HK 66: Struktur und Dynamik von Kernen XI

Zeit: Freitag 14:00–16:00 Raum: HG V

Gruppenbericht HK 66.1 Fr 14:00 HG V

Recent Results of Mass Measurements at the Experimental Storage Ring at GSI — •Ronja Knöbel for the FRS-ESR-Collaboration — GSI, Darmstadt, Germany

The combination of the fragment separator FRS and the cooler-storage ring ESR is used to perform high accuracy mass and lifetime measurements of exotic nuclei at GSI. The Schottky Mass Spectrometry gives the opportunity to measure masses down to half-lives in the second-range. For shorter-lived isotopes Isochronous Mass Spectrometry is applied.
In this talk the progress in these techniques will be shown and recent results on mass measurements of exotic nuclei produced in fission and fragmentation processes of uranium will be presented, which led, besides the mass measurements of several isotopes for the first time, to the discovery of new isotopes and isomers and yielded new information on nuclear structure aspects, e.g. pairing and nucleon separation energies, shell evolution, and proton-neutron interactions. A comparison to theoretical predictions will be given. Future aspects and developments for upcoming measurements at the current facility at GSI and the future facility FAIR will be discussed.

HK 66.2 Fr 14:30 HG V

Orbital electron capture of stored H-like ions — •Nicolas Winckler for the GO-Collaboration — MPIK, Heidelberg, Germany — GSI, Darmstadt, Germany

The accelerator facility of GSI Darmstadt with the heavy ion synchrotron SIS coupled via the projectile fragment separator FRS to the experimental storage ring ESR offers the unique opportunity to study the beta decay of highly ionized atoms. It is possible to produce, separate, and store for extended periods of time exotic nuclei with a well-defined number of bound electrons. Basic nuclear properties such as masses and lifetimes are measured by applying the mass- and time-resolved Schottky Mass Spectrometry (SMS). The change of the mass in a radioactive decay is evidenced by a corresponding correlated change of the revolution frequency. The area of the Schottky frequency peak is proportional to the number of stored ions and to the square of the atomic charge state, q^2. This allows us to precisely determine the fate of each stored ion.

In this contribution we discuss experiments performed at the FRS-ESR on orbital electron capture (EC) decay of hydrogen-like ^{140}Pr, ^{142}Pm, and ^{122}I ions. Decay events accounting for nuclear electron capture processes have been unambiguously identified and the time between production and decay has been measured. The obtained results show a significant deviation from the expected exponential decay. The interpretation of this effect is widely disputed in literature and will be discussed. The status of the data analysis, and future perspectives will be outlined.

Gruppenbericht HK 66.3 Fr 14:45 HG V

Überraschende Kollektivität in neutronenreichen Eisenisotopen — •Wolfram Rother[1], Alfred Dewald[1], Matthias Hackstein[1], Christoph Fransen[1], Thomas Pissulla[1], Jan Jolie[1], Karl-Oskar Zell[1], Gunnar Friessner[1], Krzysztof Starosta[2,6], Thomas Glasmacher[2], Alexandra Gade[2], Dirk Weisshaar[2], Hironori Iwasaki[2], David Miller[2], Philip Voss[2], Thomas Baumann[2], Daniel Bazin[2], Tom Ginter[2], Heather Crawford[2], Travis Baugher[2], Andrew Ratkiewicz[2], Sean McDaniel[2], Pavel Petkov[3], Calin Ur[4], Silvia Lenzi[4] und Gabriela Ilie[5] — [1]Institut für Kernphysik der Universität zu Köln, D-50937 Köln — [2]NSCL, MSU, East Lansing, MI, USA — [3]INRNE, BAS, Sofia, Bulgarien — [4]Univ. Padova, Italien — [5]WNSL, Yale Univ., New Haven, CT, USA — [6]SFU, Burnaby, BC, Kanada

Wir berichten über die Messung von absoluten $2_1^+ \rightarrow 0_1^+$ Übergangswahrscheinlichkeiten in ^{62}Fe, ^{64}Fe und ^{66}Fe mittels der Recoil Distance Doppler Shift Methode. Am NSCL wurden Niveaulebensdauern von Fragmentationsprodukten nach Coulombanregung in inverser Kinematik mit dem Kölner Plunger für mittlere Strahlenergien ($\approx 90 MeV/u$) gemessen. Bis dato veröffentlichte Schalenmodellrechnungen beschreiben zwar die mit zunehmender Neutronenzahl sinkende Übergangsenergie, können aber nicht den hier präsentierten Zuwachs an Kollektivität erklären. Im Vortrag werden Details des Experiments vorgestellt und diskutiert. Gefördert durch die DFG Sachbeihilfe DE 1516/1-1.

HK 66.4 Fr 15:15 HG V

Isomer spectroscopy of ^{125,127}Cd — •F. Naqvi[1,2], M. Górska[2], L. Cáceres[2,3], A. Jungclaus[3], M. Pfützner[4], H. Grawe[2], S. Pietri[2], P.H Regan[5], D. Rudolf[6], and Z. Podolyák[5] for the RISING-Collaboration — [1]Institut für kernphysik, Universitat zu Köln, Germany — [2]GSI, Helmholtzzentrum für Scwerionenforschung, Darmstadt, Germany — [3]Departmento de fisicia Teórica, Universidad Autonóma de Madrid , Spain — [4]IEP,Warsaw University, Warsaw — [5]Department of Physics, University of Surrey, Guildford ,UK — [6]Department of Physics, Lund University, Sweden

The results of investigations of isomeric decay in odd mass heavy Cd isotopes namely ^{125,127}Cd will be reported. To date information has been obtained on even mass heavy Cd isotopes and the sytematics show evolution of single particle energies for them. The experiment was performed at GSI, Darmstadt to investigate the single particle level structure of odd mass heavy Cd isotopes . Nuclei of interest were produced in fragmentation reaction of ^{136}Xe beam at energy 750MeV/u on a ^{9}Be target of 4g/cm^2 thickness. Selection of ions from unwanted reaction products and event by event identification was facilitated by FRagment Separator (FRS). Isomers populated in the reaction were implanted in a plastic catcher surrounded by 15 Ge cluster detectors from RISING array to detect gamma radiations. Level scemes based on the intensity balance and life time information were constructed for the first time for these nuclei. Comparison of the experimental results with shell model calculation will be discussed.

HK 66.5 Fr 15:30 HG V

Coulomb-Excitation of the exotic, neutron-rich nuclei ^{94}Kr and ^{96}Kr — •Michael Albers[1], Nigel Warr[1], Dennis Mücher[1], Andrey Blazhev[1], and Jarno van de Walle[2] for the MINIBALL IS485-Collaboration — [1]Institut für Kernphysik, Universität zu Köln — [2]PH Department, Cern, Switzerland

Nuclei in the neutron-rich A∼100 mass region are well suited for the understanding of the development of collectivity. By adding only a few neutrons to the N=50 shell closure, collective effects can quickly occur. For the Z=40 (Zr) isotopes, N=56 becomes an effective shell closure, so that ^{96}Zr is quoted as a doubly-magic nucleus. Adding only a few neutrons more, the Zr-isotopes get strongly deformed. This behavior indicates a shape phase transition at N=60 from spherical to deformed shapes. For the Z=38 (Sr) and Z=42 (Mo) isotopes the systematics show a similar behavior, whereas for the Z=44 (Ru) isotopes, this rapid change of shape seems to be attenuated.
The aim of our work was to investigate the behavior of the Z=36 (Kr) isotopes in this phase transition region by determining the energies of the 2_1^+ states and their E2 decay transition strengths to the ground state in ^{94}Kr (N=58) and ^{96}Kr (N=60). Therefore, we performed two experiments at REX-ISOLDE at CERN, utilizing the high-efficiency MINIBALL γ-ray spectrometer and analyzing the emitted γ-rays and scattered particles after the Coulomb-excitation reactions ^{196}Pt(^{94}Kr, ^{94}Kr*)^{196}Pt* and ^{196}Pt(^{96}Kr, ^{96}Kr*)^{196}Pt*. We will show and discuss the preliminary results.
This work was supported by BMBF under Grant 06KY205I.

HK 66.6 Fr 15:45 HG V

REX-ISOLDE Coulex Experimente mit radioaktiven Kernen um A=140 – B(E2) Werte, Lebensdauern, magnetische Momente * — •Christopher Bauer[1], Jörg Leske[1], Thorsten Kröll[1], Norbert Pietralla[1], Vinzenz Bildstein[2], Roman Gernhäuser[2], Reiner Krücken[2] und Rudi Lutter[3] — [1]Institut für Kernphysik, TU Darmstadt, 64289 Darmstadt — [2]Physik-Department E12, TU München, 85748 Garching — [3]Maier-Leibnitz-Laboratorium, LMU München, 85748 Garching

Es wurden Projektil-Coulomb-Anregungsexperimente mit den radioaktiven Projektilen ^{140,142}Ba und ^{140}Xe an REX-ISOLDE durchgeführt. Als Target für die Coulomb-Anregung dienten eine 0.9mg/cm^2 dicke Folie aus ^{96}Mo sowie ein Stopper aus ^{nat}Cu. Die Gammastrahlung wurde mit dem MINIBALL-Spektrometer detektiert, ein doppelseitiger CD-Detektor (Si) wurde zur Teilchenidentifizierung benutzt.

Die Coulomb-Anregungsquerschnitte der 2_1^+ Zustände und γ-Teilchen Winkelkorrelationen für ihre Zerfälle wurden gemessen. Durch einen Vergleich mit Berechnungen der rein elektromagnetischen Anregungsprozesse konnten die B(E2) Übergangsstärken bestimmt werden.

Die Recoil-in-vacuum Methode [1,2] wurde zum ersten Mal an REX-ISOLDE getestet und erlaubt eine Abschätzung über den $g(2_1^+)$-Faktor in ^{140}Ba.

[1] N. J. Stone et al., Phys. Rev. Lett. **94**, 192501 (2005)
[2] A. E. Stuchberry and N. J. Stone, Phys. Rev. C **76**, 034307 (2007)
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