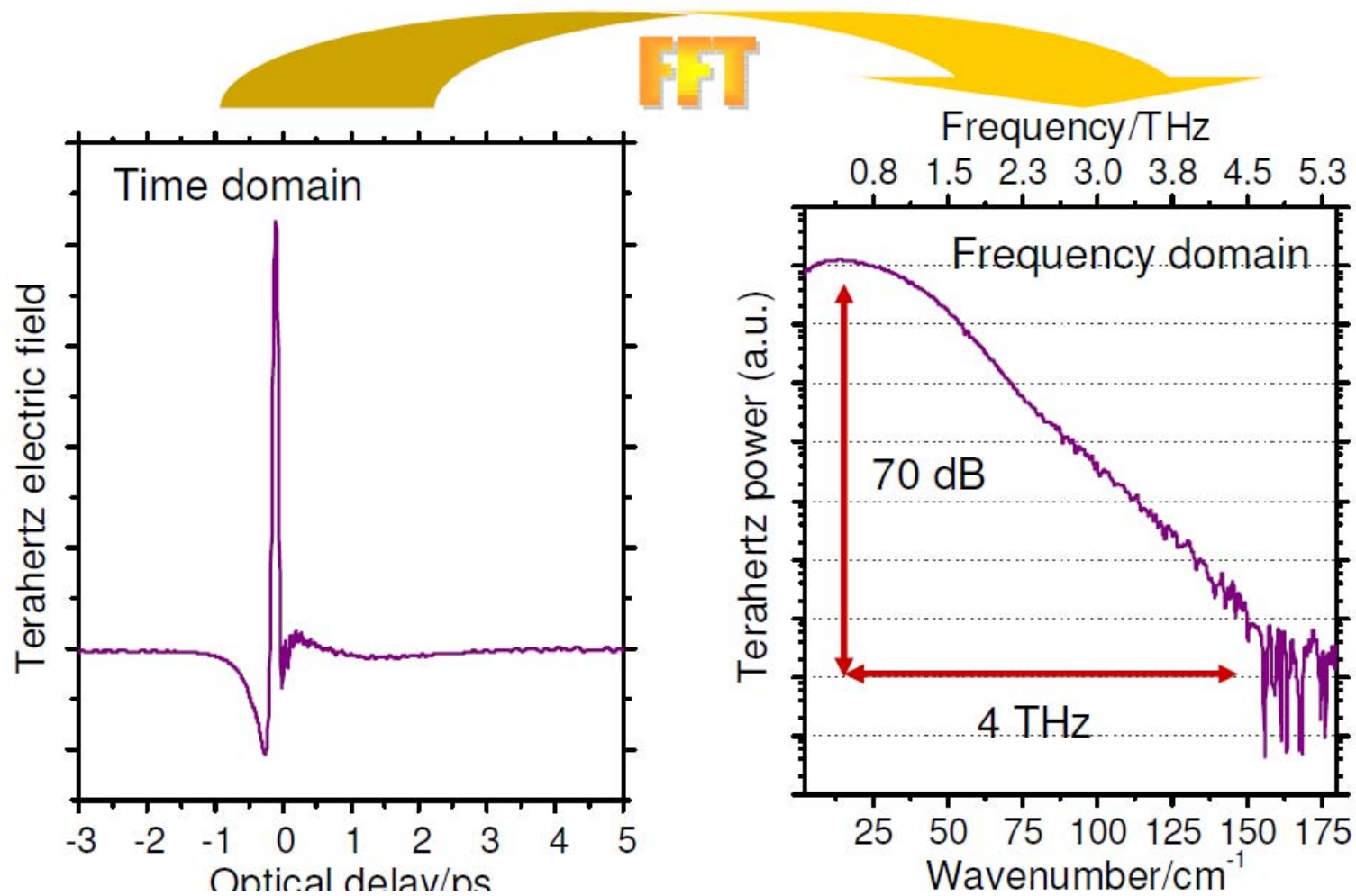


# THz: ATR

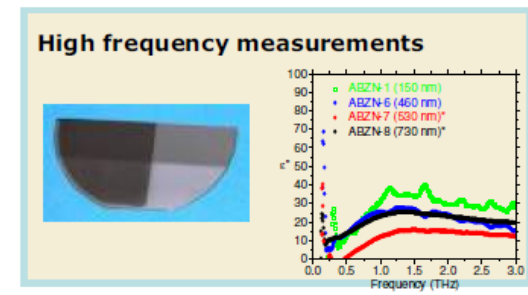
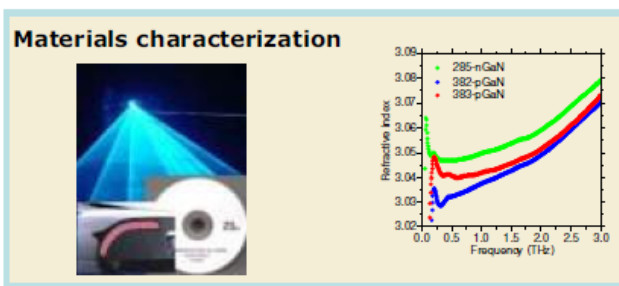
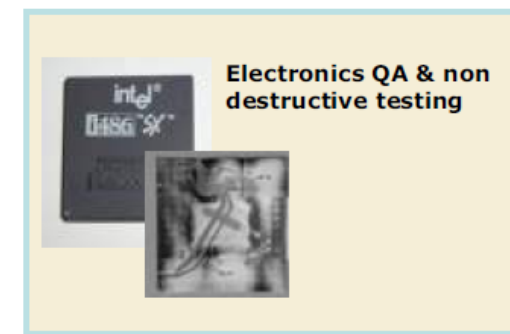
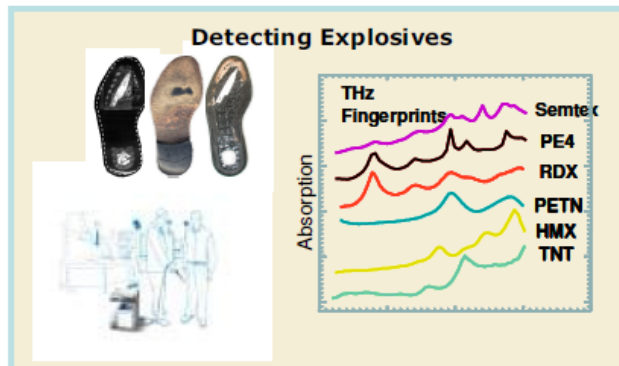
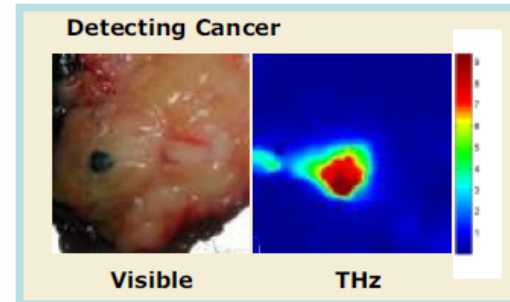
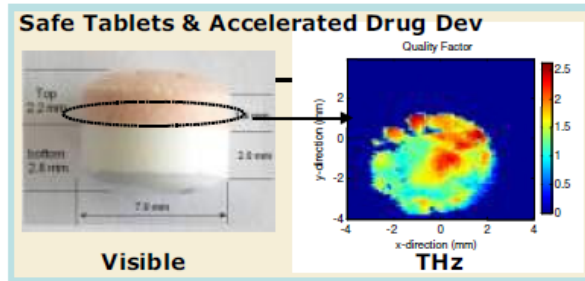


Thz depth penetration far greater than Mid IR

# THz: Von der Zeit- in die Frequenzdomäne



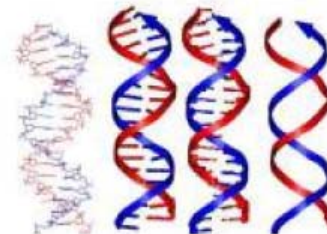
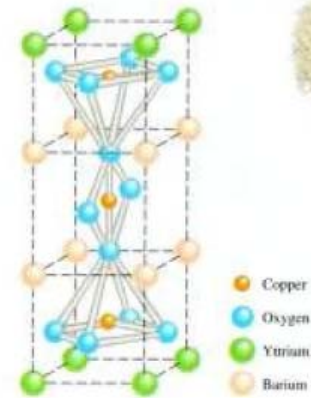
# THz-Anwendung



Ter

# THz-Anwendung

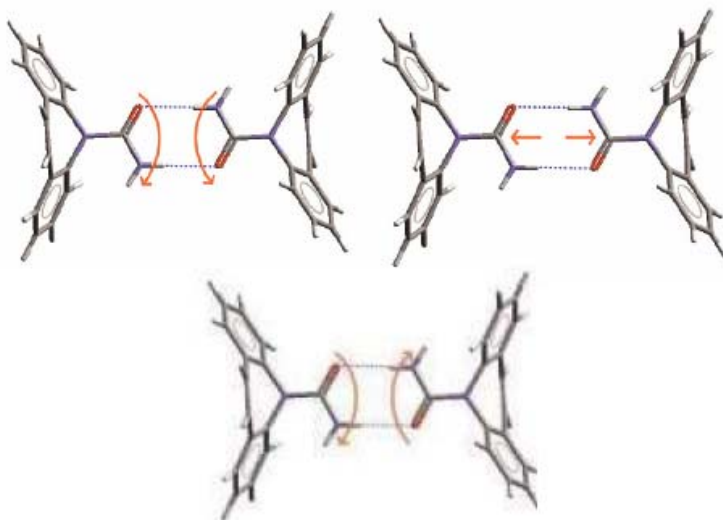
- Solid-state physics & chemistry
- Security, forensics, & defence
- Earth sciences
- Pharmaceutical
- Food science
- Biology/medical
- Gas phase and monitoring



# THz-Spektroskopie

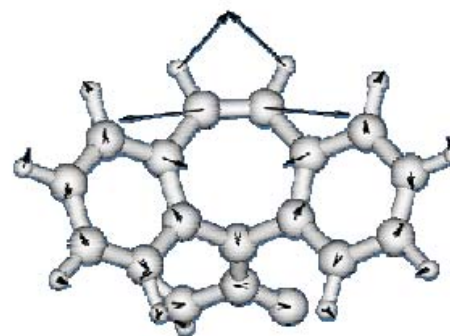
## Terahertz Spectral Region

- **Inter**molecular bond vibrations
- Directly affected by crystal changes

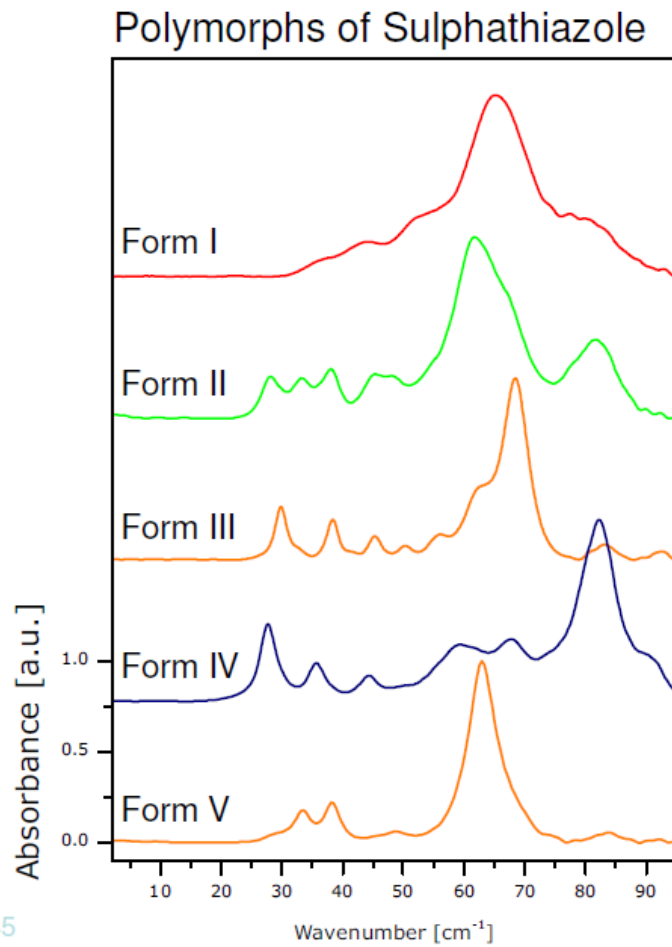


## Infrared Spectral Region

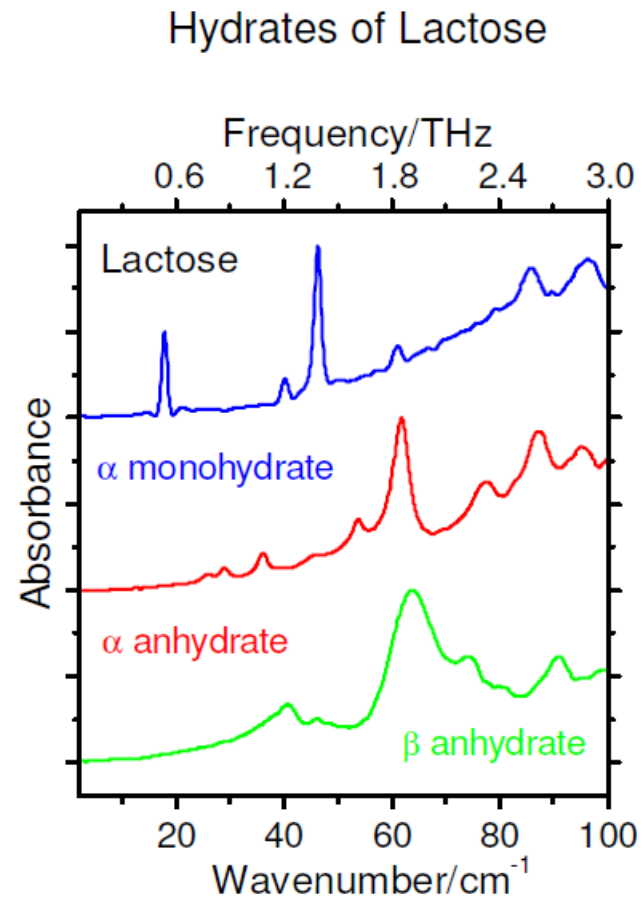
- **Intra**molecular bond vibrations
- Indirectly affected by crystal changes



# THz: Polymorphie



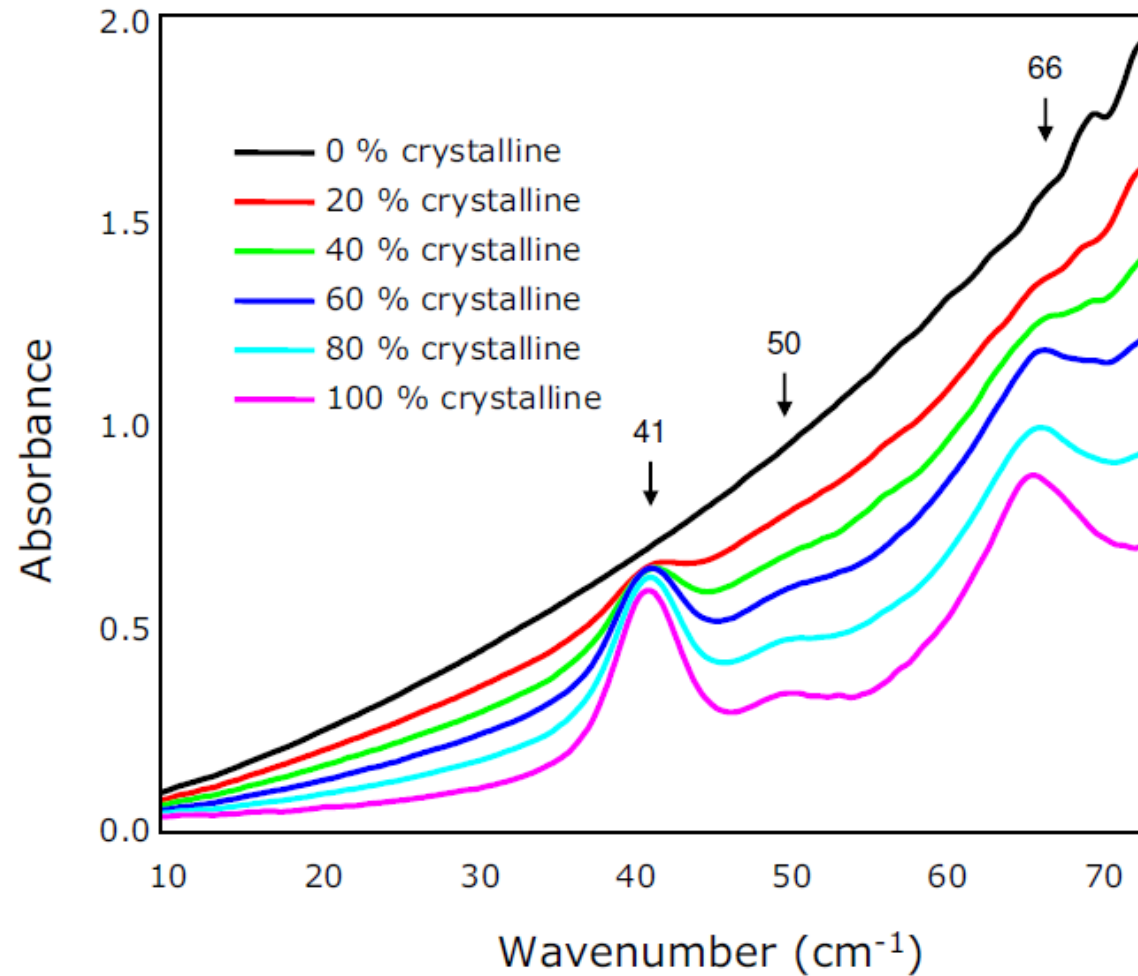
45



19

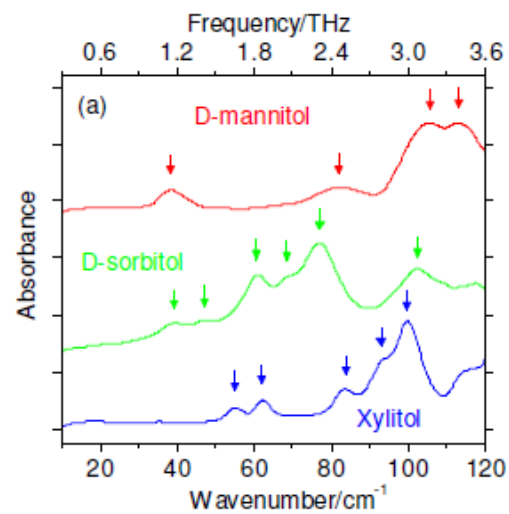
# THz: flüssig/kristallin?

Indomethacin

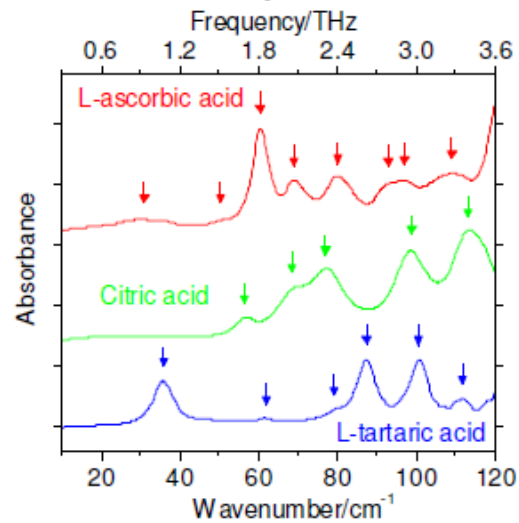


# THz: Zucker, Carboxylsäuren, Vitamine

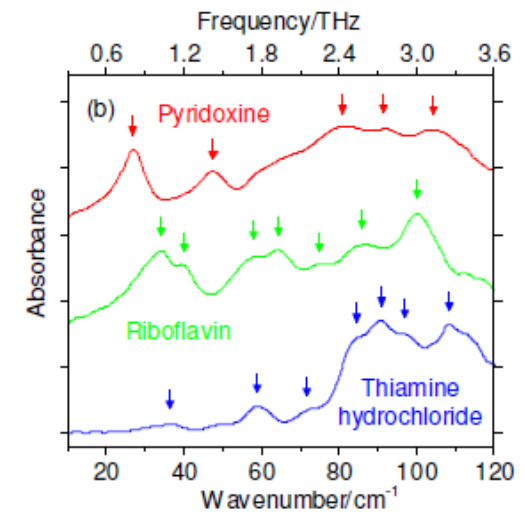
## Sugar alcohols



## Carboxylic acids

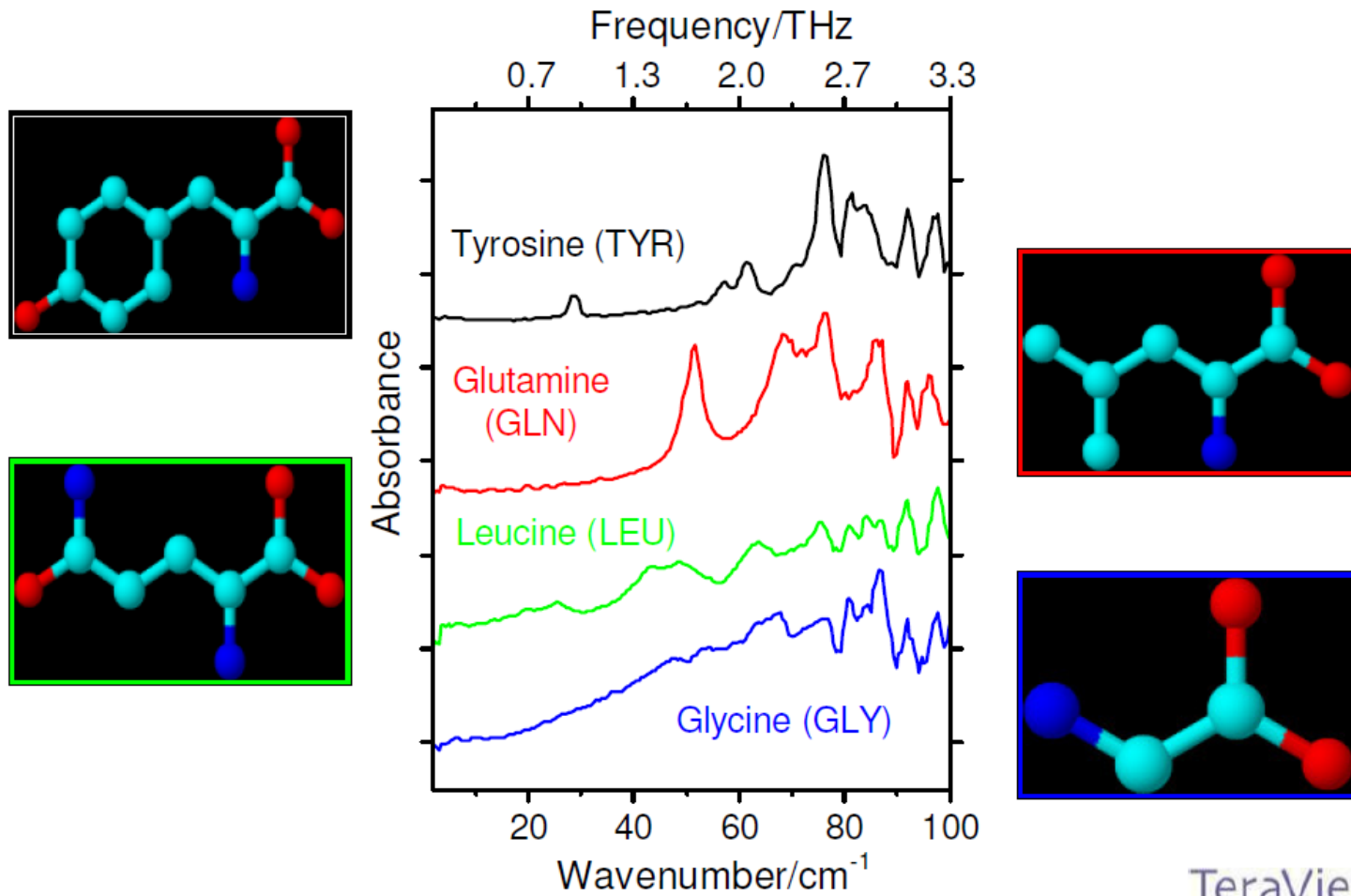


## Vitamins



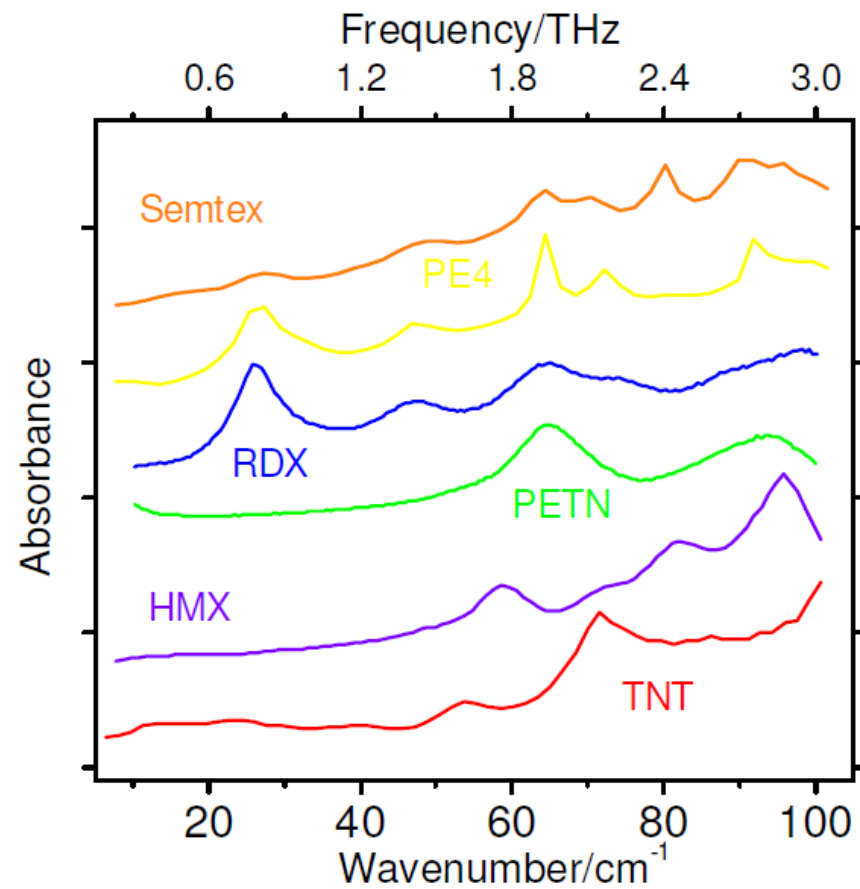
# THz: Aminosäuren

Amino acids

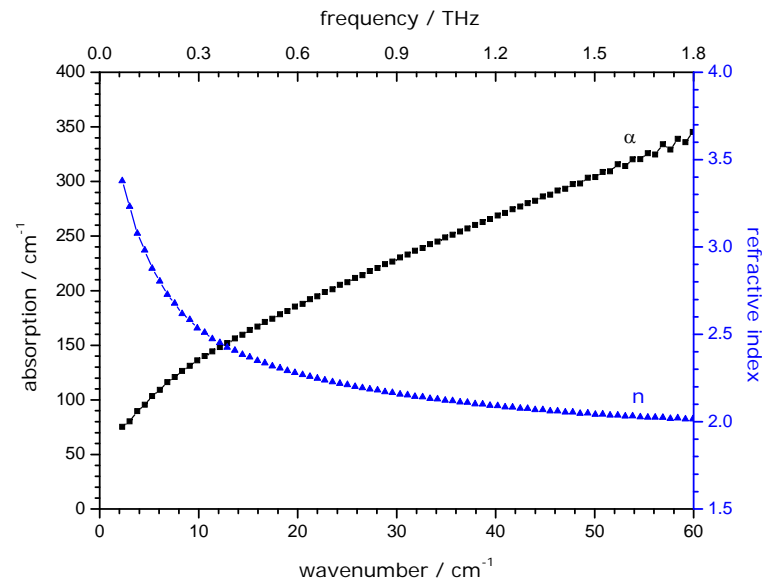


# THz: Sprengstoffe

Detecting explosives

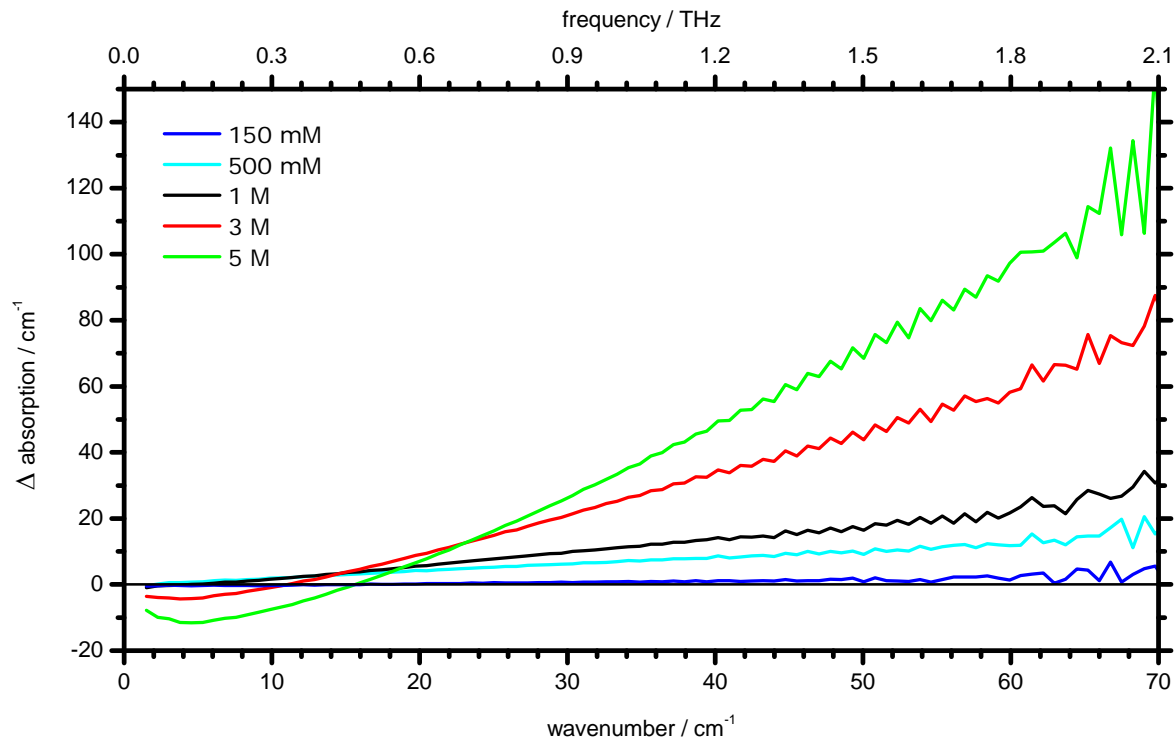


# THz: Wasser



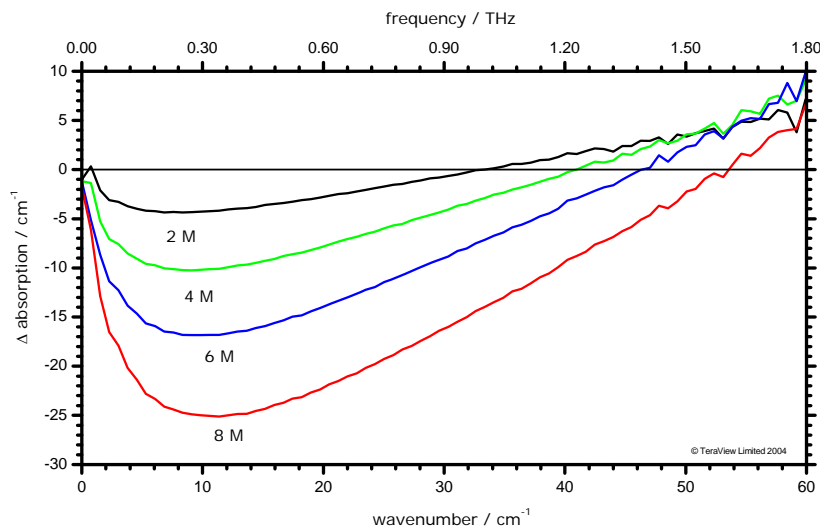
- $60 \text{ cm}^{-1}$  (1.8 THz): “rattling” motion of a single water molecule in a cage of surrounding water molecules
- $200 \text{ cm}^{-1}$  (6 THz): stretching of the water-water hydrogen bond

# THz: wässrige Salzlösungen



In solution sodium chloride and other ionic species **influence the conductivity** of the water medium, and can directly or indirectly through electronic polarisation **affect the motions and hydrogen bonding in water.**

# THz: Additive



urea

