HK 58: Structure and Dynamics of Nuclei X

Zeit: Freitag 14:00–15:30 Raum: HZO 70

Gruppenbericht HK 58.1 Fr 14:00 HZO 70

Level densities and broken axial symmetry in stable heavy nuclei — •Eckart Grosse[1] and Arnd R. Junghans[2] — [1]Institute of Nuclear and Particle Physics, Technische Univ. Dresden, 01062 Dresden, Germany — [2]Institute of Radiation Physics, Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden, Germany

From spectroscopic information for (especially odd) heavy nuclei and from multiple Coulomb excitation more and more hints on broken axial symmetry in nuclei also in the valley of stability have been found. But in quasi all prescriptions for the prediction of level densities axial symmetry is assumed ad hoc and thus it is important to investigate the consequence of symmetry breaking, e.g. by a tri-axial Fermi gas model like the TLO used for IVGDR shapes [EPJA 53(2017)225].

For excitation energies above 20 MeV a comparison of state densities from the Fermi gas approach to those extracted from combinatorial considerations indicates discrepancies which cannot be removed by a modification of the back-shift energy, but by the use of a reduced 'level density' parameter â, in accordance to nuclear matter studies.

At low energy a test using the accurately determined spacings of neutron capture resonances indicates a similar result, but for even targets only spin 1/2 states are populated for which the a spin cut-off is unimportant. Using recent results from measurements at the Oslo cyclotron the non-axial Fermi gas model proposed is verified now also for higher spin values in variously deformed nuclei.

HK 58.2 Fr 14:30 HZO 70

Quadrupole and octupole collectivity in doubly-magic ^{132}Sn — •D. Rosiak and P. Reiter for the MINIBALL IS551 and HIE-ISOLDE-Collaboration — IKP, Universität zu Köln

The vibrational first 2_1^+ and 3_1^- states of the doubly-magic nucleus ^{132}Sn were excited via safe Coulomb excitation (CE) employing the recently commissioned HIE-ISOLDE accelerator at CERN in conjunction with the highly efficient MINIBALL array. The ^{132}Sn ions were accelerated to an energy of 5.5 MeV/nucleon and impinged on a ^{206}Pb target. Dexciting γ rays from the first excited states of the target and the projectile nucleus were recorded in coincidence with scattered particles. The optimized beam energy, the high-energy resolution and good efficiency of the HPGe spectrometer provide a beneficial combination to master the challenging measurement characterized by small CE cross sections and excitation energies above 4 MeV. The reduced transition strengths were determined for $0^+_{\text{g.s.}} \to 2_1^+$, $0^+_{\text{g.s.}} \to 3_1^-$, and $2_1^+ \to 3_1^-$ in ^{132}Sn. In the past first preliminary results for the B(E2;$0^+_{\text{g.s.}} \to 2_1^+$) value were obtained with an efficient BaF2 array at ORNL [1]. The results on excited collective states in ^{132}Sn provide crucial information on cross shell configurations that are expected to be dominated by a strong proton contribution. State-of-the-art large-scale shell model calculations and new mean field predictions are compared to the results. [1] R.L. Varner, et al., Eur. Phys. J. A 25, s01, 391 (2005). Supported by the German BMBF 05P12PKFNE and 05P15PKFN9.

HK 58.3 Fr 14:45 HZO 70

Spektroskopische Analyse von ^{146}Nd über (n,$\gamma\gamma$)-Messung — •Martin von Tresckow für die 146Nd-FIPPS-Kollaboration — Institut für Kernphysik, TU Darmstadt

Kürzlich konnte in ^{144}Nd ein isovektorieller Oktupolzustand nachgewiesen werden [1], wodurch die Suche nach weiteren isovektoriellen Oktupolzuständen in dieser Region ausgeweitet wird.

In ^{146}Nd können zwei 3^--Zustände bei 2335 keV bzw. 2525 keV als potentielle Kandidaten für einen niederenergetischen isovektoriellen Oktupolzustand vorgeschlagen werden. Isovektorielle Oktupolzustände, sog. „mixed-symmetry“ Zustände, werden durch das sdf-IBM 2 vorhergesagt und tragen einen wesentlichen Anteil zum Verständnis des Oktupolfreiheitsgrades in der Proton-Neutron-Wechselwirkung bei. Im bisherigen experimentellen Kenntnisstand fehlt der notwendige starke $M1$-Übergang von den oben genannten Kandidaten in den 3_1^--Zustand.

Zudem ist die Kenntnis der Levelstruktur von ^{146}Nd lückenhaft und nicht immer eindeutig. Diesbezüglich wurden in einer (n,$\gamma\gamma$)-Kampagne mit FIPPS am ILL experimentelle Daten gesammelt und ein verbessertes Levelschema ausgearbeitet.

* Gefördert durch die DFG (KR-1796/2-1/-2) und ILL.

[1] M. Thürauf; Dissertation (TU Darmstadt, 2016)

HK 58.4 Fr 15:00 HZO 70

208Pb — •Andreas Heusler — Gustav-Kirchhoff-Str. 7/1 69120 Heidelberg

Einer der interessantesten Kerne ist 208Pb. Er wird auf vielfätige Art angeregt: (1) Paarungsvibrationen, (2) tetraedrische Rotationen und Vibrationen, (3) dodekedrische Vibrationen, (4) Einteilchen-Einloch-Anregungen und (5) Mehrteilchen-Mehrloch-Anregungen im Schalenmodell. Dazu kommen Koppelungen der elementaren Anregungen (1)-(5). Es wird vor allem über neu entdeckte tetraedrischen Vibrationen berichtet, die bisher [1] noch nicht sicher nachgewiesen wurden.

[1] A. Heusler EPJ A 53:215 (2017)

HK 58.5 Fr 15:15 HZO 70

The first step of the fission reaction — Genevieve Mouze[1], Christian Ythier[1], Hong-yin Han[2], and •Jean-Francois Comanducci[3] — [1]Universite de Nice,06108 Nice cedex 2, France — [2]CIAE, Beijing , 102413, China — [3]LE-AIEA, 4, Quai Antoine Premier, 98000 Monaco

In the capture of a thermal neutron by 235U, the formation of a dual system made of a 28 neon cluster and a 208Pb core releases an internal energy of 59.46 MeV great enough for initiating the fission reaction. 238U fissions only with 1.5- MeV neutrons because the harmonic oscillator made of the 82 proton and 126 neutron phases of 208Pb must reach its four phonon level at about 51.47 MeV, the sum of neutron energy and internal energy in 30Ne- 209Pb. Now, according to a re-interpretation of the 1988 alpha- neutron coincidence experiment of ref [1], this level de-excites by two DGDRs, each of 26 MeV, enough for expelling either up to 3.25 neutrons or an alpha of 15.9 MeV on average. Moreover, 51.47 MeV is enough to cause a shifting of p- and n- phases and therefore a dramatic collision between charged cluster and bare 82-proton phase. [1] H. -Y. Han et al., IAEA Report INDC (NDS) -220, 113 (1989).