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Collective hydration dynamics in some amino acid solutions: A combined GHz-THz spectroscopic study

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A detailed understanding of hydration of amino acids, the building units of protein, is a key step to realize the overall solvation processes in proteins. In the present contribution we have made a combined GHz (0.2-50) to THz (0.3-2.0) experimental spectroscopic study to investigate the dynamics of water at room temperature in presence of different amino acids (Glycine, L-Serine, L-Lysine, L-Tryptophan, L-Arginine and L-Aspartic acid). The THz absorption coefficient, $\alpha(\nu)$ of amino acids follows a trend defined by their solvent accessible surface area (SASA). The imaginary and real dielectric constants obtained in GHz and THz regions are fitted into multiple Debye model to obtain various relaxation times. The ~ 100 ps time scale obtained in the GHz frequency region is attributed to the rotational motion of the amino acids. In the THz region we obtain ~ 8 ps and ~ 200 fs time scales which are related to the cooperative dynamics of H-bond network and partial rotation or sudden jump of the under-coordinated water molecules. These timescales are found to be dependent on the amino acid type and the cooperative motion is found to be dependent on both the hydrophobic as well as the hydrophilic residue of amino acids.

Biography

Nirnay Samanta is a Senior Research Fellow (PhD scholar) in Physical Chemistry under the supervision of Dr. Rajib Kumar Mitra in S.N. Bose National Centre for Basic Sciences, India. He is working on biophysical Chemistry and uses THz spectroscopy, GHz spectroscopy, steady state as well as time resolved fluorescence spectroscopy etc. He has published 8 papers in reputed journals.

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