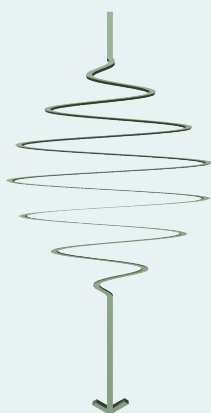


February 4<sup>th</sup>, 2013 - 14:00 pm

Seminar Room V, CFEL (Bldg. 99, 01.109)



Max Planck  
Research  
Department  
for  
Structural  
Dynamics



SEMINAR

**Tobia Nova**

Politecnico Milano

## Correlated multi-electron effects in molecules investigated by attosecond pulses

Electron-electron interactions are responsible for many natural phenomena. Autoionization, ultrafast charge transfer in complex molecules and superconductivity are only few examples. Time dependent studies of these phenomena can bring new insight into the behavior of correlated systems with consequences both theoretical and technological.

In particular, the theoretical and experimental study of the autoionization phenomenon allows to obtain important information about the time evolution of electron correlations in simple systems like atoms and molecules.

The talk presents the theoretical study of the electron dynamics in the dissociating molecule  $H_2^+$  (created by the photoionization due to a single attosecond pulse of a hydrogen molecule). The numerical solution of the time-dependent Schrödinger equation is performed to predict the kinetic energy of the ion fragments produced by the dissociation.

Moreover it is shown how the localization of the remaining electron in the dissociating molecule can be controlled by means of a few-cycle CEP-stable infrared pulse.

In both cases the simulations were performed both with and without considering the autoionizing levels of the molecule to highlight their effect on the electron dynamics. A comparison with experimental results taken from the literature is provided.

In the talk are also presented the results of the experimental study of the ultra-fast dynamics of autoionizing states in nitrogen molecules. Trains of attosecond extreme-ultraviolet pulses combined with femtosecond CEP-stable infrared pulses were used to perform attosecond transient absorption experiments. The coupling of the autoionizing levels of the molecule with below-threshold levels via two-photon transitions was observed.



Host: Andrea Cavalleri, MPD-CMD CFEL