HK 41: Kernphysik / Spektroskopie

Zeit: Donnerstag 16:30–19:00 Raum: 2G

Gruppenbericht HK 41.1 Do 16:30 2G

Nuclear Structure of the Heaviest Nuclei: K-isomers and other Features — •D. Ackermann[1], F.P. Hessberger[1], S. Antalic[2], M. Block[1], S. Heinz[1], R.-D. Herzberg[3], S. Hofmann[1,4], J. Khuyagbaatar[1,5], I. Kojouharov[1], R. Mann[1], K. Nishio[6], B. Streicher[2], B. Sulignano[1], and M. Venhart[2] — [1]GSI, Darmstadt, Germany — [2]Univ. Bratislava, Slovakia — [3]Univ. Liverpool, United Kingdom — [4]Univ. Frankfurt, Germany — [5]Univ. St. Petersburg, Russia — [6]JAEA, Tokai, Japan

The borderlines of the chart of nuclei are in the focus of interest of the nucear physics community. Ambitious projects to reach extreme isospin and to push towards the limits of stability are on the books of the funding agencies worldwide. New features of nuclear matter are expected under these extreme conditions. The quantum mechanical properties and the evolution of the shell model will be probed. In our endeavour to approach the predicted "island of stability"at Z=114, 120 or 126 and N=184 we performed, apart from the search for new elements, also nuclear structure studies for heaviest nuclei. The isomeric states that we recently observed in ^{252}No and ^{270}Ds are only two examples of the many facets of interesting physics to be discovered in this region. Systematic investigation of the nuclear structure is also essential for a successful progress in element synthesis. In radioactive decay studies, i.e. evaporation residue (ER)-α-γ coincidences of ERs implanted into a Si detector after a separator, we studied features like K-isomerism and the trend of single particle levels in isotopic and isotonic chains in the region of Z = 100 (fermium) to 110 (darmstadtium).

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Bahnverfolgungssimulationen mit Rückstoßionen für das WITCH-Experiment — •Peter Friedag, Marcus Beck und Christian Weinheimer — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

Das WITCH-Experiment untersucht den Kern-Beta-Zerfall von Ionen in einer Penningfalle unter Verwendung eines Retardierungsspektrometers. Damit wird ein Rückstoßspektrum gemessen, aus welchem sich die Beta-Neutrino-Winkelkorrelation a extrahieren läßt. Dies erlaubt Rückschlüsse auf einen skalaren Beitrag in der Schwachen Wechselwirkung. Das Ziel des WITCH-Experiments ist es a mit einer Genauigkeit von $\Delta a < 0.5\%$ zu bestimmen.

In Münster werden Bahnverfolgungssimulationen durchgeführt, mit dem Ziel die Elektrodenkonfiguration des Spektrometers zu optimieren. Eine andere Anwendung besteht darin, mit Hilfe von Monte-Carlo-Simulationen das gemessene Rückstopßspektrum zu analysieren. Es wurden Simulationen zu den Messungen der Strahlzeiten im Oktober 2006 mit ^{124}In und im Oktober 2007 mit ^{35}Ar durchgeführt. Einige dieser Resultate werden in diesem Vortrag präsentiert.

HK 41.3 Do 17:15 2G

Discovery of new n-rich isotopes and new isomers produced via Uranium projectile fragmentation and analyzed with Schottky spectroscopy at the FRS-ESR facility — •L. Chen[1,2], K. Beckert[1], P. Beller[1], F. Bosch[1], D. Boutin[1,2], I. Cullen[3], B. Franzke[1], H. Geissel[1,2], M. Hausmann[4], R. Knöbel[1,2], C. Kozhuharov[1], S.A. Litvinov[1,2], Yu.A. Litvinov[1,2], Z. Liu[3], F. Montes[4], G. Münzenberg[1], F. Nolden[1], W.R. Plass[2], Z. Podolyak[3], C. Scheidenberger[1,2], M. Shindo[5], M. Steck[1], B. Sun[1], P.M. Walker[3], H. Weick[1], and M. Winkler[1] — [1]GSI, Darmstadt — [2]JLU, Giessen — [3]Uni. Surrey — [4]MSU, East Lansing — [5]Uni. Tokyo

A large area in the neutron-rich region 82$\leq$ Z $\leq$92 has been investigated in a recent experiment with ^{238}U projectile fragments at the FRS-ESR facility. The fragments were separated in flight by the FRS and injected into the storage-cooler ring ESR. The ions stored in ESR were cooled by electron cooling and measured with time-resolved Schottky Mass Spectrometry.

5 new isotopes (e.g. ^{220}Po and ^{224}At) and 7 new isomers (e.g. ^{213m}Bi,^{214m}Bi and ^{234m}Ac) have been discovered by Schottky analysis. Furthermore, more than ten masses have been measured for the first time. The experimental setup, the data analysis and results will be presented. The observed new isotopes and isomers will be discussed in more detail.

HK 41.4 Do 17:30 2G

Recent results from SHIP on shape coexistence and electron capture delayed fission in the Pb-Rn region* — •Andrei Andreyev — Insituut voor Kern- en Stralingfysica, Univesity of Leuven, B-3001 Leuven, Belgium — (on behalf of Leuven-Bratislava-Darmstadt-Liverpool-Vancouver-Tokai Collaboration)

The contribution reviews the results of our recent experiments at SHIP (GSI, Darmstadt) aimed at the study of very neutron-deficient Pb-Rn nuclides in the vicinity of N=104.

The first part presents the unambiguous identification of the EC-delayed fission (ECDF) in the odd-odd isotopes ^{192,194}At. The ECDF data allow us to study the fission properties of the nuclei which do not decay via spontaneous fission at all. The preliminary analysis indicate unusually high ECDF probabilities for these nuclides.

The second part discusses the new data on the shape coexistence in the Pb region. Identification of the new isotopes ^{193,194}Rn and first experimental evidence for the long-sought ground state deformation in lightest Rn isotopes will be presented. The strong retardation (by a factor of $\sim$10) of the half-life of the new isotope ^{186}Po relative to the classical Geiger-Nuttall rule for alpha decay will be also discussed. This indicates that the Geiger-Nuttall rule is broken in the lightest Po isotopes.

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Kernresonanzfluoreszenz mit linear polarisierten Photonen am HIγS * — •Matthias Fritzsche[1], Norbert Pietralla[1], Genchov Rusev[3], Deniz Savran[1], Kerstin Sonnabend[1], Anton P. Tonchev[3], Henry R. Weller[3], Andreas Zilges[2] und Markus Zweidinger[1] — [1]Institut für Kernphysik, TU Darmstadt, 64289 Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, 50937 Köln, Germany — [3]Duke Free Electron Laser Laboratory (DFELL), Duke University, Durham, NC 27708, U.S.A.

An der High Intensity γ-ray Source (HIγS) der DUKE University wurde mit Hilfe von quasi monochromatischen, zu 100% linear polarisierten Photonen Streuexperimente durchgeführt.[1] Dabei konnten in den Kernen ^{40}Ar, ^{203,205}Tl und ^{206,207,208}Pb verschiedenen Zuständen Spin und Parität zugewiesen werden. Der hohe Polarisationsgrad ($P_\gamma > 99\%$) ermöglicht dabei Spin und Paritätszuweisungen auch in ungeraden Kernen wie ^{207}Pb und den Thallium Isotopen. Insgesamt konnten somit für 8 Zuständen eindeutige Aussagen getroffen werden.

[1] N. Pietralla *et al.*, Phys. Rev. Lett.**88** 012502 (2002).

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HK 41.6 Do 18:00 2G

Zustände mit reiner Konfiguration in ^{208}Pb — •Andreas Heusler[1] und Peter von Brentano[2] — [1]MPI für Kernphysik, Heidelberg — [2]Institut für Kernphysik, Uni Köln

Bei der inelastischen Protonstreuung an ^{208}Pb nahe den Analogresonanzen in ^{209}Bi sind mehr als 300 Zustände in ^{208}Pb bis Ex=7.6 MeV identifiziert worden [1-2]. Darunter sind mehr als 30 Zustände mit unnatürlicher Parität und einige Zustände mit natürlicher Parität als recht reine Konfigurationen mit einer Stärke von über 90% bestimmt worden. Die Verschiebungen gegenüber dem schematischen Schalenmodell ohne Restwecbselwirkung machen bis zu 600 keV aus. Sie können durch eine 2-Parameter-Funktion wiedergegeben werden, die auch die Anregungsenergien der tiefsten Zustände in anderen Kernen erklären.

[1] A. Heusler et al, Phys. Rev. C74, 03403 (2006) [2] A. Heusler et al, INPC 2007, http://inpc2007.riken.jp/F/F4-heusler.pdf

HK 41.7 Do 18:15 2G

High-resolution study of dipole excitations in ^{208}Pb with polarized proton scattering at 0°* — •Iryna Poltoratska[1], Tatsuya Adachi[2], John Carter[3], Hirohiko Fujita[3,4], Yoshitaka Fujita[2], Jens Hasper[1], Kichiji Hatanaka[2], Yaroslav Kalmykov[1], Maiko Kato[2], Hiroaki Matsubara[2], Peter von Neumann-Cosel[1], Vladimir Ponomarev[1], Achim Richter[1], Harutaka Sakaguchi[5], Yasuhiro Sakemi[2], Yohei Shimizu[2], Yuji Tameshige[2], Atsushi

Tamii[2], Masaru Yosoi[2], and Juzo Zenihiro[5] — [1]Institut für Kernphysik, TU Darmstdat, — [2]RCNP, Osaka University, Japan — [3]School of Physics, University of Witwatersrand, — [4]iThembaLABS, South Africa — [5]Department of Physics, Kyoto University, Japan

At angles close to 0° one can study dipole modes which apart from the isovector giant dipole resonance, are poorly understood. Recent experimental progress at RCNP Osaka, Japan [1], allows measurements of intermediate-energy polarized inelastic proton scattering at and near 0° combined with high energy resolution. This new experimental opportunity was applied for an investigation of an exotic electric dipole mode, the so-called toroidal mode. Extensive model calculations show that a unique signature of such excitations may be found in the Coulomb-nuclear interference region. Measurements of the angular distribution and polarization transfer coefficients for E1 excitations might provide direct evidence of the toroidal mode. First results from the experiments will be presented.

[1] A. Tamii et al., Nucl. Phys. A788 (2007) 53.

* Supported by the DFG through SFB 634.

HK 41.8 Do 18:30 2G

Photo-induced fission of ^{238}U with bremsstrahlung at the S-DALINAC — •Markus Köhler[1], Joachim Enders[1], Franz-Josef Hambsch[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3], Stephan Oberstedt[2], Sarla Rathi[1], Achim Richter[1], and Artem Shevchenko[1] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]EC-JRC Institute for Reference Materials and Measurements, Geel, Belgium — [3]Institutionen för Naturvetenskap, Örebro Universitet, Sweden

Photo-induced fission of ^{238}U has been studied using bremsstrahlung with endpoint energies between 6.0 MeV and 8.5 MeV at the injector of the superconducting Darmstadt electron linear accelerator S-DALINAC in prepraration of planned experiments on parity-violation. Fission fragments have been measured using a double ionization chamber with Frisch grids. The emission angles of the fragments with respect to the incident photon beam direction have been determined from drift-time measurements. Experimental setup, data analysis, and results for the mass distributions, total kinetic energy distributions, and angular distribtions will be presented.

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HK 41.9 Do 18:45 2G

New points of view on the various aspects of nuclear fission — Genevieve Mouze and •Christian Ythier — Faculte des Sciences, Universite de Nice,France

It can be shown that the symmetric,or bimodal, fission of 258Fm results from a kind of leak through the barrier created by the Coulomb energy of the fission products.Indeed,the total fission energy of the fragment pairs 128Sn-130Sn and 126Sn-132Sn is greater than the Coulomb barrier of these pairs; this explains the considerable fission yield at A about 129.This observation suggests a new description of binary fission and to define new types of fission barrier.In heavy nuclei, symmetric fission can be in competition with cluster-fission, also called quasi-fission. In superheavy nuclei, cluster-fission takes the place of symmetric fission.It can be shown that there exist two different modes of ternary fission.