HK 32: Structure and Dynamics of Nuclei V

Zeit: Mittwoch 16:45–19:00 Raum: F 33

Gruppenbericht HK 32.1 Mi 16:45 F 33

Experimental evidence for broken axial symmetry in most heavy stable nuclei — •Eckart Grosse[1], Arnd R. Junghans[2], and Ralph Massarczyk[3] — [1]IKTP, Technische Universität Dresden, 01062 Dresden, Germany — [2]IKP, Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden, Germany — [3]Los Alamos National Laboratory, New Mexico 87545, USA

Using an approximation suggested by Bohr and Mottelson nearly all analysis of experimental data is still based on axial symmetry, although hints on its breaking were found in HFB calculations published recently by Delaroche et al. in PRC 81 as well as by spectroscopic studies. For a clarification we performed a re-analysis for two types of experimental data known for their sensitivity to nuclear deformation: The electric dipole response in the region of giant resonances and the collective enhancement of nuclear level densities. For both nearly no parameters remain free to be adjusted by a separate fit, if previous information about nuclear masses, radii etc. are used to fix parameters for the Gogny force, the droplet model and the surface dissipation model as based on hydrodynamics. For the IVGDR energies only an effective mass and for their strength the blocking of p-n pair absorption in nuclei has to be adjusted, when a triple Lorentzian (TLO) is used; for the level densities only shell and pairing effects as well as the symmetry have to be known, if the Fermi gas theory with its Tcrit is applied. In both cases the axial symmetry breaking in heavy nuclei already shows up already in the valley of stability indicating a nuclear Jahn-Teller effect as mentioned long ago by Reinhard and Otten in NPA 420.

HK 32.2 Mi 17:15 F 33

Coulomb excitation of ^{142}Xe — •Corinna Henrich[1], Thorsten Kröll[1], Mirko von Schmid[1], Gary Simpson[2], and Michael Thürauf[1] for the IS548-Collaboration — [1]IKP, TU Darmstadt, Germany — [2]LPSC, Grenoble, France

The neutron rich nucleus ^{142}Xe lies in the vicinity of the doubly magic nucleus ^{132}Sn and is only two protons below ^{144}Ba, which exhibits the largest octupule collectivity in the region. To study the onset of octupole collectivity and follow the evolution of quadrupole collectivity in this area a "safe" Coulomb excitation experiment was carried out at the new HIE-ISOLDE facility (CERN) in the end of 2016. Both beam and target nuclei were measured using C-REX, i.e. an array of segmented Si detectors, covering forward as well as backward angles. The MINIBALL spectrometer was used to detect the emitted gamma rays in coincidence. The experimental setup will be presented along with the first stages of the analysis.

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HK 32.3 Mi 17:30 F 33

Multinucleon transfer as a gateway to $Z > 50, N < 82$ nuclei — •Andreas Vogt[1], Benedikt Birkenbach[1], Peter Reiter[1], Andrey Blazhev[1], Marco Siciliano[2,3], Kasia Hadyńska-Klek[2], Carl Wheldon[4], Eri Teruya[5], and Naotaka Yoshinaga[5] — [1]IKP, Universität zu Köln — [2]INFN - LNL, Italy — [3]INFN Padova, Italy — [4]University of Birmingham, UK — [5]Saitama University, Japan

Multinucleon-transfer reactions (MNT) provide access to hard-to-reach nuclei in the vicinity of the $Z = 50$ and $N = 82$ shell closures. Nuclei in this region serve as a benchmark for nuclear shell-model calculations based on modern effective interactions. Excited reaction products were measured after MNT in ^{136}Xe + ^{238}U at 1 GeV and ^{136}Xe + ^{208}Pb at 930 MeV with the γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA at LNL (INFN, Italy) as well as in the ^{136}Xe + ^{198}Pt MNT reaction employing GAMMASPHERE in combination with the gas-detector array CHICO. Furthermore, Xe and Ba isotopes were populated in fusion-evaporation reactions using the HORUS γ-ray array at the University of Cologne. The high-spin level schemes of ^{132}Xe, ^{133}Xe, ^{134}Xe, ^{135}Xe and ^{137}Ba are considerably extended to higher energies. The 2058-keV $(19/2^-)$ state in ^{135}Xe is identified as an 9.0(9)-ns isomer, closing a gap in the systematics along the $N = 81$ isotones. Latest shell-model calculations reproduce the experimental findings. The experimentally-deduced reduced transition probabilities of the isomeric states are compared to shell-model predictions. Supported by the German BMBF (05P12PKFNE TP4, 05P15PKFN9), ENSAR-TNA03, BCGS.

HK 32.4 Mi 17:45 F 33

Saturation of $B(E2)$-strength near mid-shell? Lifetimes of ^{174,176,178,180}Hf. — •Johannes Wiederhold[1], Ralph Kern[1], Volker Werner[1,4], Norbert Pietralla[1], Nicu Marginean[2], Raluca Marginean[2], Cristina R. Nita[2], Sorin Pascu[2], Dorel Bucurescu[2], Dan M. Filipescu[2], Nicoleta Florea[2], Dan G. Ghita[2], Constantin Mihai[2], Razvan Lica[2], Patrick Regan[3], Robert Carroll[3], Terver Daniel[3], Laila Gurgi[3], Ralitsa Ilieva[3,4], Nathan Cooper[4], and Farheen Naqvi[4] — [1]IKP, TU-Darmstadt — [2]IFIN-HH, Bucharest — [3]Physics Department at Surrey — [4]Yale University

Deformed nuclei in the rare earth region should show a saturation of the $B(E2; 0_1^+ \rightarrow 2_1^+)$-transition strength near mid-shell. Recent measurements of lifetimes of W-isotopes show discrepancies to literature values and seem to maximize the $B(E2)$-strength off mid-shell. An analog investigation is done on Hf-isotopes. Several lifetimes of excited states of the even-even isotopes ^{174,176,178,180}Hf have been measured with fast electronic scintillation timing (FEST) using the same experimental setup to minimize systematic deviations among the values. Excited States were populated via Coulomb excitation (^{180}Hf) and via β^+-decay following fusion-evaporation reactions (^{174,176,178}Hf) at the 9 MV tandem accelerator of the IFIN-HH near Bucharest. Obtained lifetimes of the Hf-isotopes will be presented. This work was supported by the DFG under Grants No. SFB 634 and No. SFB 1245, the U.S. DOE Grant No. DE-FG02-91ER40609 and the BMBF under the grant 05P15RDFN9 within the collaboration 05P15 NuSTAR R&D.

HK 32.5 Mi 18:00 F 33

Finite-size effects of nuclei - Transitions from the scissors mode to the γ-vibrational band of ^{164}Dy ⋆ — •Tobias Beck[1], Udo Gayer[1], Johann Isaak[2,3], FNU Krishichayan[4], Bastian Löher[1,2], Norbert Pietralla[1], Deniz Savran[2], Werner Tornow[4], and Markus Zweidinger[1] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]RCNP, Osaka, Japan — [4]Duke University, Durham, NC, USA

The understanding of collective phenomena of nuclei is attempted by a variety of theoretical models of microscopic, geometrical, and algebraic nature. In the algebraic Interacting Boson Model effects based on the finite size of the quantum system are predicted which are not incorporated in geometrical models. The observation of electromagnetic transitions between the isovector, low-lying $J_K^\pi = 1_1^+$ scissors mode and the 2_γ^+ state provides a sensitive test of finite-size effects. A photon-scattering experiment with linearly-polarized quasi monoenergetic $\vec{\gamma}$-rays has been performed at the High Intensity γ-ray Source (HIγS) at Duke University, Durham, NC, exploiting the γ^3 setup. We have unambiguously identified the $1_{sc}^+ \rightarrow 2_\gamma^+$ transition from $\gamma\gamma$-coincidences, extracted the decay branching ratio and compared it to IBM-2 predictions. First results will be presented along with the ongoing analysis. ⋆ Supported by the DFG under grant nos. SFB 634 and SFB 1245 and by the Alliance Program of the Helmholtz Association under grant no. HA216/EMMI.

HK 32.6 Mi 18:15 F 33

Studying the angular distribution of the reaction ^{94}Mo(p,p'γ)^{94}Mo @ 13.5 MeV with SONIC@HORUS — •Michelle Färber, Simon G. Pickstone, Mark Spieker, Michael Weinert, Julius Wilhelmy, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

The SONIC@HORUS setup of the Institute for Nuclear Physics in Cologne is used to investigate the low-energy response of the nucleus. Low spin states, e.g., the pygmy dipole resonance, can be studied by performing inelastic proton scattering reactions. An important observable for the investigation of these modes is the γ branching ratio which can be accessed with the setup. Furthermore, spins and parities can be assigned by measuring the angular correlation of the ejectile and the deexciting γ-ray. The obtained experimental distribution is in good agreement with the distorted wave born approximation (DWBA).

In this contribution, the results for the experimental angular distributions of the reaction ^{94}Mo(p,p'γ)^{94}Mo as well as the corresponding theoretical description will be shown.

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HK 32.7 Mi 18:30 F 33

Possible hexadecapole states in ^{96}Ru and ^{128}Te studied with the sdg-IBM-2 — •Oriana Diessel, Mark Spieker, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

Quadrupole excitations of fully-symmetric and mixed-symmetric nature are well established in atomic nuclei [1]. Octupole excitations of both types have also been discussed [2]. Recently, first candidates for mixed-symmetry hexadecapole states have been proposed based on a comparison of experimental data and sdg-IBM-2 calculations [3, 4].

In this contribution, the sdg-IBM-2 calculations for ^{96}Ru and ^{128}Te will be presented and compared to experimental data. Special emphasis will be put on possible hexadecapole-type excitations of both fully-symmetric and mixed-symmetric nature. To further test the hexadecapole phonon as a building block of nuclear structure, possible multiphonon couplings in ^{128}Te will be discussed as well.

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[1] N. Pietralla *et al.*, Phys. Rev. C **61** (2000) 021301 [2] M. Scheck *et al.*, PRC **81** (2010) 064305 [3] R.J. Casperson *et al.*, Physics Letters B **721** (2013) 51 [4] A. Hennig *et al.*, Phys. Rev. C **90** (2014) 051302

HK 32.8 Mi 18:45 F 33

Struktur des Grundzustands vom doppelt-magischen Kern ^{208}Pb — •Andreas Heusler — Gustav-Kirchhoff-Str. 7/1 69120 Heidelberg

Die Entdeckung von Vibrations- und Zweiteilchen-Zweilochkonfigurationen in ^{208}Pb [1] regt zur Klärung der lange anstehenden Frage an, wie die Struktur des Grundzustands des doppelt-magischen Kerns aussieht. Neben dem bekannten Neutron-Paarungszustand und den Doppeloktupolzuständen sind inzwischen zwei weitere 0^+ Zustände entdeckt worden, der Proton-Paarungszustand [2] und ein Zweiteilchen-Zweilochzustand mit der Struktur Einteilchen-Einlochzustand gekoppelt an den Oktupolvibrationszustand. Lange bekannte Anregungsfunktionen der inelastischen Protonstreuung an ^{208}Pb für tiefliegende Zustände werden durch Interferenzeffekte aus der bekannten Struktur von Einteilchen-Einlochzuständen erklärt. Zweiteilchen-Zweilochkonfigurationen im Grundzustand können diese Effekte bewirken. Wesentlich hierbei ist ein genaueres Verständnis der Asymmetrie von Anregungsfunktionen beim Protonzerfall von Analogresonanzen im ^{209}Bi.

[1] A. Heusler et al. Phys. Rev. C 93:054321 (2016)
[2] A. Heusler et al. Phys. Rev. C 92:011302(R) (2015)