

エクストリームフォトンクスセミナー *Extreme Photonics Seminar*

No. 4

Language: Japanese

Date: July 12th(Mon), 2010, 10:00 ~ 12:00

Location: Cooperation Center, 5F Meeting Room, W524

Title: Molecular dynamics in aqueous solution studied by ultrafast laser spectroscopy

Speaker: Professor Keisuke Tominaga
(Molecular Photoscience Research Center, Kobe Univ.)

Liquid water forms three-dimensional hydrogen bonding network, which continuously repeats formation and breaking of the hydrogen bonds as well as structural fluctuation of the network. Since the hydrogen bond is relatively large intermolecular interaction, such a fluctuation of the network causes large changes in the vibrational and electronic states of a solute molecule. In this work we obtained time-correlation function (TCF) of frequency fluctuation of both the vibrational and electronic states to compare them with theoretical predictions estimated from the dielectric relaxation data. We especially focus on temperature dependence and isotope effect on both the frequency fluctuations. As for the electronic state, we performed dynamic fluorescence Stokes shift experiment using an ionic coumarin dye molecule as a probe. The vibrational frequency fluctuations were studied by three-pulse IR photon echo technique. It is found that both TCF of the frequency fluctuations can be expressed in terms of a multi-exponential function and have a picosecond component. However, the temperature dependence and isotope effect of both the frequency fluctuations are quite different. The electronic frequency fluctuation can be well modeled by dielectric theories with results obtained recently by terahertz time-domain spectroscopy, whereas the vibrational frequency is dominated from the solvent molecules in the vicinity of the solute molecule.

Title: Recent study on soft X-ray laser excited by Z-pinch discharge at Tokyo Institute of Technology

Speaker: Dr. Yusuke Sakai
(Tokyo Institute of Technology)

A capillary Z-pinch discharge soft X-ray laser (SXRL) is a promising scheme with its long plasma column of about a few 10s cm in which the radiation is efficiently amplified. The lasing of Ne-like Ar SXRL at wavelength of 46.9 nm has been observed as a spike in X-ray photo diode signals, which occurred supposedly in an implosion phase with concave electron density profiles, by using a discharge current of about 10 kA. And, its high coherence has been shown by the interference fringes obtained in double slits experiment. In addition, it is considered that lasing of a H-like N Balmer α SXRL at an wavelength of 13.4 nm may be possible by utilizing an expansion phase. To realize the recombination SXRL, strong ionization to NVIII state with electron temperature of $T_e \approx 200$ eV and electron number density of $n_e \approx 1 \times 10^{20} \text{ cm}^{-3}$ at the maximum pinch, and following rapid recombination caused by expansion cooling of the non-equilibrium plasma resulted in temperature below $T_e \approx 50$ eV and $n_e \approx 10^{19} \text{ cm}^{-3}$ in about 10 ns are required. Utilizing a triangular current with peak amplitude of about 50 kA and a pulse width of about 50 ns, dynamics of ionizing non-equilibrium Z-pinch and characteristics of spectrum emitted from H-like N plasma will be discussed.