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Biological research with new THz sources

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Far infrared or THz spectroscopy is a useful tool for probing the low frequency (picosecond) collective fluctuations in biological systems. If one considers that a chemical reaction in a cell takes place on a time scale of several hundred femtoseconds to a few picoseconds, it becomes clear that an understanding of the motion and relaxation mechanisms of the various biological molecules in the cellular matrix on a similar time scale (corresponding to a frequency range of $\sim$ 1- 200 cm^{-1}) is essential in fully comprehending the underlying mechanisms defining cellular activity. Results from recent theoretical studies have indicated that fast, delocalized fluctuations in biological molecules play an important role in the recognition mechanism important in the initiation of many biochemical processes and also have a strong influence on the rate at which the reaction, once initiated, proceeds. New high power THz sources are now capable of experimentally probing these fast fluctuations in biomolecules under a wide range of "life like" conditions further elucidating their role in biochemical processes. In this talk I will focus on the results of recent THz spectroscopy experiments on nucleic acid and protein systems and discuss how developing an understanding about the collective fluctuations detected in their respective spectra provides new insight into the intermediate conformational states that these molecules undergo during the course of a biochemical reaction.