**THz-wave scattering in optically inhomogeneous biological tissues: Theoretical and experimental studies**

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Terahertz (THz) technology went through the rapid development during the past few decades. Nowadays, THz waves find many applications in different branches of biophotonics and medicine. But majority of biomedical applications assume tissues to be optically isotropic and homogeneous at the THz-wavelength scale and the THz response of tissues is usually described using the effective medium theory (EMT) formalism. Meanwhile, recent development in high-resolution THz technology allowed to visualize wavelength-scale heterogeneity of different types of biological tissues, which can lead to the Mie scattering. Such achievements pushed further research into realms of studying the THz- wave transport in turbid soft tissues.

To mitigate this challenge, а phantom with spherical single non-absorbing scatterers with a diameter of 10-100 𝜇m, embedded in fiber highly-absorbing hydrated matrix was developed. Analytical methods of the Lorenz–Mie scattering theory predicted non-Rayleigh scattering regime and doubts the EMT applicability for such tissues. But we found theoretically and confirmed experimentally that the effective optical properties of the proposed phantom are still determined by EMT over wide ranges of scatterers’ diameters (d ≤ 0.47λ) and volume fractions (fv ≤ 0.2).

The next point of our research was a system of cylindrical non-absorbing scatterers, also embedded in hydrated matrix, an example of which could be muscle or nerve fibers. Unlike the case of spherical scatterers, the experimental data do not agree well with the Bruggeman model.

Thereby, our research allows us to establish the limits of applicability of EMT and propose an alternative way to describe radiative transfer in such systems.