HK 41: Structure and Dynamics of Nuclei VII

Time: Wednesday 14:00–15:30 Location: HK-H7

Group Report HK 41.1 Wed 14:00 HK-H7

Mass measurements of short-lived exotic nuclei at TITAN - update on recent developments — •Tobias Murböck for the TITAN-Collaboration — TRIUMF, Vancouver, British Columbia, Canada — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Gießen, Germany

The mass of a nucleus is determined by the number of its constituents, protons and neutrons, and the binding energy resulting from the interaction between those fundamental building blocks. High-precision mass measurements therefore provide relevant data for studies of the nucleus's structure, nuclear astrophysics and fundamental symmetries. In the pursuit of exotic nuclei with extreme proton-to-neutron ratios and half-lives of just a few ms, fast and sensitive experiments are required. One of those experiments, TRIUMF's Ion Trap for Atomic and Nuclear science (TITAN), is located at TRIUMF, Canada's particle accelerator center, in Vancouver. Complementing a Penning trap mass spectrometer, a Multiple-Reflection Time-Of-Flight Mass-Spectrometer (MR-TOF-MS) has been recently added to TITAN. With its capacity for fast, non-scanning, sensitive and high-resolution mass spectrometry, the MR-TOF-MS has helped to extend TITAN's measurement program to even more exotic nuclei. Here we present recent measurements of neutron-rich $^{63-65}$Cr and $^{67-70}$Fe in the region of the N=40 island of inversion, and data from the neutron-deficient nuclei $^{60-61}$Ga and $^{74-76}$Sr in the path of the rp-process. In addition we give an update on technical developments like the improvements in mass resolution to 6E5 and the increased stability of the system.

HK 41.2 Wed 14:30 HK-H7

Energy-density functionals from local chiral interactions — •Lars Zurek[1,2], Rodrigo Navarro Pérez[3], Scott K. Bogner[4], Richard J. Furnstahl[5], and Achim Schwenk[1,2,6] — [1]Technische Universität Darmstadt, Department of Physics — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Department of Physics, San Diego State University — [4]Facility for Rare Isotope Beams and Department of Physics and Astronomy, Michigan State University — [5]Department of Physics, The Ohio State University — [6]Max-Planck-Institut für Kernphysik, Heidelberg

We construct semi-phenomenological nuclear energy-density functionals starting from conventional Skyrme functionals, here considered to represent short-range physics. Pion exchanges are added explicitly at the Hartree-Fock level by applying a density-matrix expansion to local interactions derived from chiral effective field theory. We determine energy-density functionals obtained in this fashion at different orders in the chiral expansion and investigate several choices in the density-matrix expansion.

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HK 41.3 Wed 14:45 HK-H7

Precision mass measurements of actinides at SHIPTRAP — •Manuel J. Gutiérrez[1,2], Michael Block[1,2,3], Christoph E. Düllmann[1,2,3], Francesca Giacoppo[1,2], Oliver Kaleja[1,4], Kanika Kanika[1,5], Jacques J. W. van de Laar[2,3], Yury Nechiporenko[6,7], Yuri Novikov[6,7], Wolfgang Quint[1,5], and Dennis Renisch[2,3] — [1]GSI Darmstadt, Germany — [2]HIM Mainz, Germany — [3]JGU Mainz, Germany — [4]University of Greifswald, Germany — [5]University of Heidelberg, Germany — [6]PNPI Gatchina, Russia — [7]Saint Petersburg State University, Russia

The existence of superheavy nuclides is possible due to quantum-mechanical shell effects. A region of enhanced stability, dubbed *island of stability*, was long ago predicted at the next spherical shell closure above the doubly magic ^{208}Pb. Although not yet experimentally found, its location has been pinned down to around Z=114–126 and N=184. More information can be retrieved from the study of the actinides, linked to heavier nuclides by decay chains.

Penning-trap mass spectrometry provides precise measurements of atomic masses, which directly translate into binding energies. Their high-resolution measurement provides a powerful indicator of nuclear structure effects. An offline campaign for direct mass measurements of selected U and Pu isotopes was recently carried out at the SHIPTRAP mass spectrometer at GSI, usually devoted to the investigation of superheavy elements. This campaign complements the more extensive program carried out at the TRIGA-TRAP setup in Mainz. This contribution presents the first results of the SHIPTRAP campaign.

HK 41.4 Wed 15:00 HK-H7

Nuclear charge radii of neutron-deficient scandium isotopes — •Kristian König[1,2], Robert Powel[1,3], Andrew Klose[4], Stephan Fritzsche[5], Jeremy Lantis[1,6], Yuan Liu[1], Kei Minamisono[1,3], Witek Nazarewicz[1,3], Wilfried Nörtershäuser[2], Skyy Pineda[1,6], Paul-Gerhard Reinhard[7], and Dominic Rossi[2] — [1]FRIB, Michigan State University — [2]Institut für Kernphysik, Technische Universität Darmstadt — [3]Department of Physics and Astronomy, Michigan State University — [4]Department of Chemistry, Augustana University — [5]Helmholtz-Institute Jena — [6]Department of Chemistry, Michigan State University — [7]Institut für Theoretische Physik II, Universität Erlangen-Nürnberg

Charge radii of neutron deficient ^{40,41}Sc (Z=21) isotopes have been determined at the BEam COoler and LAser spectroscopy facility at FRIB to investigate the N=20 shell closure. Particularly, the typical kink structure in the charge radius evolution at N=20 is very weak in Ar, K and Ca while it is strongly pronounced at N=28. With one additional proton in the $1f_{7/2}$ shell in Sc, additional cross-shell interactions occur and affect the behavior at the shell closure. The results will be presented, which promote a global understanding of the structure around ^{40}Ca, and the weak shell-closure signature at N=20.

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HK 41.5 Wed 15:15 HK-H7

Status report on the TRIGA-Trap experiment — •Szilard Nagy[1], Klaus Blaum[1], Michael Block[2,3,4], Stanislav Chenmarev[1,5], Christoph E. Düllmann[2,3,4], Steffen Lohse[2,3], and Jacques J. W. van de Laar[2,3] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, DE — [2]Department Chemie - Standort TRIGA, Johannes Gutenberg-Universität Mainz, DE — [3]Helmholtz-Institut Mainz, DE — [4]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, DE — [5]Petersburg Nuclear Physics Insitute, Gatchina, RU

The TRIGA-Trap setup [1] is a double Penning-trap mass spectrometer at the research reactor TRIGA Mainz. Currently we are performing high-precision mass measurements of long-lived transuranium isotopes. A new cylindrical measurement trap made possible the implementation of the phase-imaging ion cyclotron resonance (PI-ICR) technique [2], originally developed at SHIPTRAP. The current status including results for several long-lived actinide isotopes will be presented. Our results find application in nuclear structure studies and provide reliable atomic mass anchor points in the transuranium region.

1. J. Ketelaer *et al.*, Nucl. Instrum. Meth. A **594**, 162-177 (2008).
2. S. Eliseev *et al.*, Phys. Rev. Lett. **110**, 082501, (2013).