

SEMINAIRE ISMO

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Dynamical aspect of molecular spectroscopy

Interaction of molecules with XUV and X-ray radiation is of fundamental interest in physics, chemistry and biology. Significant progress in molecular spectroscopy has been achieved due to development of various types of experimental techniques, such as ion yield spectroscopy, resonant photoemission spectroscopy and momentum imaging. A further insight into the interaction of molecules with external radiation can be obtained considering the dynamical aspect of molecular spectroscopy.

In the first part of my talk I will present the results of our experiment on Resonant Inelastic X-ray Scattering (RIXS) in gas-phase iodomethane (CH_3I) performed at ID26 beam line at ESRF. We show that RIXS spectral features such as dispersion and widths of inelastic emission lines carry information on nuclear dynamics in a molecule upon core-hole excitation. The time scale of this nuclear dynamics is determined by a scattering time having a maximum value on top of the absorption resonance, corresponding to the natural lifetime of the core hole. In the case of CH_3I molecule the natural lifetime of ~ 200 asec for Iodine L-shell core hole sets a serious limitation to the occurrence of nuclear dynamics. Nevertheless, a slight deviation of RIXS spectral features around the absorption resonance observed in CH_3I demonstrates a great sensitivity of RIXS spectroscopy to nuclear rearrangement in a molecule, stretching into sub-femtosecond time scale.

The second part of the talk will be devoted to the experiments aiming at the molecular frame measurements. I will present experiments on field-free molecular alignment performed at the free electron laser in Hamburg FLASH. The impulsive alignment induced by a femtosecond near-infrared laser pulse in a sample of CO_2 is probed by ionizing and dissociating the molecules with a time-delayed XUV-FEL pulse. The time-dependent angular distributions of ionic fragments measured by a velocity map imaging spectrometer exhibit rapid changes associated with the induced rotational dynamics

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Mardi 5 octobre à 11 h 00
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