MS 6: Ion Storage Rings

Time: Wednesday 14:00–15:30 Location: GÖR 229

Invited Talk MS 6.1 Wed 14:00 GÖR 229

Hot water in space — •Henrik Buhr — Weizmann Institute of Science, Rehovot, Israel — Max-Planck-Institut für Kernphysik, Heidelberg, Germany — Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

Dissociative recombination (DR) of molecular ions with electrons plays an important role in many types of plasmas as destruction mechanism for ions and in the generation of neutral species, like water formation through DR of H_3O^+ in interstellar clouds. Information on the type and excitation of the DR products greatly helps understanding the chemistry in these environments and interpreting electro-magnetic spectra from telescope observations.

A new, energy- and position-sensitive detector recently implemented at the merged-beams facility at the TSR storage ring of the MPI für Kernphysik in Heidelberg yields impact positions and fragment identification on a single-event basis. This setup was used to study the DR of D_3O^+, i. e. the branching ratios into the various fragmentation channels for a wide range of collision energies as well as the kinetic energy releases and fragment excitations for each channel. The water formed in DR is highly excited with more than 3 eV, close to the dissociation limit into OD+D. This excitation might be the source of microwave emissions observed e. g. in cometary comae and laboratory water plasmas. Furthermore, the three-body fragmentation into OD+D+D shows a strong dependence of the correlation of fragment kinetic energies on the total kinetic energy release in the DR process.

MS 6.2 Wed 14:30 GÖR 229

Study of the Rate Acceptance of a Time-of-Flight detector for IMS at FRS-ESR — •Natalia Kuzminchuk[1,2], Samuel Ayet[1,2], Marcel Diwisch[1], Benjamin Fabian[1], Hans Geissel[1,2], Ronja Knoebel[2], Yuri Litvinov[3], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], Baohua Sun[1,2], and Helmut Weick[2] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]MPI-K, Heidelberg

For Isochronous Mass Spectrometry at the FRS-ESR facility a TOF detector is used for the measurement of the revolution times of stored ions. In the detector, ions passing a thin carbon foil release secondary electrons, which are transported to microchannel plates (MCPs) by electric and magnetic fields. Because of the high revolution frequencies in the ESR, a high rate acceptance is required as well as good timing characteristics. Offline studies show that MCPs with 5 μm pore size can accept a higher count rate than MCPs with the same active diameter but with a commonly used pore size of 10 μm. To show the advantages of MCPs with 5 μm pore size, the saturation effects were investigated online in the ESR with Ne and Ni primary beam as well as with U fission fragments. Comparison of the experimental results with Monte Carlo simulations prove that MCPs with 5 μm channel diameter are at least 3 times more resistant to the higher rates than MCPs with 10 μm pore size. In addition, the number of revolutions of the stored ions could be increased significantly by using thinner carbon foils.

MS 6.3 Wed 14:45 GÖR 229

New Isochronous Mode of the ESR — •Sergey Litvinov[1], Alexei Dolinskii[1], Christina Dimopoulou[1], Hans Geissel[1], Bernhard Franczak[1], Yuri Litvinov[2], Fritz Nolden[1], Markus Steck[1], and Helmut Weick[1] — [1]GSI (Gesellschaft für Schwerionenforschung), Darmstadt, Germany — [2]Max-Plack Institut for Nuclear Physics, Heidelberg, Germany

Isochronous Mass Spectrometry (IMS) is an experimental technique for direct mass measurements of short-lived exotic nuclei which has been developed at the storage ring facility ESR of GSI. A bottleneck for the present IMS experiments is the low transmission from the fragment separator FRS to the ESR, which is mainly due to large negative dispersion in the straight sections of the ESR.

In order to facilitate the transmission and to improve the isochronicity of the ring, the present isochronous optics of the ESR has been recalculated. A new isochronous setting has been experimentally verified. The results of the first test run and the perspectives of further improvements will be presented. A sketch of the new isochronous storage ring CR within the future FAIR project will be outlined.

MS 6.4 Wed 15:00 GÖR 229

Status of the cryogenic heavy-ion storage ring CSR — •Michael Lange, Felix Berg, Klaus Blaum, Florian Fellenberger, Michael Froese, Manfred Grieser, Claude Krantz, Felix Laux, Sebastian Menk, Dmitry A. Orlov, Roland Repnow, Andrey Shornikov, Claus Dieter Schröter, Thomas Sieber, Joachim Ullrich, Robert von Hahn, and Andreas Wolf — Max-Planck-Institut für Kernphysik, Postfach 10 39 80, 69029 Heidelberg

At the MPI für Kernphysik the new cryogenic electrostatic heavy ion storage ring CSR is currently under construction. By applying liquid helium cooling, it will reach a residual gas pressure in the 10^{-14} mbar region, which will enable the storage of even highly charged atomic ions over extraordinarily long times. In addition the ring can be operated at any temperature between 10 K and room temperature. As an electrostatic device, it will allow storage of ions of masses up to and above 100 a.m.u. In two of its straight sections, an electron cooling device for beam cooling and low-energy electron collision experiments, and a reaction microscope with a gas jet for kinematically complete high energy investigations are foreseen. The ring will hence be a unique tool for future atomic, molecular and cluster physics experiments under very low densities of residual gas and blackbody radiation, and thus enable a new class of experiments especially in laboratory astrophysics.

In this presentation, we will give an introduction to the ring design and present the current status of its construction.

MS 6.5 Wed 15:15 GÖR 229

The injection beam lines of the Cryogenic Storage Ring (CSR) — •Felix Berg, Klaus Blaum, Florian Fellenberger, Michael Froese, Manfred Grieser, Claude Krantz, Michael Lange, Felix Laux, Sebastian Menk, Roland Repnow, Andrey Schornikov, Robert von Hahn, and Andreas Wolf — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

At the Max-Planck-Institute for Nuclear Physics in Heidelberg an electrostatic cryogenic storage ring (CSR) is under construction. The ions for the CSR will be provided by two ion sources with up to 60kV and 300kV potential, respectively. The layout of the beamlines connecting the ion sources with the CSR will be presented. They will be merged using an electrostatic deflector with an opening in the outer electrode, thereby allowing quick switching between the two ion sources. In order to determine the influence of the opening on the beam optics the deflector has been modeled and a modified transport matrix has been derived. An additional beamline element is a detachment region for the neutralization of a negative ion beam by photodetachment. The potential of the detachment region defines the precise energy of the neutral particles. Calculations of the ion beam optics using the MAD X code will be described.