HK 51: Struktur und Dynamik von Kernen VIII

Time: Thursday 14:00–15:45 Location: A-1

Group Report HK 51.1 Thu 14:00 A-1

Novel Results of Schottky Mass Measurements at the FRS-ESR Facility at GSI — •Ronja Knöbel for the FRS-ESR-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

The combination of the fragment separator FRS and the experimental storage ring ESR was used to measure the masses and half - lives of neutron - rich ^{238}U fragments with the time-resolved Schottky Mass Spectrometry (SMS) at GSI, Germany. The heavy neutron-rich region from thallium to uranium was investigated. An overview of the achieved experimental results will be presented and comparisons with theoretical predictions will be given.

HK 51.2 Thu 14:30 A-1

Providing new anchor points for the mass surface with direct high-precision mass measurements on rare-earth nuclides at TRIGA-TRAP — •M. Eibach[1,2], T. Beyer[2,3], K. Blaum[2,3], M. Block[4], R.B. Cakirli[3,5], K. Eberhardt[1], A. Gonschior[1], F. Herfurth[4], J. Ketelaer[3], Sz. Nagy[3,4], D. Neidherr[3,4], W. Nörtershäuser[1,4], D. Renisch[1,3], and C. Smorra[1,2] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz — [2]Physikalisches Institut, Ruprecht-Karls-Universität, Heidelberg — [3]Max-Planck-Institut für Kernphysik, Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [5]Department of Physics, University of Istanbul, Turkey

High-precision nuclear mass data is required for several scientific applications like calculations on the astrophysical r-process, nuclear structure studies and tests of nuclear mass models. Such data is gained for example by the double Penning trap mass spectrometer TRIGA-TRAP, one branch of the TRIGA-SPEC experiment, which has recently been set up in order to investigate the neutron-rich as well as the long-lived transuranium area of the chart of nuclides. The nuclides of interest are either produced by thermal neutron-induced fission of a uranium target or ionized off-line in a laser ablation ion source. Mass measurements on rare-earth nuclides were already performed and deviations from the literature values were discovered.
In this talk the present status of the TRIGA-TRAP experiment will be outlined and the influence of the latest mass measurement results on the Atomic-Mass Evaluation will be presented.

HK 51.3 Thu 14:45 A-1

Investigation of heavy neutron-rich nuclides with Schottky spectrometry at the ESR — •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], J.J. Carroll[5], D.M. Cullen[6], A.Y. Deo[3], B. Detwiller[5], C. Dimopoulou[4], F. Farinon[4], H. Geissel[4,7], E. Haettner[7], 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[8], R. Mao[9], C. Nociforo[4], F. Nolden[4], W.R. Plass[7], A. Prochazka[4], M.S. Sanjari[4], C. Scheidenberger[4,7], M. Steck[4], Th. Stöhlker[2,4], B. Sun[4], T.P.D. Swan[3], G. Trees[5], H. Weick[4], N. Winckler[1], M. Winkler[4], P.J. Woods[8], and T. Yamaguchi[10] — [1]MPI-K, Heidelberg — [2]Uni. Heidelberg — [3]Uni. Surrey — [4]GSI, Darmstadt — [5]YSU, Youngstown — [6]Uni. Manchester — [7]Uni. Gießen — [8]Uni. Edinburgh — [9]IMP, Lanzhou — [10]Saitama Uni.

Neutron-rich nuclides produced in fragmentation of ^{197}Au projectiles were studied in the storage ring ESR. The nuclides were separated in flight with the fragment separator FRS and injected at relativistic energies of 400 MeV/u into the ESR. The properties of cooled ions were investigated with time-resolved Schottky spectrometry, which allowed simultaneous measurement of their masses and lifetimes. In total 54 neutron-rich nuclides ($69 \leq Z \leq 79$) have been identified. Five long-lived isomeric states were discovered in ^{183,184,186}Hf and ^{186,187}Ta [M. Reed et al., PRL105 (2010) 172501]. Masses for five nuclides and half-lives for three nuclides were determined for the first time. The experiment, the data analysis and the obtained results will be presented.

HK 51.4 Thu 15:00 A-1

Direct correlations between experimental isotope shifts and differentials of spectroscopic and mass observables — •R.Burcu Cakirli[1,2], Klaus Blaum[1], and Richard F. Casten[3] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117, Heidelberg, Germany — [2]Department of Physics, University of Istanbul, Istanbul, Turkey — [3]Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520, USA

Empirical correlations in isotopic differentials of charge radii have been combined with the differentials for data on the energy of the first excited 2^+ state, on $R_{4/2}$=E(4_1^+)/E(2_1^+), on the transition rate from the 2_1^+ to the ground state and the two neutron separation energies. These differential results exhibit remarkable consistency with each other although, individually, structure and/or mass observables reveal different patterns. In the past, there are number of valuable studies of isotope shifts comparable to different observables but not the direct correlations as will be presented here. We show that a single general pattern occurs for five different observables for each mass region. This helps one to follow the structural changes more easily by looking at one type of pattern. This study may be a guide for both experimental studies, future measurements in charge radii, masses, spectroscopic observables, and theoretical studies.

HK 51.5 Thu 15:15 A-1

Bestimmung der Anregungsenergie des isomeren Zustandes in ^{194}Tl im Rahmen von massenspektrometrischen und zerfallsspektroskopischen Messungen an ISOLTRAP — •Juliane Stanja für die ISOLTRAP-Kollaboration — TU Dresden

Mit dem Penningfallen-Massenspektrometer ISOLTRAP ist es auf Grund der erreichbaren Genauigkeit von $\delta m/m = 1 \cdot 10^{-8}$ möglich, isomere Zustände im Bereich von wenigen hundert keV aufzulösen. Der vom Isotopenseparator ISOLDE (CERN) bereitgestellte Strahl besteht neben dem Grund- und isomeren Zustand des Nuklids von Interesse zumeist auch aus isobaren Kontaminationen. Diese können mittels verschiedener Selektionsverfahren beseitigt werden. Abhängig von Produktionsrate, Anregungsenergie und Halbwertszeit können dann die Zyklotronfrequenzen von Grund- und isomerem Zustand des zu untersuchenden Isotops mit Hilfe der Flugzeitmethode gemessen werden. Aus diesen Frequenzen lassen sich Masse und Anregungsenergie ermitteln. Zur Bestätigung der Zusammensetzung des Ionenstrahls wird dieser in ein hinter der Präzisionsfalle platziertes Tape implantiert und spektroskopisch untersucht. Es wird das Verfahren anhand der Messung an isomeren Zuständen in $^{193-195}$Tl mit besonderem Augenmerk auf die erstmalige Bestimmung der Anregungsenergie des isomeren Zustandes in ^{194}Tl diskutiert.

HK 51.6 Thu 15:30 A-1

Nuclear structure studies based on high-precision mass measurements at ISOLTRAP — •Christine Böhm for the ISOLTRAP-Collaboration — MPI für Kernphysik, Heidelberg

High-precision mass measurements of ^{190}Tl, ^{193}Tl, ^{202}Pb and ^{208}Pb were performed at the Penning-trap mass spectrometer ISOLTRAP at ISOLDE (CERN). In ^{190}Tl, the ground state and the first isomeric state have been studied by measuring the cyclotron frequency of the trapped particles using the time-of-flight detection technique. Since different alpha-decay chains include the ^{190}Tl^{g,m}, ^{193}Tl and ^{202}Pb nuclei, the measured masses in this study provide improved mass values for further nuclei lying on the decay line, amongst others for ^{194}Bi^n and ^{197}Bi^m, which are known only from systematic studies. The resulting binding energies can be used to investigate nuclear structure of the region we studied, considering, e.g., the S_{2n}-values. The impact of the improved mass values will be discussed.