HK 51: Structure and Dynamics of Nuclei X

Zeit: Donnerstag 14:00–16:00 Raum: S1/01 A03

HK 51.1 Do 14:00 S1/01 A03

Beobachtung des gemischt-symmetrischen Ein-Phononen-$2^+_{1,ms}$-Zustands von ^{204}Hg — •Robert Stegmann[1], Thomas Möller[1], Norbert Pietralla[1], Georgi Rainovski[2], Christian Stahl[1], Marc Lettmann[1], Robert Janssens[3], Mike Carpenter[3] und Shaofei Zhu[3] — [1]Institut für Kernphysik, TU Darmstadt — [2]Faculty of Physics, St. Kliment Ohridski University Sofia, Bulgarien — [3]Argonne National Laboratory, Argonne, IL, USA

Im Rahmen des Interacting Boson Modells ergeben sich Proton-Neutron gemischt-symmetrische Zustände als Vertreter niedrigliegender Anregungen mit isovektoriellem Charakter. Der grundlegende gemischt-symmetrische Zustand in schwach kollektiven Kernen ist der stark mit dem 2^+_1-Zustand verwandte Ein-Quadrupol-Phonon-$2^+_{1,ms}$-Zustand. Bisher wurden solche Zustände in stabilen Kernen der Region um $A \approx 90$ und kürzlich auch um $A \approx 130$ untersucht. In der Umgebung des schwersten stabilen doppeltmagischen Kerns ^{208}Pb hingegen wurden noch keine solchen Zustände identifiziert. Als einzig stabiler Kern in der unmittelbaren Nachbarschaft mit $2\pi - 2\nu$-Struktur erweist sich ^{204}Hg. Aus diesem Grund wurde am Argonne National Laboratory ein Experiment durchgeführt, bei dem ^{204}Hg-Projektile mit dem ATLAS-Beschleuniger auf 890 MeV beschleunigt und beim Durchgang durch ein ^{nat}C-Target Coulomb-angeregt wurden. Gammastrahlung wurde mit dem Gammasphere-Spektrometer detektiert. Ergebnisse werden präsentiert und mit Rechnungen aus dem „quasiparticle phonon model“ verglichen. Gefördert durch die DFG unter Pi 393/2-3 und durch das BMBF unter 05P12RDCIB und 05P15RDCIA.

HK 51.2 Do 14:15 S1/01 A03

Identifikation niederenergetischer isovektorieller Oktupol-Zustände in ^{144}Nd — •Michael Thürauf, Thorsten Kröll und Marcus Scheck für die EXILL-Kollaboration — Institut für Kernphysik, TU Darmstadt, Germany

Isovektorielle Oktupolzustände, sog. „mixed-symmetry“ Zustände, werden im Rahmen des sdf-IBM-2 vorhergesagt. Die sichere Identifikation liefert einen wesentlichen Beitrag zur Dekomposition der Oktupol-Oktupol-Restwechselwirkung in einen isoskalaren und isovektoriellen Anteil. Dies trägt wesentlich zum Verständnis des Oktupolfreiheitsgrades bei.

In ^{144}Nd ist der 3^-_3-Zustand bei 2778 keV ein guter Kandidat für einen solchen „mixed-symmetry“ Oktupol-Zustand. Für den Übergang von einem „mixed-symmetry“ Oktupol-Zustand in den symmetrischen 3^-_1-Zustand erwartet man eine starke $M1$-Komponente. Um die Natur dieses Zustandes zu klären, wurde 2012 im Verlauf der (n,γ)-Kampagne mit dem EXILL-Aufbau am ILL, Grenoble, ein ^{143}Nd(n,γ)-Experiment durchgeführt. Mit den Daten aus dieser Kampagne war es möglich, die Multipolmischungsverhältnisse δ der Übergänge $3^-_i \rightarrow 3^-_1$ zu bestimmen und damit die Natur der 3^-_i-Zustände festzulegen. Die Bestimmung der Linearpolarisation und dem damit verbundenen Strahlungscharakter σ durch Compton-Polarimetrie der $3^-_i \rightarrow 3^-_1$-Übergänge wird zurzeit noch ausgewertet. Erste vorläufige Ergebnisse sowie ein Ausblick auf die bevorstehende Lebensdauermessung des 3^-_3-Zustandes mit GAMS@ILL werden gezeigt.

Gefördert durch die DFG (KR 1796/2-1) und HGS-HIRe for FAIR.

HK 51.3 Do 14:30 S1/01 A03

Probing the O(6) character of ^{196}Pt with inelastic electron scattering — •Simela Aslanidou, Sergej Bassauer, Christoph Kremer, Andreas Krugmann, Peter von Neumann-Cosel, Norbert Pietralla, Maxim Singer, and Volker Werner — Institut für Kernphysik, Technische Universität Darmstadt

The Interacting-Boson-Model (IBM) [1] provides an elegant tool to classify low-lying collective states in medium and heavy mass even-even nuclei. One of its dynamical symmetries is O(6) and a crucial test of this theory is to investigate the monopole transitions to the band head of the K=0 , σ=N-2 band. A powerful tool to investigate monopole transitions is inelastic electron scattering. An experiment on ^{196}Pt -claimed to be a perfect O(6) nucleus [2]- has been recently completed at the superconducting electron linear accelerator S-DALINAC at Darmstadt using the high resolution LINTOTT spectrometer. The experiment and analysis results will be presented as well as the interpretation within the framework of IBM.

This work was supported by the DFG under contract SFB 634.

[1] F. Iachello, Phys. Rev. Lett. **87**, 052502 (2001)
[2] J. Cizewski et al., Phys. Rev. Lett. **40**, 167 (1978)

HK 51.4 Do 14:45 S1/01 A03

Study of the neutron deficient nucleus ^{180}Pt — •Claus Müller-Gatermann[1], Christoph Fransen[1], Alfred Dewald[1], Thomas Braunroth[1], Julia Litzinger[1], Jan Jolie[1], Karl-Oskar Zell[1], Rauno Julin[2], Tuomas Grahn[2], and Pavel Petkov[3] — [1]Institut für Kernphysik, Universität zu Köln, Deutschland — [2]Dept. of Physics, University of Jyväskylä, Finnland — [3]Bulgarian Academy of Sciences, Sofia, Bulgarien

The nuclei ^{176,178,180}Os are known to show the characteristic features of the critical point symmetry X(5). This symmetry was introduced by F. Iachello and describes nuclei at the critical point of deformation phase transition from a vibrator to axial rotor. A rapid change in deformation is expected when the proton number is changed, because the neutron number is close to mid-shell. Therefore we performed measurements to determine the lifetimes of low lying states in ^{180}Pt which is a neighbor of the X(5) type Os nuclei, from which absolute transition probabilities can be deduced directly. In this contribution we will report on a Recoil distance Doppler shift experiment which was performed at the JYFL, Jyväskylä (Finland). Furthermore the results of the ^{168}Yb(^{16}O,4n)^{180}Pt experiment using the fast timing technique to determine the lifetime of the rather longlived first 2+ state at the IKP, University of Cologne (Germany) will be presented. The experimental results will be discussed in the framework of the Interacting Boson Model and compared to a General Collective Model calculation. Supported by the Project ENSAR in the seventh framework programme, and the DFG under contract number DE 1516/3-1 and JO 391/16-1

HK 51.5 Do 15:00 S1/01 A03

Mixed-symmetry states and shape coexistence in N=52-56 Mo isotopes — •V. Werner[1,2], T. Thomas[2,3], J. Jolie[3], K. Nomura[4,5], T. Ahn[2,6], N. Cooper[2], H. Duckwitz[3], A. Fitzler[3], C. Fransen[3], A. Gade[3,7], M. Hinton[2], G. Ilie[2], K. Jessen[3,8], A. Linnemann[3], P. Petkov[3,9], N. Pietralla[1], and D. Radeck[3,10] — [1]IKP, TU Darmstadt — [2]WNSL, Yale U — [3]IKP, U Köln — [4]GANIL — [5]U Zagreb — [6]U Notre Dame — [7]NSCL, Michigan State U — [8]LMU München — [9]Bulg. Acad. Sci., Sofia — [10]PTB Braunschweig

Angular correlation experiments have been performed on ^{96}Mo and ^{98}Mo [1] at the IKP, Universität zu Köln, and at WNSL, Yale University. Lifetimes of excited states have been determined from line shape analyses. The extensive data set, compared to IBM-2 configuration mixing calculations based on microscopic EDFs, reveals the occurrence of coexistence of near-spherical and deformed configurations in both Mo isotopes. Furthermore, the main fragments of one-phonon mixed-symmetry 2^+ states have been identified. The systematic of their decay behavior in the Mo chain from N=52 to 56, namely the crossing of the strongest M1 decay branch to the first and second 2^+ states as a function of neutron number, suggests a new signature for shape coexistence. Supported through U.S. DOE Grant No. DE-FG02-91ER-40609 and DFG grant SFB 634.

[1] T. Thomas *et al.*, Phys. Rev. C **88**, 044305 (2013).

HK 51.6 Do 15:15 S1/01 A03

First measurement of the decoupling parameter for the $K = 1$ band of ^{156}Gd ⋆ — •Tobias Beck[1], Jacob Beller[1], Vera Derya[2], Udo Gayer[1], Johann Isaak[3,4], Bastian Löher[3,4], Norbert Pietralla[1], Philipp Ries[1], Christopher Ries[1], Marcus Scheck[1,5,6], Werner Tornow[7], Henry R. Weller[7], Volker Werner[1], and Markus Zweidinger Markus[1] — [1]IKP, TU Darmstadt — [2]IKP, Universität zu Köln — [3]EMMI, GSI, Darmstadt — [4]FIAS, Frankfurt — [5]School of Engineering, UWS Paisley, UK — [6]SUPA, Glasgow, UK — [7]Duke University, Durham, USA

In a deformed nucleus the nuclear states are combinations of an intrinsic motion and a rotational motion of the core. In this scenario the Coriolis force changes the projection of the angular momentum on the symmetry axis and admixes different K values. The effects of the Coriolis interactions have been observed experimentally for $K = 1/2$ bands. The recent observation of the first excited rotational state of the isovector low-lying $J^\pi_K = 1^+_1$ scissors mode in a (γ, γ') experiment

inaugurates a case to study the Coriolis decoupling for $K = 1$ bands. In the talk, the theoretical description provided by Bohr and Mottelson will be presented and their adaption to the particular case will be explained alongside the ongoing analysis and open questions.
⋆ Supported by the DFG within the scope of SFB 634

HK 51.7 Do 15:30 S1/01 A03

Investigation of dipole strength in ^{156}Gd up to 7.1 MeV — •E. Aciksoz[1,2], T. Beck[3], J. Beller[3], U. Gayer[3], L. Mertes[3], H. Pai[3], N. Pietralla[3], P. Ries[3], C. Romig[3], V. Werner[3], M. Zweidinger[3], J. Isaak[4,5], B. Löher[6], D. Savran[4,6], J. Silva[4,5], and M. Tamkas[4,7] — [1]Akdeniz University, Department of Physics, 07058 Antalya, Turkey. — [2]Nuclear Science Application and Research Center, Akdeniz University, 07058 Antalya, Turkey. — [3]Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt. — [4]ExtreMe Matter Institute EMMI, GSI, Darmstadt. — [5]Frankfurt Institute for Advanced Studies FIAS, Frankfurt. — [6]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt. — [7]Graduate School of Natural and Applied Sciences, Yıldız Technical University, Istanbul.

Low-lying magnetic and electric dipole strengths, the latter often referred to as the pygmy dipole resonance (PDR), has been investigated in the nucleus ^{156}Gd using the Nuclear Resonance Fluorescence (NRF) technique up to a bremsstrahlung endpoint of 7.1 MeV. The experiment was performed at the S−DALINAC using an unpolarized and continuous spectrum of bremsstrahlung photons. The fragmentation of dipole strength was found to be high. Nevertheless, NRF cross sections were determined for the strongest excitations that may be attributed to the PDR. Some of these states have been observed in an (γ, γ') experiment for the first time in ^{156}Gd. The results achieved from $^{156}Gd(\gamma, \gamma')$ experiment will be presented and discussed.

HK 51.8 Do 15:45 S1/01 A03

Low-lying dipole strength in the well-deformed nucleus ^{156}Gd — •M. Tamkas[1,2], J. Isaak[1,3], D. Savran[1,5], B. Löher[5], J. Silva[1,3], E. Aciksoz[8], T. Beck[4], J. Beller[4], U. Gayer[4], N. Pietralla[4], C. Romig[4], W. Tornow[6], H. Weller[6], V. Werner[4], A. Zilges[7], and M. Zweidinger[4] — [1]ExtreMe Matter Institute EMMI, GSI, Darmstadt — [2]Graduate School of Natural and Applied Sciences, Yıldız Technical University, Istanbul — [3]Frankfurt Institute for Advanced Studies FIAS, Frankfurt — [4]Institut für Kernphysik, Technische Universität, Darmstadt — [5]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [6]Department of Physics, Duke University, TUNL, Durham, USA — [7]Institut für Kernphysik, Universität zu Köln — [8]Department of Physics, Akdeniz University, Turkey

In this study the dipole strength has been investigated in the well-deformed nucleus ^{156}Gd using the method of Nuclear Resonance Fluorescence (NRF). The NRF experiment was performed at the High Intensity $\vec{\gamma}$-ray Source at Duke University in combination with the γ^3 setup [1] using a mono-energetic and linearly polarised beam. The dipole strength of ^{156}Gd has been studied with photon beam energies between 3 MeV and 6.2 MeV. The parity quantum numbers of J=1 states have been determined for the energy region above $\sim$ 3 MeV for the first time. Recent results of the ^{156}Gd$(\vec{\gamma},\gamma')$ experiment will be presented and discussed.
[1] B. Löher *et al.*, NIM A 723 (2013) 136.
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