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Investigating the dielectric properties of the cornea and tympanic membrane using Synchrotron ATR and transmission at THz frequencies

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High GHz and THz frequencies are becoming important in the communication, security, and industrial fields. With the increasing use of THz technology, the skin, cornea, and tympanic membrane will be subjected to increased incidental and purposeful THz radiation. There is an urgent need to adequately characterise the way the cornea and tympanic membrane interact with THz radiation to understand potential THz exposure hazards and refine dosimetry guidelines. The understanding of the complex permittivity of the cornea and tympanic membrane at THz frequencies may lead to the development of THz-based diagnostic techniques and therapeutic techniques based on the differences of permittivity at THz between normal and pathological states.

THz is highly absorbed by liquid water. The cornea and tympanic membrane are “high bulk water content” tissues (over 70% water). We have devised innovative approaches to interrogate biological samples with attenuated total reflection (ATR) apparatus at THz frequencies at THz/far-infrared beamline in the Australian Synchrotron. One new method extends the capabilities of the ATR apparatus to a partial reflection/partial transmission mode (APR). A second method was to vary the temperature of biological tissues whilst continually scanning the sample. The combination of the methods brought a very accurate determination of the temperature-dependent variation of the refractive index. The last technique extends the useful range of the apparatus to exploring samples with refractive index beyond the maximum possible with attenuated total reflection, bringing water-based biological samples within the capacity of the diamond crystal ATR at the Australian Synchrotron.

Level of Expertise

Student

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

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