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Seminar über Ultrafast Science and Technology

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Titel: THz Stark Spectroscopy

Stark spectroscopy has been an invaluable tool to reveal information about the physicochemical properties of a molecule, specifically its dielectric properties or charge redistribution [1]. Typically, two molecular properties dominate Stark spectra, i.e. a dipole moment change or a difference in polarizability between ground and excited state. An analysis of the Stark effect leads to a deeper understanding of photo-induced electron and charge transfer, biological organization and energy tuning, and design of nonlinear material properties [2-3]. However, a successful measurement in a conventional system, which employs a low frequency alternating current (AC) voltage source, is subject to some preconditions such as limited sample thickness, limited E-field strength, geometric constraints, and freezing issues. To overcome such limitations, we demonstrate terahertz (THz) Stark spectroscopy. Using intense single cycle THz pulses as the electric field source and monitoring transient spectral responses with a coincident fs-supercontinuum (SC) pulse offers advantages over traditional Stark spectroscopy and opens previously inaccessible perspectives. 1) THz pulses, with their picosecond transients, oscillate faster than typical solvent responses and consequently eliminate the requirement to freeze the samples to prevent poling effects. 2) THz frequencies allow for peak fields much beyond the dielectric breakdown limit in conventional low frequency experiments. 3) All-optical approaches eliminate the geometric issues of applying E-fields to different sample thicknesses in arbitrary polarization directions. Thus, we can now conduct time-resolved studies at room temperature and at ambient conditions more relevant to physiological or operative conditions.

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