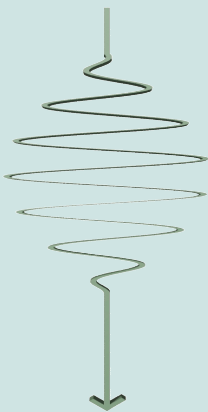


September 2nd, 2010 - 11:00 am

Seminar Room 108, DESY Bldg. 49



Max Planck
Research
Department
for
Structural
Dynamics



SEMINAR

Mukesh Jewariya

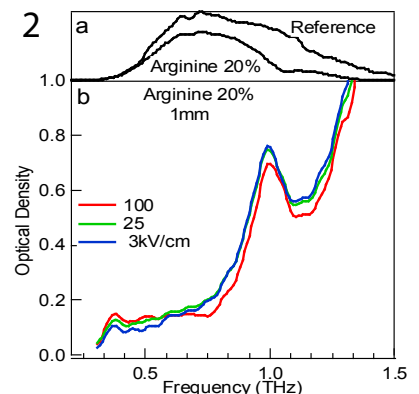
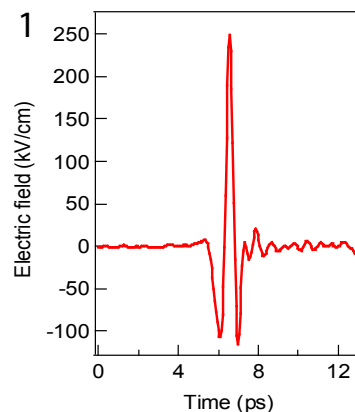
Solid State Spectroscopy Group, Dep. of Physics, Kyoto Univ., JAPAN

Resonant Excitation of Large Amplitude Anharmonic Vibrations of Amino acids Micro Crystals by an Intense Monocycle Terahertz Pulse

We succeed in the generation of THz pulse with maximum electric field of 250 kV/cm via non-collinear process in LiNbO_3 . We optimize the generation process and discuss the mechanism of High power THz generation. Using this source we drive large-amplitude motions in L-arginine micro crystals. Absorption spectra show the suppression of peaks and enhancement of low frequency absorption. These results are reproduced by simulation based on coherent transition in quantum levels of anharmonic potential and show 20 steps ladder climbing. © 2010 Department of Physics, Kyoto University

Ultrashort pulse excitations for molecules and solids have been attracting us in view-point of novel efficiency control of material properties. Xie et al performed THz pump-probe measurement in bacteriorhodopsin using free electron laser and nonlinear signal related to conformational transition has been reported for the first time [1]. Even in ferroelectric materials, new domain orientation control with THz pulse has been proposed [2]. However, nonlinearity of bosonic vibrations mode is intrinsically less apparent which gives rise to difficulty in the observation of nonlinear optical response. So a high power THz pulse is required.

Figure 1 shows the temporal profile of emitted THz electric field from LiNbO_3 with a maximum electric field of 250 kV/cm. Figure 2a shows the power spectra of the averaged incident THz pulses that passed with/without the sample. Figure 2b shows the optical density spectra using intense monocycle THz pulse at different amplitudes of incident electric field. With increasing incident electric field amplitude, absorption peak becomes gradually reduced and, alternatively, optical density below 0.4 THz is increases. We expected that the large amplitude intermolecular vibration coherently driven by intense THz pulse brings in nonlinearity. These spectral changes can be easily simulated with assumption of coherent transit processes in several quantum levels in anharmonic potential [4]. The appearance of such nonlinearity will open new techniques of multi-dimensional spectroscopy and material control. We also measured the sucrose and structural change in sucrose crystal was observed.



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- [3] M. Jewariya, M. Nagai, and K. Tanaka, J. Opt. Soc. Am. B 26, A101 (2009)
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Host: Andrea Cavalleri, MPSPD