A 11 Ion-Atom/Molecule Collisions, Exotic Atoms

Zeit: Montag 16:30–17:45 Raum: HU 3075

Fachvortrag A 11.1 Mo 16:30 HU 3075

Untersuchung des interatomaren Wechselwirkungspotentials bei axialer Oberflächengitterführung schneller Atome — •Andreas Schüller und Helmut Winter — Physik der Grenzflächen und dünnen Schichten, Humboldt-Universität zu Berlin, Institut für Physik, Newtonstraße 15, 12489 Berlin

Bei der streifenden Streuung schneller Atome an atomar ebenen Einkristalloberflächen werden im Regime des axialen Channelings definierte Maxima in den Winkelverteilungen der gestreuten Projektile beobachtet, welche als Regenbogenstreuung interpretiert werden. Der resultierende Regenbogenwinkel zeigt eine ausgeprägte Abhängigkeit vom Wechselwirkungspotential zwischen Projektil und den Atomen der Oberfläche. Ein Vergleich mit Ergebnissen aus Trajektorien-Simulationen ermöglicht die experimentelle Überprüfung der Beschreibung der interatomaren Wechselwirkungspotentiale im Energiebereich von 1 eV bis zu einigen 10 eV. Ergebnisse für die Streuung verschiedener Atome an Ag(111), Cu(111) und Al(111) werden mit Simulationen verglichen, die auf verschiedenen Approximationen sowie auf individuell berechneten interatomaren Potentialen basieren. Während man mit den individuell berechneten Potentialen die Messdaten gut beschreiben kann, zeigen die Näherungen zum Teil deutliche Abweichungen. Dies gilt insbesondere für das häufig verwendete ZBL-Potential.

Fachvortrag A 11.2 Mo 16:45 HU 3075

Slowing-down-experiments with (40-300)MeV/u ^{58}Ni-ions — •R. Knöbel[1], F. Attallah[2], K. H. Behr[2], V. Chichkine[2], S. Eliseev[1], H. Geissel[1,2], H. Hausmann[2], B. Kindler[2], B. Lommel[2], M. Maier[1,2], G. Münzenberg[2], N. Nankov[1,2], T. Ohtsubo[2], M. Portillo[2], G. Savard[3], C. Scheidenberger[1,2], K. Sümmerer[2], H. Weick[1,2], and M. Winkler[1,2] — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, D-35392 Gießen, Germany — [2]Gesellschaft für Schwerionenforschung, Planckstrasse 1, D-64291 Darmstadt, Germany — [3]Physics Division, Argonne National Laboratory, 9700 South Cass Ave, Argonne, IL 60439, USA

New experimental results of ^{58}Ni-ions slowed down in matter at the FRS at GSI will be presented. The measurements were performed at projectile energies of 300MeV/u, 100MeV/u, 70MeV/u and 50MeV/u. The ions penetrate through various target materials (Be, C, Al, Cu, Ag, Au) of different thicknesses. Measured charge-state distributions, stopping power and energy straggling will be shown. The experimental results are compared with calculations employing different theoretical models.

Fachvortrag A 11.3 Mo 17:00 HU 3075

Numerical solutions of scattering integral equations — •Ivo Häring — Am Buntengraben 4, 79576 Weil-Haltingen

When examining analytical properties of quantum mechanical scattering various integral equations are elegant and effective tools (e.g. PRL **91** 070403). However, actual computations of scattering quantities often resort to single or two point boundary value problems equivalent to the integral formulations. We numerically investigate direct solutions of the integral equations. For generic radial potentials and selected methods achievable accuracies and needed computational resources in terms of time and memory are discussed.

Fachvortrag A 11.4 Mo 17:15 HU 3075

Evaporation of negative ions out of a 22-pole ion trap — •J. Mikosch[1,2], U. Frühling[2], M. Weidemüller[2], D. Schwalm[1] und R. Wester[2] — [1]Max-Planck-Institut für Kernphysik, 69117 Heidelberg — [2]Physikalisches Institut, Universität Freiburg, 79104 Freiburg

Ion traps with controllable temperature offer a ideal environment for reactions of molecular ions with neutral buffer gas molecules. In our experiment a multipole RF ion trap is used as a source for state-selected ions for a crossed beam experiment.

In this work we have studied the storage conditions in this trap with Cl^- anions. These are selected from a supersonic expansion ion source via time of flight and analyzed after storage with a second time of flight detector. We achieve storing conditions, where there are practically no reactive collisions taking place in the trap. This enables us to investigate trap losses dominated by elastic collisions of the ions with the buffer gas and by interactions among the ions themselves. We have studied the dependence of the evaporation rate on buffer gas density, temperature and trap depth. These results are compared with models of the evaporation process.

Fachvortrag A 11.5 Mo 17:30 HU 3075

A new Measurement of the Decay Rate of the Positronium Negative Ion — •F. Fleischer[1], G. Gwinner[1], K. Degreif[1], M. Lestinsky[1], V. Liechtenstein[2], F. Plenge[1], and D. Schwalm[1] — [1]MPI für Kernphysik, 69029 Heidelberg — [2]Kurchatov Institute, Moscow

Consisting of two electrons and a positron, the positronium negative ion (Ps^-) represents the simplest three-body-system with a bound state. As no perturbations due to strong interactions have to be considered and because of its unique mass ratio the system provides interesting opportunities to test our understanding of the three-body problem and quantum electrodynamics. Previous experiments have so far only proved the existence of Ps^- [1] and determined the decay rate with 4% accuracy [2]. To allow for a test of radiative corrections and bound-state contributions to the decay rate an increase in precision is necessary. Other parameters of particular interest are the photodetachment cross section with its narrow resonances predicted around the Ps($n = 2, 3, 4 \ldots$) threshold and the $3\gamma/2\gamma$-branching ratio. An experiment has been built up at the MPI für Kernphysik to investigate the decay rate and other properties of Ps^- in more detail. The results of a new measurement of the decay rate as well as possibilities for further experiments concerning the properties of Ps^- — using the new high-flux positron source NEPOMUC at the FRM II research reactor in Munich — will be discussed.

[1] A.P. Mills, Jr., Phys. Rev. Lett. 46, 717(1981)
[2] A.P. Mills, Jr., Phys. Rev. Lett. 50, 671(1983)