Investigation of Strong Laser Field-Induced Fragmentation Dynamics of Hydrocarbon Molecules using Coincidence Momentum Imaging

Upon interaction with a strong laser field molecules may become multiply ionized. After the removal of electrons not only the charge density will be redistributed, also the molecule itself may undergo severe structural deformation and may fragment into several parts. Especially the dynamics of protons is of interest since the fragmentation of a molecule can be largely determined by its protons. This proton dynamics bridges the gap between the most fundamental level in molecular dynamics, which is the sub-fs dynamics of the valence electrons, and the rather slow dynamics of the other, much heavier nuclear species within the molecule. The momentum vectors of cations and electrons resulting from the interaction of the laser field with a molecule can be measured with a “reaction microscope”, which constitutes a coincidence momentum imaging technique. From these momentum vectors the laser field-induced reaction can be reconstructed.

In particular, I will focus on the fragmentation behaviour of 1,3-butadiene which reveals clear signs of single and even double hydrogen migration prior to the fragmentation of the molecule. Furthermore, I will report on the observation of highly energetic protons (up to 60 eV) ejected from a series of polyatomic hydrocarbon molecules due to Coulomb explosion from unexpectedly high charge states of the molecules.

Thursday, March 24th, 2011, 16:00
Seminarraum Institut für Photonik, Gusshausstrasse 27, 1040 Wien, Raum CBEG02