HK 35 Kernphysik/Spektroskopie

Zeit: Mittwoch 16:30–18:30 Raum: C

Gruppenbericht

HK 35.1 Mi 16:30 C

Bestimmung von Zustandsdichten niedrigliegender 0^+-Zustände mittels (p,t) Transferreaktionen. — •J. Jolie[1], N. Braun[1], S. Heinze[1], C. Scholl[1], O. Möller[1], D. Muecher[1], P. von Brentano[1], D. A. Meyer[2], R.F. Casten[2], R. Kruecken[3], H.-F. Wirth[3], T. Faestermann[3], M. Maghoub[3], M. Reithner[3], G. Graw[4], R. Hertenberger[4] und D. Bucurescu[5] — [1]Institut für Kernphysik, Universität zu Köln, D-50937, Köln — [2]WNSL, Yale University, New Haven, USA — [3]Physik Department, TU-München, D-85748 Garching — [4]Sektion Physik, LMU-Munchen, D-85748 Garching — [5]NIPN, Bucharest, Romania

Bei unserer systematischen Untersuchung von acht gerade-gerade Atomkernen aus dem Bereich der seltenen Erden mittels (p,t)-Transferreaktionen konnten wir 96 0^+-Zustände identifizieren, davon 67 bislang unbekannte [1]. Dazu wurde das Garchinger Q3D-Spektrometer mit seiner Auflösung von 4 keV bei 22 MeV Tritonen genutzt. Die gemessene Zustandsdichte bis 2.5 MeV erlaubt es, eine Vohersage des Verhaltens dieser Zustandsdichte am sphärisch-deformierten Quantenphasenübergang zu überprüfen: die Dichte der Zustände erreicht dort ein Maximum für den Übergang zwischen sphärischen und oblaten Atomkernen [2]. Wir konnten diese Vohersagen mit den experimentellen Ergebnissen bestätigen [1]. Diese Arbeit wurde durch die DFG (JO391/2-3, C4-Gr894/2-3 und Kr2326/1) gefördert. [1] D. A. Meyer et al. subm. to Phys. Rev. Lett. [2] P. Cejnar and J. Jolie, Phys. Rev. E61 (2000) 6237.

Gruppenbericht

HK 35.2 Mi 17:00 C

Untersuchung der Pygmydipolresonanze in $(\alpha, \alpha'\gamma)$ Koinzidenzexperimenten * — •D. Savran[1], P. Dendooven[2], M.N. Harakeh[2], J. Hasper[1], A. Matic[2], A.M. van den Berg[2], H.J. Wörtche[2] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt — [2]Kernfysisch Verneller Instituut, NL-9747 Groningen, Niederlande

Die Pygmydipolresonanz (PDR) wurde in den letzten Jahren in zahlreichen Kernen systematisch untersucht. In stabilen Kernen wurde dazu meist die Methode der Kernresonanzfluoreszenz (KRF) benutzt, so z.B. in den Ca-Isotopen [1] und den N=82 Isotonen [2]. In instabilen neutronenreichen Kernen verwendet man die Methode des Coulombaufbruchs in inverser Kinematik [3]. Um den Isospin Charakter dieser Anregungsmode zu untersuchen, wurden $(\alpha, \alpha'\gamma)$ Koinzidenzexperimente am Big-Bite Spektrometer (BBS) des KVI durchgeführt. Die koinzidente Messung von Anregungs- und Zerfallsenergie, zusammen mit der sehr guten Energieauflösung der γ-Detektoren, ermöglichten dabei die PDR von anderen Anregungen im gleichen Energiebereich zu trennen. Erste Ergebnisse einer $(\alpha, \alpha'\gamma)$ Messung an ^{140}Ce werden präsentiert. Der Vergleich der Ergebnisse mit Resultaten aus KRF Experimenten ergibt klare Hinweise auf eine deutliche Strukturierung der E1-Stärkeverteilung.

* gefördert durch die DFG (SFB 634), FOM und der EU im Rahmen von EURONS.

[1] T. Hartmann et al.,Phys. Rev. Lett. **93** (2004) 192501
[2] A. Zilges et al.,Phys. Lett. **B 542** (2002) 43
[3] P. Adrich et al.,Phys. Rev. Lett. **95** (2005) 132501

HK 35.3 Mi 17:30 C

Theory of Pygmy Dipole Resonances in Exotic Nuclei — •Nadia Tsoneva and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

The possible connection between neutron skins and low-energy dipole excitations is investigated. For this purpose, a method incorporating both HFB and multi-phonon QPM theory was developed [1]. The mean field parameters can be determined self-consistently for every nucleus under consideration. The evolution of the dipole strength with the neutron excess for the Z=50 isotopic chain and N=82 isotones is investigated. From QRPA and QPM calculations a low-energy dipole strength concentrated in the energy region $E_x \sim 6-8$ MeV is obtained. The calculations are compared to recent data from photon scattering experiments. The analysis of the corresponding neutron and proton transition densities indicates almost pure neutron oscillations at the nuclear surface such that a PDR can be identified. The dependence of the PDR properties on the neutron excess has been investigated. A close correlation between the total PDR strength and the size of the neutron skin could be identified [1]. An interesting point was to explain the PDR behaviour in nuclei close to the transition from a neutron to a proton skin, e.g. ^{100}Sn-^{110}Sn, possibly transforming the neutron PDR mode into a proton. An important step in the understanding of the dipole spectra is to disentangle the PDR states from the low-energy two-phonon dipole states. This is achieved by using the QPM approach with up to three-phonon configurations. Supported by DFG, project Le 439/2-5.

[1] N. Tsoneva, H. Lenske, Ch. Stoyanov, Phys. Lett. B **586** (2004) 213.

HK 35.4 Mi 17:45 C

Binary fission and Coplanar Ternary Cluster Decay from Hyper-deformed States in ^{60}Zn. — •V. Zherebchevsky[1,2,3], W. von Oertzen[1,2], D. Kamanin[4], S. Thummerer[1], H.G. Bohlen[1], B. Gebauer[1], Tz. Kokalova[1], Ch. Schulz[1], and C. Wheldon[1] — [1]Hahn-Meitner-Institut, Berlin, Germany — [2]Freie Univesität Berlin, Germany — [3]St. Pertersburg State University, St. Petersburg, Russia — [4]Flerov laboratory for Nuclear Reactions, Dubna, Russia

Binary and ternary cluster decay of ^{60}Zn compound nuclei at high angular momentum,formed in the ^{36}Ar + ^{24}Mg reaction at $E_{lab}(^{36}\text{Ar}) = 195$ MeV, have been measured in a unique kinematic coincidence set-up consisting of two large area position sensitive (x,y) gas detector telescopes with Bragg-ionisation chambers(BRS). The BRS gives the opportunity to measure the reaction angles in- and out-of-plane and through Bragg-curve spectroscopy a complete identification of the nuclear charge for different final channels. Also the yields of the binary and non-binary channels with missing mass up to A=18 have been determined. We observed very narrow out-of-plane angular correlations for two heavy fragments emitted in either purely binary events or in events with a missing mass consisting of 2 and 3 α-particles. The latter correlations are interpreted as ternary fission decay from compound nuclei at high angular momenta through an elongated (hyper-deformed) shape with very large moment of inertia, where the lighter mass in the neck region remains at rest or with very low momentum in the center of mass.

HK 35.5 Mi 18:00 C

Ternary fission within statistical approach — •Alexander Andreev[1,2], Gurgen Adamian[2], Nikolai Antonenko[1,2], Svetlana Ivanova[2], Sergey Kuklin[2], and Werner Scheid[1] — [1]Institut für Theoretische Physik der Justus-Liebig-Universität, Giessen, Germany — [2]Joint Institute for Nuclear Research, Dubna, Russia

The formation of the ternary system is considered as the second step after the formation of the binary system by extracting one or several alpha-particles and neutrons from one or both binary fragments in the region of their interaction. Using this model, the charge number distributions for fission of the heavy nucleus ^{252}Cf and the light nucleus ^{56}Ni accompanied by various light charged particles (LCP) are described. The relative yields of different LCPs are calculated for fission of ^{252}Cf. Based on the calculations of the excitation energy at scission, the neutron multiplicity distributions from the primary fission fragments of ^{252}Cf are obtained. The mean total kinetic energy of fission fragments is also described. The results are compared with the experimental data.

HK 35.6 Mi 18:15 C

Nonexistence of low-energy symmetric fission — •Geneviève MOUZE — University of Nice, France

The so-called symmetric (or bimodal) fission is nothing else than a partially barrier-free asymmetric fission. In the narrowly symmetric fission mode of 258Fm (s.f.) (1), the width of only 8 u of the peak at symmetry of the fragment mass spectrum results from the fact that for only two fragment pairs (128Sn-130Sn, 126Sn-132Sn) the total binding energy- release Q is greater than their individual Coulomb barrier B. The sphericity correction to apply to B for Sn-fragment pairs of 258Fm can be determined. The broadly symmetric mass spectrum observed in trans-Md nuclei (e.g.266Hs) results from the greater number of mass splits for which Q is greater than B. These observations show that the concept of fission barrier has to be revisited. Here the major role is played by the electrostatic properties of individual binary configurations. But another kind of fission barrier can result from the lack of activation energy of a primordial dinuclear system (e.g. 208Pb-28Ne in 238U). (1) D.C. Hoffman et al., Los Alamos Report UR - 77, 29 01(1977); E.K. Hulet et al. P.R.C.21 (1980) 966.