HK 4 Kernphysik/Spektroskopie

Zeit: Montag 14:00–16:00 Raum: C

HK 4.1 Mo 14:00 C

Single-particle structure of ^{7}He* — •N. Ryezayeva[1], C. Bäumer[2], A. van den Berg[3], L.V. Chulkov[4,5], D. Frekers[2], D. De Frenne[6], P. Haefner[2], E. Jacobs[6], H. Johanson[4], Y. Kalmykov[1], A. Negret[6], P. von Neumann-Cosel[1], L. Popescu[6], S. Rakers[2], A. Richter[1], G. Schrieder[1], A. Shevchenko[1], H. Simon[5], and H.J. Wörtche[3] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Kernphysik, Universität Münster, Germany — [3]KVI Groningen, Netherlands — [4]GSI Darmstadt, Germany — [5]Kurchatov Institute, Moscow,Russia — [6]Universiteit Gent, Belgium

The disappearance of the usual magic numbers in extremely neutron-rich nuclei implies a considerable modification in the spin-orbit interaction. Recent experiments give contradictory statements about a possible existence of the $p_{1/2}$ spin-orbit partner of the ^{7}He ground state with a dominant $p_{3/2}$ single-particle character. In order to clarify this question a study of the ^{7}Li(d,^{2}He)^{7}He reaction has been performed using a 171 MeV deuteron beam from the KVI cyclotron. A possible resonance at an excitation energy $E_x \simeq 1.5$ MeV with a width $\Gamma \simeq 2.0$ MeV is suggested by a decomposition of the spectrum using known resonances and quasifree charge-exchange contributions, taking into account the cluster structure of ^{7}Li. Gamow-Teller strengths for transitions to the lowest states in ^{7}He are in remarkable agreement with results from ab initio Quantum Monte Carlo calculations. The neutron spectroscopic factor S_n of the ^{7}He ground state is extracted by a R-matrix analysis.

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HK 4.2 Mo 14:15 C

Electron scattering study of the monopole transition to the Hoyle state in ^{12}C: Is there an α-condensate?* — •M. Chernykh[1], H. Feldmeier[2], T. Neff[3], P. von Neumann-Cosel[1], and A. Richter[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]NSCL, Michigan State University, USA

Electron scattering form factors for the ground state and the second 0^+ state (7.654 MeV, Hoyle state) in ^{12}C have been compiled in [1]. The data, together with new measurements at low momentum transfer at the S-DALINAC, are compared with microscopic calculations within the Fermionic Molecular Dynamics model [2,3]. Excellent description of the ground state and a reasonable description of the excited state is found. Consequences for a possible interpretation of this state as an α-particle condensate [4] are discussed.

[1] H. Crannell, private communication
[2] H. Feldmeier and J. Schnack, Rev. Mod. Phys. 72 (2000) 655
[3] R. Roth, T. Neff, H. Hergert, H. Feldmeier, Nucl. Phys. A745 (2004) 3
[4] A. Tohsaki, H. Horiuchi, P. Schuck, and G. Röpke, Phys. Rev. Lett. 87 (2001) 192501

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HK 4.3 Mo 14:30 C

High-accuracy mass measurements on neutron deficient neon isotopes — •K. Blaum[1,2], S. Baruah[3], P. Delahaye[4], S. George[1,2], C. Guénaut[5], F. Herfurth[1], A. Herlert[4], A. Kellerbauer[4], H.-J. Kluge[1], D. Lunney[5], S. Schwarz[6], L. Schweikhard[3], C. Weber[1], and C. Yazidjian[1,4] for the ISOLTRAP collaboration — [1]GSI, 64291 Darmstadt, Germany — [2]Inst. f. Physik, Universität Mainz, 55099 Mainz, Germany — [3]Inst. f. Physik, Universität Greifswald, 17487 Greifswald, Germany — [4]CERN, Physics Department, 1211 Geneva 23, Switzerland — [5]CSNSM-IN2P3-CNRS, 91405 Orsay-Campus, France — [6]NSCL, Michigan State University, East Lansing, MI 48824-1321, USA

The atomic masses of the short-lived nuclides ^{17}Ne and ^{19}Ne have been measured with the triple-trap mass spectrometer ISOLTRAP at ISOLDE/CERN. The obtained mass excess for both nuclides deviates significantly from the literature value, in the case of ^{17}Ne by about 40 keV. The mass value of ^{17}Ne can be applied for a test of the isobaric multiplet mass equation with respect to an isospin $T = 3/2$ quartet. In addition, both masses can contribute to the data analysis of collinear laser-spectroscopy experiments where mean-square nuclear-charge radii are determined.

HK 4.4 Mo 14:45 C

RISING: Fragmentation relativistischer radioaktiver Strahlen und "In-beam" Gamma-Spektroskopie — •Frank Becker[1], M. Bentley[2], G. Hammond[2] und M. Taylor[2] für die RISING-Kollaboration — [1]GSI Darmstadt — [2]University of York

Im Rahmen des RISING (Rare ISotope Investigations at GSI) Projektes wurden unter anderem Doppelfragmentationsreaktionen untersucht: stabile Strahlen mit relativistischer Energie (600 - 1000 AMeV) wurden auf ein 9Be Target am Eingang des FRS (FRagment Separator) geschossen. Mittels FRS wurden exotische Kerne aus den produzierten Fragmenten selektiert und zum Endfokus des Spektrometers geleitet. Dort trafen die ausgesuchten Kerne auf ein zweites 9Be Target und konnten so nochmals fragmentiert werden. Das zweite Target war von einem Gammaspektrometer, bestehend aus EUROBALL CLUSTER Detektoren, umgeben, so dass die von den angeregten exotischen Kernen emittierte Gammastrahlung gemessen werden konnte. Die in der Doppelfragmentation produzierten Fragmente wurden in einem CAlorimeter TEleskop (CATE) identifiziert. Die durch die Doppelfragmentation populierten Zustände verschiedenen Spins werden mittels gammaspektroskopischer Methoden untersucht. Die Abhängigkeit der Drehimpulsverteilung von der Anzahl der in der Fragmentation abgedampften Nukleonen wird analysiert und mit theoretischen Vorhersagen verglichen.

HK 4.5 Mo 15:00 C

Search for E0 Transitions in Mg Isotopes around the Island of Inversion* — •W. Schwerdtfeger[1], D. Habs[1], T. Kröll[2], R. Krücken[2], T. Morgan[1], O. Schaile[1], M. Sewtz[1], P. Thirolf[1], and K. Wimmer[1] for the IS414 collaboration — [1]Department für Physik, Ludwig Maximilians Universität München — [2]E12, Technische Universität München

Around the island of inversion a coexistence of spherical and deformed 0^+ states in neutron rich Mg nuclei is predicted. Resulting from a fast timing experiment on ^{30}Mg at ISOLDE the 1789 keV state is expected to be a candidate for the deformed 0^+ state with a potentially strong E0 decay branch to the sperical 0^+ groundstate. To search for this decay an exploratory experiment was performed using a Mini-Orange spectrometer for the detection of the E0 decay. The expected strong E0 branch could not be confirmed, however a limit for the E0 strength $\rho^2(E0) \leq 0.26$ (intensity $\leq 0.1\%$) could be derived. An improved experimental setup is in preparation which will allow for an increased sensitivity by about a factor of ≥ 750 through a coincidence measurement of E0 decay electrons and β decay background. Thus the presently dominating β background will be drastically suppressed. According to estimates the expected E0 strength from the deformed 0^+ state can be expected for $\rho^2(E0) \sim 0.02 - 0.26$, which will be clearly within reach with our improved setup.

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HK 4.6 Mo 15:15 C

Die elektrische Quadrupolstärke unterhalb der Quadrupolriesenresonanz in magischen Kernen* — •J. Enders, C. Hessler, O. Karg, P. von Neumann-Cosel und V.Yu. Ponomarev — Institut für Kernphysik, TU Darmstadt

In einem Photonenstreuexperiment am halbmagischen Kern ^{52}Cr, das am supraleitenden Darmstädter Elektronenlinearbeschleuniger S–DALINAC durchgeführt wurde, konnten keine Hinweise auf elektrische Quadrupolstärke (E2–Stärke) zwischen 4 und 9.5 MeV gefunden werden. Damit weicht die E2–Stärkeverteilung unterhalb der isoskalaren Quadrupolriesenresonanz (GQR) stark von den doppeltmagischen Kernen ^{40,48}Ca ab [1], in denen die energiegewichtete E2–Summenregel (EWSR) unterhalb von 10 MeV zu 25% bzw. 40% ausgeschöpft wird. Wir diskutieren diesen Befund im Lichte mikroskopischer Modellrechnungen und einer systematischen Betrachtung halbmagischer und doppelt magischer Kerne in einem weiten Massenbereich. Es zeigt sich, dass in doppelt magischen Kernen die EWSR unterhalb der GQR stärker ausgeschöpft wird als in den halbmagischen Kernen. Die nicht energiegewichtete totale E2–Stärke bei Energien unterhalb der GQR ist aber in allen untersuchten Kernen vergleichbar.

[1] T. Hartmann *et al.*, Phys. Rev. Lett. 85, 274 (2000); Phys. Rev. C 65, 034301 (2002)

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Gruppenbericht

HK 4.7 Mo 15:30 C

Mirror symmetry of new subshell closures: ^{36}Ca vs ^{36}S — •Pieter Doornenbal[1,2] and Peter Reiter[2] for the RISING collaboration — [1]GSI Darmstadt, Germany — [2]Univ. Köln, Germany

The new N,Z=14(16) shell stabilisation and the N=20 shell quenching in ^{32}Mg are supposed to be caused by the monopole part of the nucleon-nucleon residual interaction. Disregarding the different neutron binding energy an isospin symmetric scenario is expected for the N=16-20 mirror region and can be verified by experiments along the light Ca (Z=20) isotopes. The ^{36}Ca ions were produced by secondary fragmentation reactions of a secondary ^{37}Ca beam of 200 AMeV impinging on a 0.7 g/cm^2 ^{9}Be target at the FRS focal plane. Gamma-rays were observed by the Ge Cluster detectors, the MINIBALL spectrometer, the HECTOR array of the RISING setup and recorded together with particle and position information. The 2^+ excitation energy in ^{36}Ca of 3017(24) keV is 270 keV lower than its T=2 mirror ^{36}S. Shell model calculations were performed using a ^{16}O core, the sd shell isospin symmetric interaction USD and experimental single particle energies (SPE) from ^{17}O and ^{17}O. Preliminary results reproduce the energy shift qualitatively indicating that a major part of it is due to the Thomas-Ehrmann shift of A=17 SPE.