Multidimensional IR Spectroscopy: Chemistry and Biophysics in Real Time

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The emerging technique of multidimensional IR spectroscopy employs a sequence of ultrafast infrared laser pulses to measure couplings and correlations of molecular vibrations. Similar as in 2D-NMR spectroscopy, cross-peaks between coupled transitions are found also in 2D-IR spectra. Information on molecular structure and dynamics can be obtained in real-time on the femtosecond to millisecond timescale. At the same time, a wide variety of samples from molecular monolayers to bulk solutions can be addressed. I will discuss the information content of various 2D-IR experiments comprising ultrafast measurement of structure parameters, chemical exchange processes, vibrational energy transfer, protein ligand interaction, ligand migration and conformational dynamics in proteins.