MS 4: Ion Storage Rings

Time: Tuesday 10:30–11:45 Location: V57.06

Invited Talk MS 4.1 Tue 10:30 V57.06

Present and future mass measurements at the FRS-ESR Facility at GSI — •Ronja Knöbel — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt, Germany

Schottky and Isochronous Mass Spectrometry were developed at the FRS-ESR facility at GSI and are essential methods for precise and accurate mass measurements. New developments of experimental tools and refinements in the analysis were achieved for both methods which led to the discovery of new isotopes and new isomers along with new mass and half-life measurements. Recent results from both methods will be presented and comparisons to theoretical predictions will be given. These results improve the understanding of nuclear structure and of the astrophysical nucleosynthesis-pathways.

MS 4.2 Tue 11:00 V57.06

Isochronous mass spectrometry with longer observation of ions and improved timing performances of a time-of-flight detector at ESR — •Natalia Kuzminchuk[1,2], Marcel Diwisch[1], Samuel Ayet[2], Timo Dickel[1,2], Hans Geissel[1,2], Ronja Knöbel[1,2], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], Baohua Sun[1,2], and Helmut Weick[2] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt

Using Isochronous Mass Spectrometry at the FRS-ESR the mass of the exotic nuclei can be deduced from precise revolution time measurements by a time-of-flight detector. In the detector, the ion impinge on a thin carbon foil and the emitted secondary electrons are deflected by 180° with an applied electric and magnetic fields to two MCP detectors. Due to the high revolution frequencies of the ions in the ESR (∼2 MHz), a high rate acceptance is required as well as good timing characteristics. The rate capability improvements developed in offline work using MCPs with smaller pore size and employing thinner carbon foils were studied online with ^{238}U fragments for the first time at the FRS-ESR facility. As a result, up to 10 times more revolutions of the stored ions in the ring were observed. To improve the timing accuracy the TOF detector was modified for higher kinetic transport energies of the secondary electrons from the foil to the MCPs. Offline measurements with a radioactive alpha source showed that the time accuracy of the detector was improved by up to 50 %.

MS 4.3 Tue 11:15 V57.06

Investigation of heavy neutron-rich nuclides with time-resolved Schottky mass spectrometry — •D. Shubina[1,2], M.W. Reed[3], I.J. Cullen[3], P.M. Walker[3], Yu.A. Litvinov[1,4], K. Blaum[1], F. Bosch[4], C. Brandau[4], R.B. Cakirli[1,5], J.J. Carroll[6,7], R.F. Casten[8], D.M. Cullen[9], A.Y. Deo[3], B. Detwiler[6], C. Dimopoulou[4], F. Farinon[4], H. Geissel[4,10], E. Haettner[10], M. Heil[4], R.S. Kempley[3], R. Knöbel[4], C. Kozhuharov[4], J. Kurcewicz[4], N. Kuzminchuk[4], S.A. Litvinov[4], Z. Liu[11], R. Mao[12], C. Nociforo[4], F. Nolden[4], Z. Patyk[4], W.R. Plass[10], A. Prochazka[4], M.S. Sanjari[4], C. Scheidenberger[4,10], M. Steck[4], Th. Stöhlker[2,4], B. Sun[4], T.P.D. Swan[3], G. Trees[6], H. Weick[4], N. Winckler[1], M. Winkler[4], P.J. Woods[11], and T. Yamaguchi[13] — [1]MPIK, Heidelberg — [2]Heidelberg Uni. — [3]Surrey Uni. — [4]GSI, Darmstadt — [5]Istanbul Uni. — [6]YSU, Youngstown — [7]US Army RL — [8]Yale Uni. — [9]Manchester Uni. — [10]Gießen Uni. — [11]Edinburgh Uni. — [12]IMP, Lanzhou — [13]Saitama Uni.

Neutron-rich heavy nuclides, which were produced by fragmentation of a ^{197}Au primary beam and separated in the FRS, were investigated with Schottky Mass Spectrometry (SMS) using the GSI ESR. Masses for nine nuclides were measured for the first time: ^{181,183}Lu, ^{185,186}Hf, ^{187,188}Ta, ^{191}W and ^{192,193}Re. Also, the accuracy of the mass values for three other nuclides (^{189,190}W and ^{195}Os) was significantly improved. The new data was used for nuclear structure investigations by studying the behavior of two neutron separation energies, S_{2n}, and comparing them with the energies of the first excited 2^+ states.

MS 4.4 Tue 11:30 V57.06

Direct mass measurements of short-lived proton-rich nuclides at CSRe — •X.L. Yan[1,2], X.L. Tu[1,2], M. Wang[1], Yu.A. Litvinov[1,3,4], Y.H. Zhang[1], H.S. Xu[1], Z.Y. Sun[1], G. Audi[5], K. Blaum[3], C.M. Du[1,2], W.X. Huang[1], Z.G. Hu[1], P. Geng[1,2], S.L. Jin[1,2], L.X. Liu[1,2], Y. Liu[1], B. Mei[1], R.S. Mao[1], X.W. Ma[1], H. Suzuki[6], P. Shuai[7], Y. Sun[1,8], S.W. Tang[1,2], J.S Wang[1], S.T Wang[1,2], G.Q. Xiao[1], X. Xu[1,2], J.W Xia[1], J.C. Yang[1], R.P. Ye[1,2], T. Yamaguchi[9], Y.J. Yuan[1], Y. Yamaguchi[10], Y.D. Zang[1,2], H.W. Zhao[1], T.C. Zhao[1], X.Y. Zhang[1], X.H Zhou[1], and W.L Zhan[1] — [1]IMPCAS, China — [2]GUCAS, China — [3]MPIK, Germany — [4]GSI, Germany — [5]CSNSM-IN2P3-CNRS, Université de Paris Sud, France — [6]Uni. of Tsukuba, Japan — [7]USTC, China — [8]SJTU, China — [9]Saitama Uni., Japan — [10]RIKEN, Japan

Masses of $A = 2Z - 1$ proton-rich nuclides were measured with the experimental cooler storage ring CSRe in Lanzhou by employing the isochronous mass spectrometry (IMS) method. The short-lived proton-rich nuclides were produced via ^{78}Kr projectile fragmentation, separated in the radioactive beam line RIBLL2 and then stored in CSRe. A typical mass resolving power of $R = m/\Delta m \approx 1.7 \cdot 10^5$ was achieved. After the improvement of the stability of CSRe dipole magnet power supplies, a new measurement with ^{58}Ni projectile fragments was carried out. The data analysis methods for both experiments will be presented.