Time-resolved infrared spectroscopy with tunable Quantum Cascade Lasers

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Time-resolved Step-Scan FTIR difference absorption spectroscopy is a commonly used technique for determining time-resolved information of light sensitive proteins, undergoing a periodic photocycle. However, to obtain spectral and kinetic information on just a narrow wavenumber range, e.g. the structure sensitive amide I region, a complete FTIR experiment has to be performed. On fast cyclic proteins as bacteriorhodopsin an experiment can require several hours to achieve satisfactory SNR levels. For slow cyclic proteins this is therefore too time-consuming. This problem is aggravated if higher wavenumber resolution is required, further increasing the experimental time.
Here a direct pump-probe measurement approach for measuring kinetics of absorption changes has been designed, using tunable Quantum Cascade Lasers. The developed system provides increased overall recording speed, an outstanding SNR level even with only a few repetitions and higher time- and wavenumber resolution compared with time-resolved Step-Scan FTIR.