MS 6: Ion Storage Rings and Precision Mass Spectrometry

Time: Wednesday 11:00–12:15 Location: F 442

Invited Talk MS 6.1 Wed 11:00 F 442

Recent results in mass measurements of short-lived nuclides at CSRe-Lanzhou — •Yuhu Zhang[1], Hushan Xu[1], and Yuri Litvinov[2,1] — [1]IMP, Lanzhou, China — [2]GSI, Germany

Nuclear mass is the fundamental property of a nucleus. The complex interplay of strong, weak and electromagnetic interactions in the nucleus contributes to the difference between its mass and the sum of the masses of its constituent nucleons. Precise and systematic measurements of nuclear masses not only provide information on nuclear structure, but also find their important applications in nuclear astrophysics. Recent commissioning of the Cooler Storage Ring at the Heavy Ion Research Facility in Lanzhou (HIRFL-CSR) has allowed us for direct mass measurements at the Institute of Modern Physics in Lanzhou (IMP), Chinese Academy of Sciences. In the past few years, a series of mass measurement experiments have been carried out using the CSRe-based isochronous mass spectrometry. Masses of short-lived neutron-deficient nuclides have been measured via fragmentation of the energetic beams of ^{78}Kr, ^{58}Ni. The implications of these results with respect to nuclear structures and nucleosynthesis in the *rp*-process of x-ray bursts are discussed.

MS 6.2 Wed 11:30 F 442

Online mass measurements with a Multiple-Reflection Time-of-Flight Mass Spectrometer (MR-TOF-MS) at the FRS Ion Catcher — •Jens Ebert[1], Timo Dickel[1,2], Wolfgang R. Plass[1,2], Samuel Ayet[2], Peter Dendooven[3], Alfredo Estrade[2], Fabio Farinon[2], Hans Geissel[1,2], Florian Greiner[1], Emma Haettner[1,2], Christian Jesch[1], Nasser Kalantar-Nayestanaki[3], Ronja Knoebel[1,2], Jan Kurcewicz[2], Johannes Lang[1], Iain Moore[4], Ivan Mukha[2], Chiara Nociforo[2], Martin Petrick[1], Marek Pfutzner[2], Stephane Pietri[2], Andrej Prochazka[2], Sivaji Purushothaman[2], Moritz P. Reiter[1], Ann-Kathrin Rink[1], Christoph Scheidenberger[1,2], Maya Takechi[2], Helmut Weick[2], John Winfield[2], Marcel Diwisch[1], and Mikhail I. Yavor[5] — [1]JLU Giessen — [2]GSI, Darmstadt — [3]KVI, University of Groningen, Netherlands — [4]University of Jyväskylä, Finland — [5]Russian Academy of Sci., St. Petersburg

At the Low-Energy-Branch (LEB) of the Super-FRS at FAIR experiments with-slowed down exotic nuclei will be performed. The FRS Ion Catcher experiment at the FRS serves a test facility for the LEB. The relativistic ions are thermalized in a novel cryogenic stopping cell, extracted and transported to a MR-TOF-MS for high precision mass measurements or decay-spectroscopy. In summer 2012 direct mass measurements of U projectile fragments have been performed for the first time with a MR-TOF-MS, among then ^{213}Rn with a half-life of only 19.5 ns.

MS 6.3 Wed 11:45 F 442

Simulations of a Dual TOF Detector System for Isochronous Mass Spectrometry in the Collector Ring at FAIR — •Marcel Diwisch[1], Natalia Kuzminchuk-Feuerstein[1], Timo Dickel[1,2], Hans Geissel[1,2], Ronja Knöbel[1,2], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], and Helmut Weick[2] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt

Direct mass measurements of short-lived exotic nuclei yield key information for modern nuclear physics. Experimentally determined mass values of exotic nuclei have a big impact on numerous applications in fundamental and applied science. With the Superconducting-Fragment Separator (Super-FRS) at the new FAIR facility a whole new range of exotic nuclei far away from stability will be accessible. Higher beam intensities and larger phase space volumes impose new challenges for the detection systems. To measure masses of short-lived exotic nuclei one can use the Isochronous Mass Spectrometry (IMS)which presently is successfully performed at the FRS-ESR facility. For IMS in the future Collector Ring, (CR) a first version of a new dual Time-Of-Flight (TOF) detector system, which fulfills the requirements of the new beam parameters has been designed. Simulationresults for the new TOF detector in the CR will be shown.

MS 6.4 Wed 12:00 F 442

Exploring the nuclear structure above fermium with SHIPTRAP — •E. Minaya Ramirez[1,2], D. Ackermann[2], K. Blaum[3,4], M. Block[2], C. Droese[5], Ch. E. Düllmann[1,2,6], M. Eibach[6], S. Eliseev[3], E. Haettner[2,7], F. Herfurth[2], F.P. Hessberger[2], S. Hofmann[2], G. Marx[5], D. Nesterenko[8], Yu. Novikov[8], W.R. Plass[2,7], D. Rodríguez[9], C. Scheidenberger[2,7], L. Schweikhard[5], P.G. Thirolf[10], and C. Weber[10] — [1]Helmholtz-Institut Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]Max-Planck-Institut für Kernphysik, Heidelberg — [4]Ruprecht-Karls-Universität Heidelberg — [5]Ernst-Moritz-Arndt-Universität, Greifswald — [6]Johannes Gutenberg-Universität Mainz — [7]Justus-Liebig-Universität Gießen — [8]PNPI RAS Gatchina, St. Petersburg — [9]Universidad de Granada — [10]Ludwig-Maximilians-Universität München

Penning-trap mass spectrometry of radionuclides provides direct mass measurements with an accuracy of a few keV. The mass gives access to the nuclear binding energy, a crucial parameter to investigate the nuclear shell structure. Furthermore, the combination of α-decay spectroscopy and directly measured masses above fermium ($Z = 100$) allows determining the masses of higher-Z nuclides to guide the exploration of the island of stability of superheavy elements. Recently, the masses of the nuclides $^{252-255}$No and ^{255,256}Lr have been measured with high accuracy using the Penning trap mass spectrometer SHIPTRAP at GSI Darmstadt. The accurate experimental binding energies allow mapping of the shell effects at $N = 152$. In order to measure the masses of nuclides with production cross sections even lower than ^{256}Lr, new developments are envisaged to improve the efficiency of the SHIPTRAP setup. Future measurements and recent developments will be presented.