Consiglio Nazionale delle Ricerche

Istituto per i Processi Chimico-Fisici

Area della Ricerca di Pisa

Avviso di Seminario

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ore 15:30 - Aula 30

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terrà un seminario su:

Hydrocarbon molecules in intense laser fields: skeletal bond breaking, ejection of triatomic-hydrogen molecular ions and hydrogen-atom migration

From the recent intensive investigations of dissociative ionization processes of organic compounds in intense laser fields, it has been revealed that a variety of phenomena are induced and that these phenomena are sensitively dependent on the properties of ultrashort light pulses such as the temporal- pulse width, wavelength, pulse shape, polarization, and phase. For ethanol, selective chemical-bond breaking processes in intense laser fields are investigated by open-loop and closed-loop approaches [1]. In the open loop control, various types of pulse trains of intense laser pulses are systematically generated to maximize the yield ratio of C-O bond breaking with respect to the C-C bond breaking. In the closed loop control, the maximization is achieved by the self-learning algorithm. These results show consistently that the total duration of the period that the sequence of pulses covers is a crucial factor determining the yield ratio; that is, as the duration increases the ratio increases to the maximum value, indicating the robustness of the wavepacket motion along the bond-braking coordinate of the light-dressed
potential energy surface of ethanol cation. It has also been revealed that ultrafast hydrogen atom transfer within molecules [2] and clusters [3] is induced when hydrocarbon molecules are exposed to intense laser fields. In order to understand the mechanism of the ultrafast hydrogen-atom dynamics in intense laser fields, the dissociative ionization processes of hydrocarbon molecules such as methanol and ethanol in
intense laser fields (800 nm, ~1014 W/cm2) are investigated by mass-resolved momentum imaging and coincidence momentum imaging techniques. In the case of methanol, fragment ions such as H+, H2+, H3+, C+, CH+, CH2+ and CH3+ are observed. On the basis of the anisotropy of the ejection direction of the fragment ions, competing dynamical processes of hydrogen-atom migration and H3+ ejection are investigated [4].

References

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(NH3)2]+ and [NH4(NH3)m]+ (m = 1 - 3) from size-selected aniline-ammonia cluster cations in intense laser fields", Chem. Phys. Lett. 396, 208-212 (2004).

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