Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

February 26th 2014 – 15:00
CFEL Seminar room IV, 01.111 (Bldg. 99)

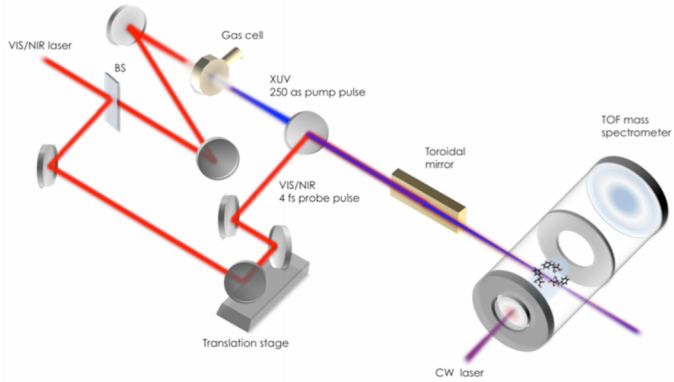
Francesca Calegari

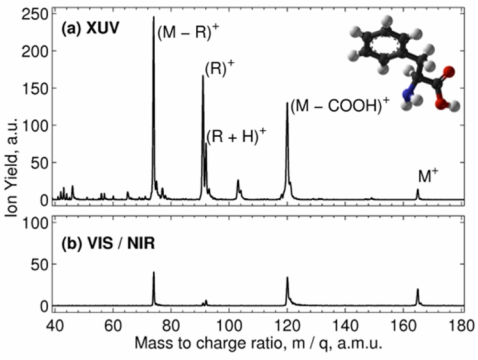
Institute for Photonics and Nanotechnologies, IFN-CNR, Milano, Italy

Ultrafast electron dynamics in amino-acids induced by XUV attosecond pulses

Electron transfer within a single molecule is the fundamental step of many biological processes and chemical reactions. It plays a crucial role in catalysis, DNA damage, photosynthesis and photovoltaics. The investigation of this process has been the subject of considerable research effort [1]. Electron transfer driven by solely electronic correlations is well known as “charge migration” and it occurs in a few femtoseconds. In this talk I will present the first measurement of ultrafast charge migration occurring in an amino acid using XUV attosecond pulses. Neutral molecules were produced in gas phase by heating a thin metallic foil with a CW laser. Phenylalanine molecules were irradiated by a 250-as pump pulse with photon energy in the range 16-35 eV, followed by a 4-fs VIS/NIR probe pulse. The produced parent and fragment ions were then extracted into a linear TOF device for mass analysis.

Pump-probe measurements evidenced an exponential decay of the yield of the doubly charged immonium ion with a time constant of 30 fs. This ultrashort time constant suggests that the dication dynamics is initiated by ionization of an inner-valence electron. By increasing the temporal resolution of the measurement (i.e. by reducing the delay-step from 3 fs to 500 as) we were able to observe a clear modulation on the yield with a periodicity of a few femtoseconds. This ultrafast dynamics can only be associated with purely electronic processes, thus constituting a clear experimental evidence of charge migration in biomolecules.





[1] O. Bixner et al., J. Chem. Phys. 136, 204503 (2012).
[2] L. Belshaw et al., J. Phys. Chem. Lett. 3, 3751 (2012).

Host: Andrea Cavalleri

MAX-PLANCK-GESELLSCHAFT