MO 16: Stossprozesse, Energietransfer 1

Zeit: Mittwoch 14:00–16:00 Raum: VMP 6 HS-G

Preisträgervortrag MO 16.1 Mi 14:00 VMP 6 HS-G

Ion-Molekül-Reaktionen unter der Lupe — •Roland Wester — Physikalisches Institut, Universität Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg — Träger des Gustav-Hertz-Preises

Seit langem wird an der Beobachtung und am Verständnis des Ablaufs molekularer Reaktionen geforscht. In den letzten Jahren konnte die dreidimensionale Impulsabbildung als präzise Technik zur Beobachtung molekularer Stöße etabliert werden. Damit wurden bereits mehrere elementare Reaktionen neutraler Moleküle analysiert. Uns ist es gelungen, dieses Gebiet um die Erforschung reaktiver Prozesse positiver und negativer Ionen zu erweitern. Die kinematisch vollständigen Streuexperimente liefern einen neuen Zugang zur Dynamik dieser, in vielen Bereichen wichtigen, Reaktionen. Als Modellsystem für die Reaktionsdynamik komplexer Moleküle haben wir Austauschreaktionen negativer Halogenionen untersucht. Dies erlaubte uns die Identifikation verschiedener, zum Teil gänzlich unerwarteter, Reaktionsmechanismen [J. Mikosch *et al.*, Science **319**, 183 (2008)].

MO 16.2 Mi 14:45 VMP 6 HS-G

Molecular fragment excitation in cold electron collisions with polyatomic ions: new views through EMU — •M.B. Mendes[1], H. Buhr[1,2], D. Schwalm[1,2], M.H. Berg[1], D. Bing[1], O. Heber[2], B. Jordon-Thaden[1], C. Krantz[1], S. Menk[1], O. Novotný[1], S. Novotny[1], D.A. Orlov[1], A. Petrignani[1], M.L. Rappaport[2], T. Sorg[1], J. Stützel[1], J. Varju[3], D. Zajfman[2], and A. Wolf[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Weizmann Institute of Science, Rehovot, Israel — [3]Charles University Prague, Czech Republic

The dissociative recombination (DR) of a molecular ion and a low energy (few meV) electron, often yielding excited and chemically active fragments, is a very important process in cold and dilute ionised media. Event-by-event studies of the reaction are performed with cold ion and electron beams merged in a storage ring. Fragment momenta can be derived by coincidence imaging. However, the multichannel plate detectors used so far are insensitive to fragment masses. This limited the reaction analysis for many cases apart from simple diatomics. We present a new energy-sensitive multi-strip detector (EMU), able to identify fragment masses together with offering good position resolution. A wide range of applications opens with this device for the measurement of excitation energies of molecular products from polyatomic ions. Recent results were obtained for the DR of D_3O^+ and suggest that certain dissociation paths on the molecule's potential energy surface are preferred. A further promising application is the measurement of accurate product branching ratios for interstellar chemical models.

MO 16.3 Mi 15:00 VMP 6 HS-G

Dissociative electron capture in collisions of Ar^{8+} and CO_2 — •Nadine Neumann, Jasmin Titze, Lothar Schmidt, Achim Czasch, Ottmar Jagutzki, Horst Schmidt-Böcking und Reinhard Dörner — Institut für Kernphysik, Goethe Universität Frankfurt, Max-von-Laue Str. 1, 60438 Frankfurt am Main, Germany

We are using the Cold Target Recoil Ion Spectroscopy (COLTRIMS) to investigate the break up of CO_2 in impact processes with slow highly charged ions. While the slow highly charged ions passes the CO_2 molecule electron capture into the projectile causes a conformation change of the CO_2 molecule. With the COLTRIMS set up we are able to measure the 4π solid angle in momentum space of the dissociating ion fragments. The motivation for this experiment is to ascertain the change of the CO_2 molecule conformation.

Fachvortrag MO 16.4 Mi 15:15 VMP 6 HS-G

Electron-Exchange Parameter Measurements for Molecular Open-Shell-Targets — •Ingo Holtkötter and G. Friedrich Hanne — Department of Physics, Münster, Germany

Low-energy electron exchange collisions with simple open-shell molecules such as O_2, NO or NO_2 play an important role in both atmospheric physics and plasma chemistry. Due to the paramagnetic properties of these molecules, electron exchange collisions are experimentally observable. In our experiment, exchange collisions are investigated directly by measuring the change of spin polarization after the scattering of polarized electrons from unpolarized molecules with energies between 8 and 20 eV and scattering angles up to 130 °. Since previous experimental results and theoretical calculations with O_2 and NO as targets were not in satisfactory agreement, we revived these measurements to gain a deeper insight into spin-exchange effects with open shell-molecules. Additionally, we achieved the first inelastical exchange parameter measurements for O_2. For NO_2, we present the first experimental results for differential elastic electron exchange scattering at low energies.

With our recent measurements, we get a detailed view of the discrepancies between the experimental and older theoretical results. New calculations for electron exchange processes with O_2 as target show a very good agreement with our data. In other cases, however, there are still discrepancies between the experimental results and theoretical calculations. Up to now, there are no calculations available for the exchange parameter for collisions with NO_2.

MO 16.5 Mi 15:45 VMP 6 HS-G

Detection of Molecular Alignment with pure Nanosecond Pulses — •Sebastian Trippel[1], Martin Stei[1], Petr Hlavenka[1], Rico Otto[1], Matthias Weidemüller[2], and Roland Wester[1] — [1]Physikalisches Institut, Universität Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg — [2]Physikalisches Institut, Universität Heidelberg, Albert-Überle-Str. 3-5, 69120 Heidelberg

Strong light fields are known for their capability to align molecules in free space [1]. The presence of this strong laser field also influences the dissociation dynamics of molecules. In this talk we present results on adiabatic alignment and dissociation of CH_3I using an improved velocity map imaging spectrometer. Dissociation and ionization of the molecules are accomplished by using solely nanosecond lasers. With the strong field present, we observe alignment of the molecules and new channels in the dissociation of CH_3I. In the future, the aligned molecules will be used to study orientational effects in reactions with ions.

[1] H. Stapelfeldt and T. Seideman, Rev. Mod. Phys. **75**, 543 (2003)