HK 42: Struktur und Dynamik von Kernen VII

Zeit: Donnerstag 14:00–15:45 Raum: HG II

HK 42.1 Do 14:00 HG II

Hyperon Nucleon scatterin at next-to-leading order in Chiral Perturbation Theory — •Simon Kazmierowski — IKP-3, Forschungszentrum Jülich GmbH, 52425 Jülich

The hyperon-nucleon interaction has not been studied as intensively as the nucleon-nucleon interaction. In my Diploma thesis I have investigated the usefulness of the ChPT approach using SU(3)-flavour symmetry for low-energy hyperon-nucleon scattering, extending the chiral expansion up to second order. We constructed a SU(3) invariant potential, consisting of a long- and a short-range part. The long range physics is governed by one-Goldstone boson exchange while the short-range part is determined by contact interaction using 23 free parameters. Out of those only the S-wave related could be determined by a fix to low-energy hyperon-nucleon cross-sections, the remaining 10 P-wave related low-energy constants are still undetermined due to the scarcity and poor quality of the scattering data.

We could obtain a good desciription of the data, even at lab momenta that exceed those that have been used for the fitting procedure. The value of chi squared could be reduced compared to the leading order work. For a cut-off in the range of 550 MeV - 700 Mev we obtained a correctly bound hypertriton. However the predictions of the angular dependence remains optimzable. This problem might be overcome once we find a efficient way to fix the P-wave related low-energy constants.

HK 42.2 Do 14:15 HG II

Structure of Ba with N∼90 and Ra with N∼132 from high precision mass measurements of $^{136-146}$Xe and $^{223-229}$Rn — •R. Burcu Cakirli[1] and Rick Casten[2] for the ISOLTRAP-Collaboration — [1]Max-Planck-Institut für Kernphysik, D-69117 Heidelberg, Germany — [2]Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520-8120, USA

Recent $^{136-146}$Xe and $^{223-229}$Rn atomic mass results from the double Penning trap mass spectrometer ISOLTRAP at ISOLDE-CERN will be presented [1-2]. These new results include the first measurements on $^{144-146}$Xe and $^{223-229}$Rn (including the first identification of ^{229}Rn). Proton-neutron interaction strengths, δV_{pn}, extracted from these new atomic mass results, double differences of binding energies, will be shown for both the N∼90 and N∼132 regions, in particular for Ba and Ra. Structural effects will be discussed considering the δV_{pn} results. A unique pattern was identified in both regions. In addition, microscopic density functional theory predictions for δV_{pn} will be compared with the experimental results.

[REREFENCES]:
[1] D. Neidherr et al., Phys. Rev. Lett., 102, 112501 (2009).
[2] D. Neidherr, R.B. Cakirli et al., Phys. Rev. C 80, 044323 (2009).

HK 42.3 Do 14:30 HG II

Transient field g-factor measurement on radioactive ^{100}Pd(2_1^+) via alpha transfer reaction† — •Karl-Heinz Speidel[1], Noemie Benczer-Koller[2], Gerfried Kumbartzki[2], Gülhan Gürdal[2], Larry Zamick[2], Yitzhak Y. Sharon[2], Tan Ahn[3], Robert Casperson[3], Raphael Chevrier[3], Andreas Heinz[3], Gabriele Ilie[3], Desiree Radeck[3], Mallory Smith[3], Elizabeth Williams[3], and Peter Maier-Komor[4] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]Rutgers University, New Brunswick, NJ — [3]Yale University, New Haven, CT — [4]Physik-Department, Technische Universität München

^{100}Pd has four proton holes in the $g_{9/2}$ and four neutrons in the $d_{5/2}$ orbitals around the N= Z = 50 shell closures and is therefore a suitable candidate for studying single particle effects in the nuclear wave function. The α transfer from a carbon target to an energetic beam of ^{96}Ru close to the Coulomb barrier has been used to populate the 2_1^+ state in radioactive ^{100}Pd via the reaction ^{12}C(^{96}Ru, ^{8}Be)^{100}Pd. ^{96}Ru beams of 343 MeV were provided by the Yale WNSL tandem accelerator. The two α particles from the breakup of ^{8}Be as well as the carbon ions which Coulomb excited the Ru projectiles were detected in a Si detector in coincidence with gamma rays recorded in four Ge Clover detectors. Angular correlations and precessions have been measured via the transient field technique. Preliminary data yield the first measurement of the g factors of the 2_1^+ state in ^{100}Pd and of the 4_1^+ state in ^{96}Ru.

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HK 42.4 Do 14:45 HG II

New measurement of the ^{68}Zn(4^+) g factor and reinterpretation of previous data — •Kevin Moschner[1], Karl-Heinz Speidel[2], Jörg Leske[3], Cristopher Bauer[3], Christian Bernards[1], Linus Bettermann[1], Jan Jolie[1], Thomas Möller[3], Dennis Mücher[1], and Peter Maier-Komor[4] — [1]Institut für Kernphysik, Universität zu Köln — [2]Helmholtz Institut für Strahlen- und Kernphysik, Universität Bonn — [3]Institut für Kernphysik, TU Darmstadt — [4]Physik-Department, TU München

The g factor of the first excited 4^+ state in ^{68}Zn has been remeasured due to currently existing inconsistencies of earlier data [1-3]. Coulomb excitation in inverse kinematics of ^{68}Zn beams provided by the Munich tandem accelerator has been applied in combination with the transient field technique. The multi-layered target used consisted of a thick carbon layer on copper backed gadolinium. Gamma rays were detected with large-volume Ge detectors in coincidence with forward scattered carbon ions. The g factors deduced from the observed spin precessions were compared with previous data whereby the inconsistencies in the 4^+ g factor values could be removed by applying a novel analysis procedure to the measured field-up/-down ratios of each detector. Details of the experiment and results from the reanalysis will be discussed. The finally obtained g(4^+) value and results for the first 2^+ and the second 2^+ states will be compared with large-scale shell model calculations.

[1] J. Leske et al., Phys. Rev. C 71, 034303 (2005)
[2] J. Leske et al., Phys. Rev. C 72, 044301 (2005)
[3] P. Boutachkov et al., Phys. Rev. C 75, 021302(R) 2007

HK 42.5 Do 15:00 HG II

Hartree-Fock und RPA für deformierte Kerne mit realistischen Wechselwirkungen — •Bastian Erler, Panagiota Papakonstantinou und Robert Roth — Institut für Kernphysik, TU Darmstadt

Mittels unitärer Transformationen renormierte, realistische Nukleon-Nukleon Potentiale werden bereits erfolgreich für Studien an sphärisch symmetrischen Kernen eingesetzt. Auf Hartree-Fock (HF) Grundzuständen basierende Second-Random-Phase-Approximation (SRPA) Rechnungen liefern vielversprechende Resultate für sphärische, mittelschwere Kerne.

Diese Studien werden nun auf Kerne mit axialer Deformation ausgedehnt. Der deformierte Grundzustand ergibt sich aus dem HF Verfahren ohne Beschränkung auf sphärische Symmetrie. Der Grundzustand (Drehimpuls-Eigenzustand) ergibt sich durch explizite Drehimpulsprojektion. Auf Basis der deformierten HF Wellenfunktionen können kollektive Anregungen mittels Random-Phase-Approximation (RPA) untersucht werden. Hierbei müssen alle sich aus den in der HF Rechnung berücksichtigten Oszillatorzuständen ergebenden Teilchen-Loch Paare auf konsistente Weise berücksichtigt werden.

Vorläufige Resultate für deformierte HF-RPA Rechnungen werden am Beispiel von ^{28}Si diskutiert und mit experimentellen Daten verglichen. Abschließend wird die Möglichkeit zur Anwendung der SRPA auf deformierte Kerne diskutiert.

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HK 42.6 Do 15:15 HG II

Full Triaxial Angular Momentum Projection with the Gogny force — •Tomas R. Rodriguez[1,2] and J. Luis Egido[2] — [1]GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany — [2]Universidad Autónoma de Madrid, Madrid, Spain

Modern beyond mean field methods with effective forces are able to describe many properties of nuclei spread out in the whole nuclear chart like the appearance or degradation of shell closures, shape coexistence, shape transitions, fission barriers, etc. In these methods, the wave functions that describe the ground and excited states of the atomic nucleus are linear combinations of particle number and angular momentum restored product wave functions defined along some collective degrees of freedom. Except of few preliminary cases with Skyrme and Relativistic interactions, most of the calculations has been restricted to angular momentum restoration of axial quadrupole deformed configurations. However, it is well known that there are cases where other collective

degrees of freedom, in particular the triaxial deformation, can play an important role in the structure of the nucleus. In this contribution we will show the first results obtained with full triaxial angular momentum restoration with the Gogny force studying some selected cases and comparing the results with the corresponding axial approaches and experimental data. Furthermore, the inclusion of this degree of freedom open new exciting possibilities for understanding the spectroscopy of many nuclei and gives a reliable alternative and/or complement to shell model calculations.

HK 42.7 Do 15:30 HG II

Investigation of chiral bands in ^{106}Ag — Evgenia Lieder[1,2], •Rainer Lieder[1], Rob Bark[1], Elena Lawrie[1], Kobus Lawrie[1], Sifiso Ntshangase[1], Simon Mullins[1], Paul Papka[1], Ntombi Kheswa[1], Jie Meng[3,4], Bin Qi[5], Shuangquan Zhang[3], and Zhipan Li[3] — [1]iThemba LABS, Somerset West, South Africa — [2]FhG, INT, Euskirchen, Germany — [3]PhS, PKU, Beijing, China — [4]PhS, BUAA, Beijing, China — [5]SDU, Weihai, China

Dipole bands in ^{106}Ag have been studied with the γ-detector array AFRODITE at iThemba LABS, South Africa. A ^{96}Zr(^{14}Nd,4n)^{106}Ag reaction at a beam energy of 71 MeV has been used. The three previously known negative-parity bands in ^{106}Ag have been extended. Bands 1 and 2 were proposed to be chiral partner bands [1]. However, in view of the present results, bands 2 and 3 seem to be better candidates for chiral partner bands since their staggering parameters, $B(M1)/B(E2)$ ratios, kinematic moments of inertia and quasiparticle alignments agree much better than those of bands 1 and 2. Triaxial relativistic mean field (RMF) and particle-rotor model (PRM) calculations support this interpretation. In the potential energy surface of ^{106}Ag, obtained in RMF calculations, two minima have been found in the $\beta_2 - \gamma$ plane. Based on PRM calculations using the deformation parameters of the two minima and a $\nu h_{11/2} \otimes \pi g_{9/2}^{-1}$ particle-hole configuration, bands 2 and 3 may represent partners with chiral vibration at $\gamma \approx 12°$. Band 1, located in the other minimum, may be a magnetic dipole band or the partner of a second pair of chiral bands.

[1] P. Joshi et al., Phys. Rev. Lett. 98, 102501 (2007)