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Titel: Measurement of ultrafast hydrogen migration dynamics of hydrocarbon molecules induced by intense laser fields

Termin: Freitag, 29. Jänner 2010, 14:00 Uhr s.t.

Ort: Seminarraum des Instituts für Photonik  
Gußhausstrasse 27, 1040 Wien, Raum CBEG02

Abstract:

The ultrafast hydrogen migration dynamics of allene and 1,3-butadiene induced by intense laser fields was investigated by coincidence momentum imaging. For allene, it was confirmed by the observation of CH₃⁺, C₂H₃⁺, and H₃⁺ in the two-body Coulomb explosion processes that the chemical bond rearrangement associated with the ultrafast hydrogen migration occurs prior to the Coulomb explosion. The migrating proton covering the entire range of an allene molecule was visualized by the momentum correlation maps and by the geometrical structure of triply charged allene reconstructed from the observed momentum vectors of fragment ions in the three-body coulomb explosion processes. The extent of hydrogen migration was found to play a decisive role in breaking selectively one of the two initially equivalent C-C chemical bonds that become inequivalent in the course of the hydrogen migration. For 1,3-butadiene, four dissociation pathways, C₄H₆²⁺ → CH₂⁺ + C₃H₄⁺, C₄H₆²⁺ → CH₃⁺ + C₃H₅⁺, C₄H₆²⁺ → C₂H₃⁺ + C₂H₃⁺ and C₄H₆²⁺ → C₂H₂⁺ + C₂H₄⁺, were identified. The existence of the second and fourth pathways can be regarded as evidences of the chemical bond rearrangement processes associated with hydrogen migration in the intense laser field. It was found that the hydrogen atom bonded originally to one of the two central carbon atoms migrates preferentially to its neighboring terminal carbon atom site.

Host: A. Baltuska