Recent mass measurements of exotic neutron-deficient nuclides below ^{100}Sn at the FRS Ion Catcher and at JYFLTRAP

Z. Ge,[1,2] M. Reponen,[2] A. Mollaebrahimi,[3,4,6] T. Eronen,[2] W. R. Plaß,[1,3] T. Dickel,[1,3] D. Amanbayev,[3] S. A. Andrés,[1,3] S, Beck,[1,3] J. Bergmann,[3] A. Blazhev,[7] H, Geissel,[1,3] M. Górska,[1] F. Greiner,[3] E. Haettner,[1] M. Hukkanen,[2] B. S. Hu,[4] A. Kankainen,[2] N. Kalantar-Nayestanaki,[6] G. Kripko-Koncz,[3] Y. H. Lam,[5] I. D. Moore,[2] Ivan Miskun,[3] D. A. Nesterenko,[2] S. Nikas,[2] F. Nowacki,[8] C. Hornung,[1] C. Scheidenberger,[1,3,9] A. Zadvornaya,[3] and the IGISOL, FRS-IC Collaboration

[1] *GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany*
[2] *Department of Physics, University of Jyväskylä, P.O. Box 35, FI-40014, Jyväskylä, Finland*
[3] *II. Physikalisches Institut, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany*
[4] *TRIUMF, 4004 Wesbrook Mall, Vancouver, BC V6T 2A3, Canada*
[5] *Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou 730000, People's Republic of China*
[6] *ESRIG, University of Groningen, Zernikelaan 25, 9747 AA, Groningen, the Netherlands*
[7] *Institut für Kernphysik, Universität zu Köln, Zülpicher Straße 77, D-50937 Köln, Germany*
[8] *Université de Strasbourg, CNRS, IPHC UMR, Strasbourg, 7178, F-67000, France*
[9] *Helmholtz Research Academy Hesse for FAIR (HFHF), GSI Helmholtz Center for Heavy Ion Research, Gießen, 35392, Germany*

The heavy N=Z and neighboring nuclei have been actively investigated both theoretically and experimentally due to their importance in nuclear structure studies and high impact in modelling nuclear astrophysical processes. Direct mass measurements of very exotic neutron-deficient nuclides in ground and isomeric states around the N=50 shell closure below ^{100}Sn have been recently performed at the IGISOL facility/Finland [1,2] and the FRS Ion Catcher (FRS-IC) at GSI/Germany [3,4]. In this contribution, the results from these two experiments will be reported.

At IGISOL, the atomic masses of $^{95-97}$Ag have been measured recently with the JYFLTRAP Penning trap setup [2]. Additionally, the excitation energy of the low-lying isomeric state in ^{96}Ag was measured with a precision of ~1 keV/c^2. The time-of-flight ion-cyclotron resonance (TOF-ICR) [5] and the phase-imaging ion-cyclotron-resonance (PI-ICR) method [6,7] were employed in the measurements. With the PI-ICR technique, atomic masses of long-predicted β-decaying 2^+ and 8^+ states in ^{96}Ag have been identified and measured for the first time. The newly measured masses have been utilized to investigate the N=50 neutron shell closure and the proton-neutron interaction. Ab initio theoretical calculations have been employed and compared to the experimental results in terms of the empirical shell-gap energies. Preliminary results of the new mass values used as inputs for modelling the astrophysical rapid proton-capture process have also been obtained.

At the FRS [8], projectile fragmentation of ^{124}Xe has been employed to produce exotic fragments in a similar mass region. Masses of 14 ground states and two isomers ($43<Z<49$) have been measured using the multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) of the FRS-IC [3,4]. Relative mass uncertainties down to 1×10^{-7} [9] have been reached [9]. The masses of ^{98}Cd and ^{97}Rh were directly measured for the first time. A new Q_{EC} value has been obtained for ^{98}Cd, resulting in a refined summed Gamow-Teller (GT) strength *B(GT)*. Investigation of this result in state-of-the-art shell model approaches accounting for the first time for the experimentally observed spectrum of GT transitions points to a good agreement for the N=50 isotones. The results favor the recent *B(GT)* value from the beta decay experiment reported by RIKEN [10] and calls for future investigations on ^{100}Sn. The excitation energy of the long-lived isomeric state in ^{94}Rh has been determined for the first time with an uncertainty of 21 keV. This result combined with the shell model calculations allows us to understand the level ordering in ^{94}Rh.

[1] M. Reponen et al., Nat Commun 12, 4596 (2021).
[2] T. Eronen et al., Eur. Phys. J. A 48, 46 (2012).
[3] W.R. Plaß et al., Nucl. Instrum. Meth. B 317 457 (2013).
[4] T. Dickel et al., Nucl. Instrum. Meth. A 777 172 (2015).
[5] M. König et al., Int. J. Mass Spectrom. Ion Process. 142, 95 (1995).
[6] S. Eliseev et al., Phys. Rev. Lett. 110, 082501 (2013).
[7] D. A. Nesterenko et al., Eur. Phys. J. A 54, 154 (2018).
[8] H. Geissel et al., Nucl. Instrum. Meth. B 70 286 (1992).
[9] A. Mollaebrahimi et al., Physics Letters B 839 137833 (2023).
[10] D. Lubos et al., Phys. Rev. Lett. 122, 222502 (2019).