No.9

エクストリームフォトニクスセミナー
Extreme Photonics Seminar

Language: Japanese

日時: 平成21年 11月 11日(水)
15:00 ～ 17:00, November 11 (Wed), 2009

場所: 研究交流棟5階会議室 W524
Cooperation Center, 5F Meeting Room, W524

題目: Coherent molecular dynamics induced by nonresonant intense short laser pulse

"非共鳴高強度超短パルス光誘起のコヒーレント分子ダイナミクス"

講師: 長谷川 宗良 氏 （分子科学研究所 ）
Dr. Hirokazu HASEGAWA (Institute for Molecular Science (IMS))

要旨: The rotational excitation known as molecular alignment has been widely studied in time domain. On the other hand, the excitation process can be directly revealed in frequency domain. We've investigated molecular dynamics in the electronic ground state induced by nonresonant intense short laser pulse in frequency domain using high-resolution ns laser system. In addition to rotational motion, we've succeeded in an observation of vibrational excitation. In this seminar, we talk about these molecular rotational and vibrational dynamics in the electronic ground state.

題目: Observation and control of molecular vibrational dynamics by use of mid-infrared pulses

"中赤外超短パルスによる分子振動ダイナミクスの追跡と制御"

講師: 芦原 聡 氏 （東京農工大学 ）
Prof. Satoshi ASHIHARA (Tokyo University of Agriculture and Technology)

要旨: The short pulses in the mid-infrared range are useful in unraveling the dynamics that molecular structure, vibrational state, and local environments evolve. We applied nonlinear vibrational spectroscopy with femtosecond time resolution to the study on vibrational relaxation in liquid water. Using both inter- and intramolecular vibrations as structural probes, we revealed the energy relaxations with a time scale of ~200 fs for intra-molecular vibrational modes and <100 fs for inter-molecular modes. In perspective of the liquid structure, a two-stage structural response of hydrogen-bonded network happens upon energy disposal: vibrational energy from individually excited water molecules is transferred to intermolecular modes, resulting in a sub-100 fs nuclear rearrangement. Subsequent energy delocalization over many molecules occurs on an ~1 ps time scale. The scenario should be relevant for local energy disposal during and after chemical reactions and in aqueous environments.

Mid-infrared pulses also provide key tools in controlling the molecular dynamics. The selective infrared excitation can lead to highly excited vibrational levels, which may lead to the dissociation, the isomerization, the exchange of the hydrogen bonds, the proton transfer, etc. Toward such quantum control at the electronic ground state, we have constructed the mid-infrared pulse shaper based on an acousto-optic modulator. Up to now, the amplitude- and phase-modulation have been achieved with a spectral resolution of ~5 cm-1. The possible quantum control schemes will be discussed in the talk.

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