Terahertz Absorption Spectrum of Liquid Water

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Funded by: NASA & Army Research Office (ARO)

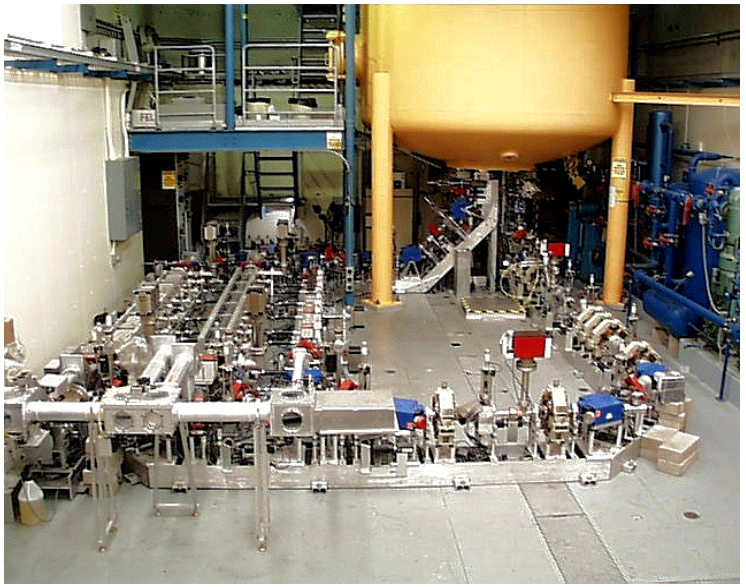
Motivation

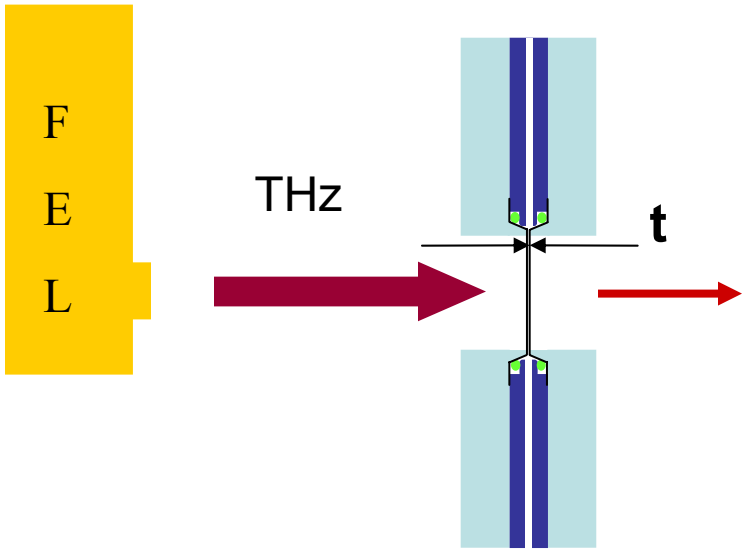
- To Study the Physical Property of Liquid Water.
- Terahertz Absorption Spectrum of Water:
  - Not Well Established
  - Few Powerful Terahertz Sources
  - Only Recent Development in Terahertz Optics

Approach

- Direct Absorption Measurement:
  - How Much Does the Media Absorb per Thickness?
  - $P^{n}_{out} \propto \exp(-t_n \alpha)$

Experimental Apparatus





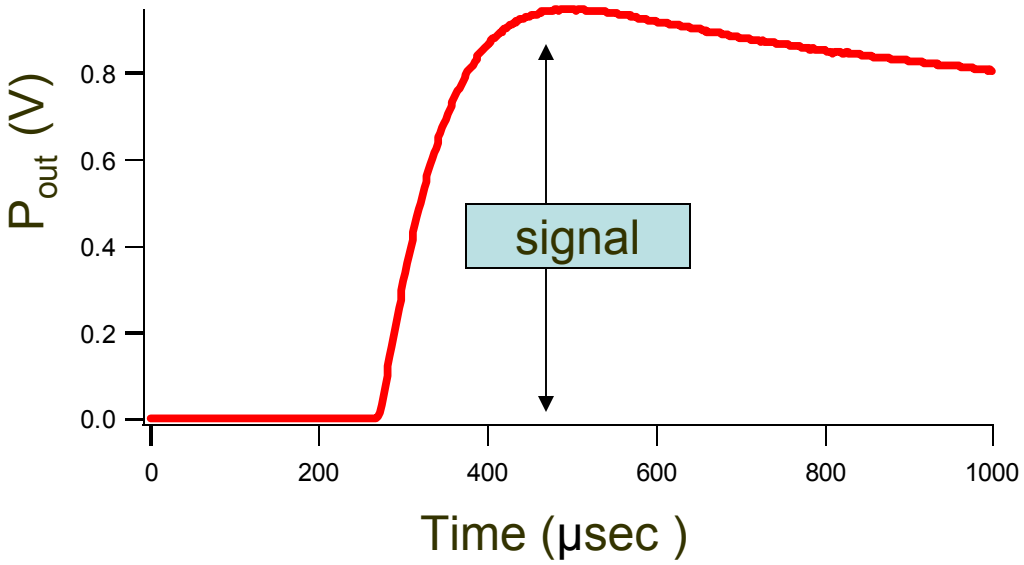
$$P_{out} \propto e^{-t\,\alpha}$$

Sample holder

t = Sample Thickness

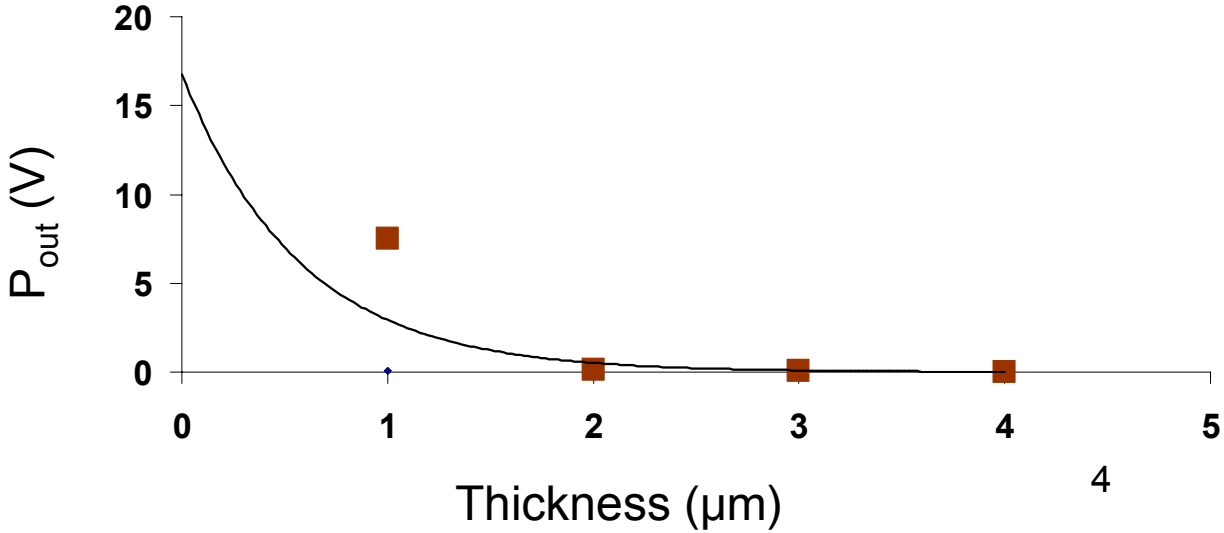
0.08 μm
0.16 μm
0.20 μm
0.24 μm

Preliminary Data



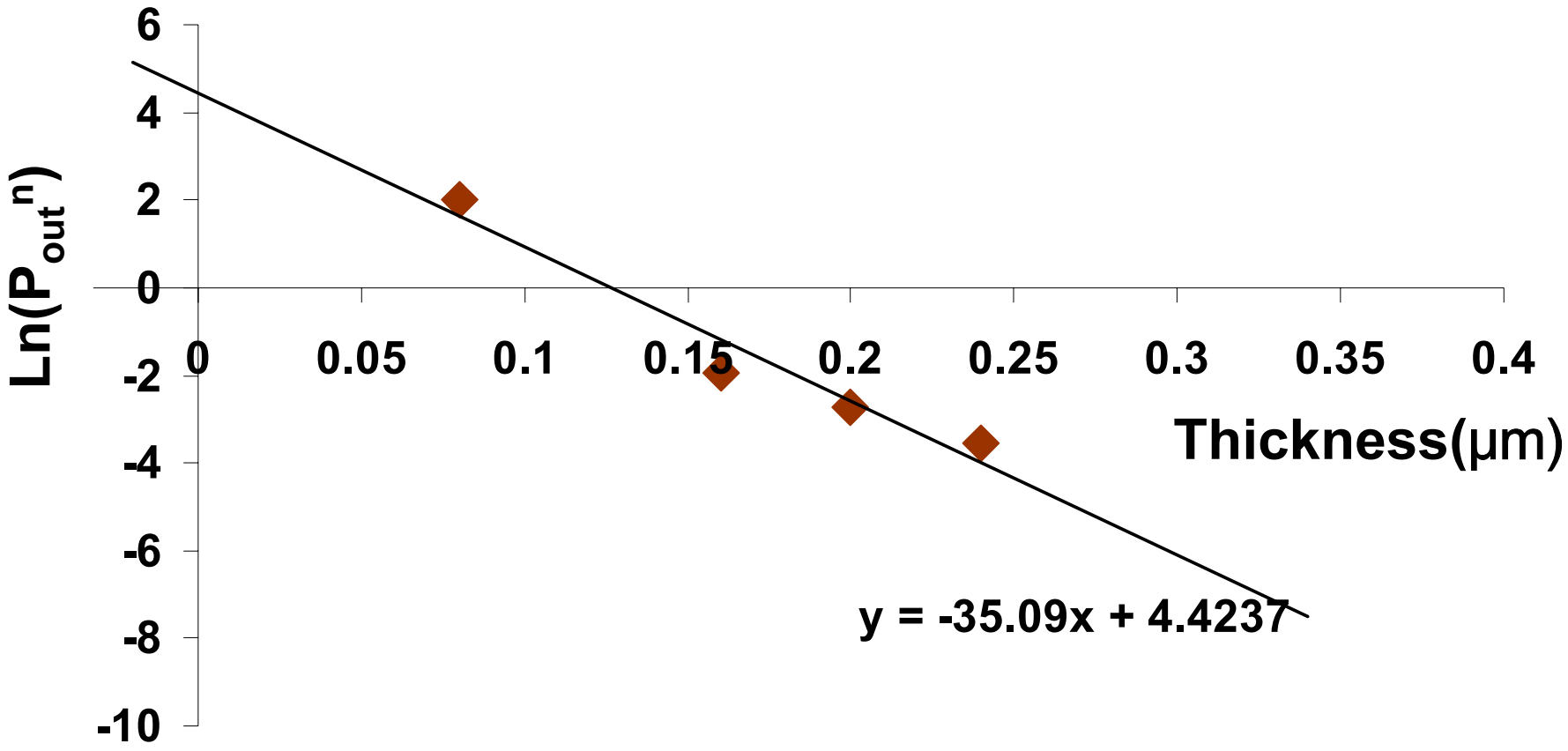
$$P_{out}^{n} \propto e^{-t_n \alpha}$$

Absorption



Absorption Coefficient

$$Ln(P_{out}^{n}) \propto -t_n\alpha$$



$\alpha = 35.09\ \mu m^{-1}$, $R^2 = 94.8\%$

Future Work

- Create A Spectrum of the Absorption Coefficients of Liquid Water in the Terahertz Range.
- Compare Data with Current Theories of Absorption Spectrum of Liquid Water.
- Measure Terahertz Absorption Spectrum of Liquid Water with Biomaterial.

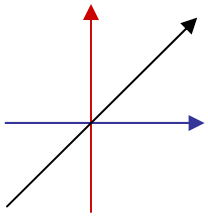
Acknowledgements

Professor Jim Allen
Jing Xu
Professor Kevin Plaxco
Mike Wrocklage
Liu-Yen Kramer
Trevor Hirst
Al Flinck
Nick Arnold
Mike Northen
Mel McLaurin
Eric Hoffmann
National Science Foundation
Army Research Office
NASA

Terahertz Circular Dichroism Spectroscopy

- Argument:
  - Well structured, chiral, stereochemically-pure *macromolecules* are a universal sign of life.
- Approach:
  - Making a spectrometer that will detect & fingerprint these *macromolecules.*
- Hopeful Conclusion:
  - Finding life. (funded by NASA)
  - Finger-printing and identifying biological polymers. (funded by the ARO)

Circular Dichroism:
Differential Measurement



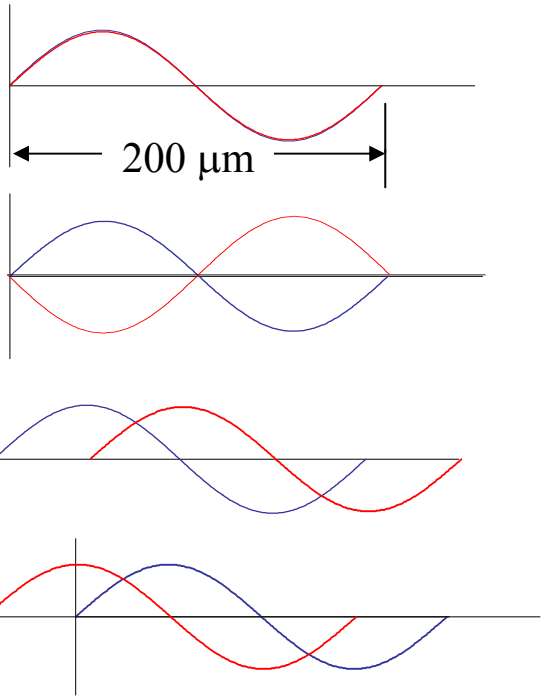
Phase Difference

0°

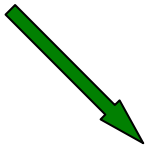
180°

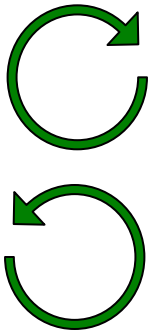
90°

-90°

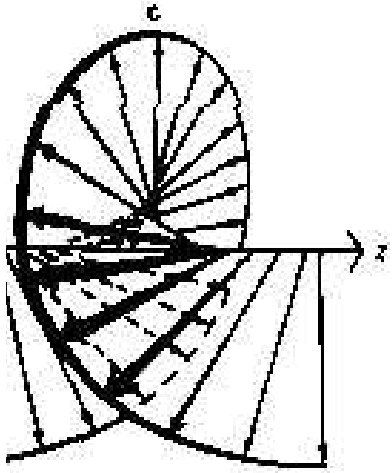


Result





Circularly Polarized Light



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8/1/2003

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