A 28: Poster: Interaction of matter with ions

Time: Wednesday 16:30–19:00 Location: Poster.V

A 28.1 Wed 16:30 Poster.V

Optimierung der Strahlinjektion in den Frankfurter Niederenergie-Speicherring — •Annika M. Jung, Kurt E. Stiebing, Reinhard Dörner, Lothar Ph. H. Schmidt, Dirk Tiedemann, Marco Völp, Steffen Enz und Thomas Kruppi — Institut für Kernphysik der Goethe Universität Frankfurt, Max von Laue Straße 1, 60438 Frankfurt a.M.

Bei dem Frankfurter Niederenergie-Speicherring (Frankfurt Low Energy Storage Ring - FLSR [1]) handelt es sich um einen elektrostatischen Speicherring des Instituts für Kernphysik der Universität Frankfurt a.M., der Ionen und Moleküle beliebiger Masse bis zu einer Energie von 50 keV speichern kann. Das Projekt befasst sich mit der Optimierung der Injektion in den FLSR und schließt auch die Konstruktion eines 50 kV Terminals für Ionenquellen zur Versorgung des Rings mit Ionen/Molekülen ein. In diesem Beitrag werden erste Ergebnisse vorgestellt. [1] K.E. Stiebing et al. Nucl. Instr. And Meth. A 614 (2010) 10-16

A 28.2 Wed 16:30 Poster.V

Projectile coherence effects in ion-impact induced single ionization of He — •Xincheng Wang[1], Micheal Schulz[2], Aaron LaForge[1], Katharina Schneider[1], Aditya Kelkar[1], Joachim Ullrich[1], Robert Moshammer[1], and Daniel Fischer[1] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany — [2]Institut für Kernphysik, Universität Frankfurt, Max-von-Laue Strasse 1, D-60438 Frankfurt, Germany

In recent ion-molecule collision experiments the influence of the spatial coherence of the projectile ions on the differential cross sections has been discovered. Even though this effect seems - due to wave-particle duality - rather evident, it has not been considered before: In essentially all theoretical models the projectile ions either have been regarded as plane waves or as classical particles. We investigate the influence of the projectile coherence length in single ionization of helium and have measured the fully differential cross sections in 3MeV proton collisions at the Test Storage Ring (TSR). Here the projectile beam was cooled down using the electron cooling, thus decreasing the beam emittance and thereby increasing the transverse coherence length. The results are in a much better agreement with the theoretical prediction than earlier 100MeV/u C^{6+} data with smaller coherence length and the same perturbation. These observations suggest, that the earlier observed discrepancies between experiment and theory that have been a puzzle for many years, can be explained considering the coherence properties of the ion beam.

A 28.3 Wed 16:30 Poster.V

State-selective study of electron capture by coincident recoil-ion and x-ray measurement — •Zhangyong Song, Xincheng Wang, Aditya Kelkar, Daniel Fischer, Robert Moshammer, and Joachim Ullrich — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany

Electron capture in collisions between slow highly charge ions (HCI) and neutral atoms will be studied at the Heidelberg EBIT using a Reaction Microscope. In such collisions predominantly highly excited states in the projectile ions are populated that, for one-electron transitions, decay radiatively. In our experiments, the momentum of the recoil ions will be measured containing the information on the Q-values (i.e. inelasticity) of the collisions. The direct measurement of the x-rays emitted from the projectile subsequently will additionally enable to obtain information on the decay channels. Thus, a more complete picture of charge transfer and relaxation processes in HCI-atom collisions can be gained.

A 28.4 Wed 16:30 Poster.V

Observation of the $2p_{3/2}$-$2s_{1/2}$ Radiative Transition in Li-like Uranium using the Resonant Coherent Excitation in Si-crystal. — •Alena Ananyeva[1,2], Toshiyuki Azuma[3,5], Harald Bräuning[2], Angela Bräuning-Demian[2], Denis Dauvergne[4], Christina Dimopoulou[2], Yasuyuki Kanai[5], Carl Kleffner[2], Yuji Nakano[3,5], Yuri Pivovarov[6], Marcus Steck[2], Shintaro Suda[3], and Yasunori Yamazaki[5,7] — [1]Goethe Universität Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Tokyo Metropolitan University, Japan — [4]IPNL - Institut de Physique Nucléaire de'Lyon, France — [5]RIKEN, Tokyo, Japan — [6]National ResearchTomsk Polytechnic University, Russia — [7]University of Tokyo, Japan

Taking advantage of the cooled, relativistic ion beams delivered by the Experimental Storage Ring (ESR) at GSI, Darmstadt the energy of the $1s^2 2p_{3/2}$- $1s^2 2s_{1/2}$ transition in Li-like U ions was measured by using the resonant excitation of ions in a Si-crystal in channelling conditions. The excitation of the projectile traversing a solid target with an ordered structure is induced with great probability by the periodic potential defined by the atoms of the crystal lattice when the oscillation frequency of the crystal field fits the energy difference between two levels of the ion. The resonant character of the process enables the determination of transition energy with high precision. The present scheme is quite universal being applicable for various ions and for a wide range of transition energies in the field of atomic as well as nuclear physics.

A 28.5 Wed 16:30 Poster.V

Dynamics of transfer ionization in 1MeV/u O^{7+} on He collisions — •Katharina Schneider[1,2], Michael Schulz[3], Aditya Kelkar[1,4], Xincheng Wang[1,2], Manfred Grieser[1], Robert Moshammer[1], Joachim Ullrich[1], and Daniel Fischer[1] — [1]MPI für Kernphysik, Heidelberg, Germany — [2]EMMI at GSI, Darmstadt, Germany — [3]Missouri University of Science and Technology, Rolla, USA — [4]Universität Innsbruck, Austria

In ion-atom collisions, the capture of one target electron with simultaneous emission of a second target electron may occur. This process is called Transfer Ionization and has gained much interest in recent years. Here the correlation between the target electrons plays an important role, as it is involved in several mechanisms that result in this two-electron transition. Two of them are in the literature referred to as Thomas transfer ionization and ee-process which both have a distinct signature in the final momentum space. At large perturbations η (projectile charge to velocity ratio), an independent process dominates, where capture and ionization can be considered as two separate interactions with the projectile. We studied Transfer Ionization in O^{7+} + He collisions obtaining kinematically complete information with a Reaction Microscope implemented at the Test Storage Ring TSR at the MPI-K. The differential cross sections are compared to single ionization and severe differences were observed. Here we present the data as well as a comparison to several theoretical models.

A 28.6 Wed 16:30 Poster.V

An asymptotically corrected two-centre potential for the description of He^+- He collisions — •Gerald Schenk[1], Tom Kirchner[1], and Hans-Jürgen Lüdde[2] — [1]Department of Physics and Astronomy, York University, Toronto, Ontario, M3J 1P3, Canada — [2]Institut für Theoretische Physik, Goethe Universität Frankfurt, Germany

The Basis Generator Method (BGM) was developed to calculate ionization and electron transfer probabilities in ion-atom collisions [1]. In its two-centre (TC) implementation electrons from both collision centres can be propagated in a single potential, based on the Independent Particle Model. However, this leads to a complication. Looking at the asymptotic behaviour of the potential towards large internuclear distances it becomes apparent, that a combination of (screened) atomic potentials can not be asymptotically correct for both centres simultaneously. Either a potential correct for the target or for the projectile electron can be chosen.

An approach to avoid this is to use a potential that locally shows the correct asymptotic behaviour for both collision centres by combining both cases through a minimum function. First results obtained from TC-BGM calculations with such a potential will be presented for He^+-He collisions at intermediate impact energies.

[1] M Zapukhlyak *et al* 2005 *J. Phys. B:* **38** 2353

A 28.7 Wed 16:30 Poster.V

Interference in Dissociative Ionization of H_2^+ - Helium Collisions — •Shaofeng Zhang[1,2], Daniel Fischer[1], Robert Moshammer[1], Alexander Voitkiv[1], Michael Schulz[1], Bennaceur Najjari[1], Joachim Ullrich[1], and Xinwen Ma[2] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg,

Germany — [2]Institute of Modern Physics, CAS, Nanchang Road 509, Lanzhou, China

The wave properties of moving particles have gained increasing attention in collision physics in the last decades. One fundamental manifestation arises from the scattering of two atomic centers of diatomic molecules (the so-called Young-type interference). So far, two different kinds of Young-type interference in ion collisions have been reported: One is due to the electron emission from the two molecular centers, where the interference results in a significant modification of the electron energy and angular distributions. In the second branch of interference studies, electron capture involving a molecular projectile or target has been investigated where a strong dependence on the molecular orientation was observed.

In the present study we report on interference in ionization of atoms colliding with molecules. At the Max-Planck-Institut für Kernphysik in Heidelberg, we investigated the dissociative ionization channel in He-H_2^+ collisions. Interference effects in the momentum transfer patterns as well as in the individual momenta of electrons and He^+ -ions are investigated. The experimental results are reproduced by a model based on the first Born approximation.