HK 24 Kernphysik/Spektroskopie

Zeit: Dienstag 17:00–18:30 Raum: C

Gruppenbericht

HK 24.1 Di 17:00 C

Relativistic Projectile Coulomb Excitation to the Yrast and Non-yrast2^+ States with the Rare Isotope Beams of ^{134}Ce and ^{136}Nd — •T.R. Saito[1], N. Saito[1], K. Starosta[2], D.L. Balabanski[3], A. Bracco[4], and C.M. Petrache[5] for the RISING collaboration — [1]GSI — [2]NSCL, MSU — [3]University of Sofia — [4]Università di Milano — [5]Camerino and INFN Perugia

Relativistic Coulomb excitation of ^{134}Ce and ^{136}Nd projectiles at approximately 100 A MeV on a gold target with a thickness of 0.4 g/cm^2 was performed with the RISING-FRS setup at GSI in order to measure reduced E2 transition probability, B(E2), of the transitions depopulating the second 2^+ states, which could provide unique information on the nuclear triaxiality. Single-step Coulomb excitation to the first and second 2^+ states has been observed with measurements of γ-rays depopulating these states by the RISING germanium detector array with EUROBALL cluster and MINIBALL detectors, and B(E2) of transitions from these states have been deduced by normalizing to the known B(E2) of the transition from the first 2^+ state to the ground state in ^{134}Ce. Particle-γ angular correlation of the E2 transition from the first 2^+ state in ^{134}Ce has been measured, and an isotropic distribution has been observed.

HK 24.2 Di 17:30 C

Evolution of gamma-correlations in well deformed rare earth nuclei — •C. Hinke[1], R. Krücken[1], R.F. Casten[2], V. Werner[2], and N.V. Zamfir[3] — [1]Physik Department E12, TU München — [2]Wright Nuclear Structure Laboratory, Yale University, New Haven, USA — [3]National Institute of Physics and Nuclear Engineering, Bucharest, Romania

We will show that the evolution of structure of well deformed rare earth nuclei within the symmetry trianlge of the interactin boson model (IBM) is related to the quasi-particle structure of the gamma-vibrational state in the Nilsson-model. Simplified RPA calculations for the deformed rare earth nuclei have been performed in order to determine the quasi-particle contributions to the \$2ˆ+\$ gamma-vibrational state. It is found that the distribution of quasi-particle contributions to the wave functions seems to be related to the parameter Chi in the interaction boson approximation. On the basis of our comparison the different trajectories within the IBA symmetry triangle obtained for various isotopic chains of rare earth nuclei[1] can be quite naturally related to the underlying quasi-particle correlations.

[1] E.A. McCutchan, N.V. Zamfir, and R.F. Casten, Phys. Rev. C69, 064306 (2004).

HK 24.3 Di 17:45 C

Critial point description of the paring phase transition in nuclei — •R. Krücken[1], R.M. Clark[2], A.O. Macchiavelli[2], and L. Fortunato[3] — [1]Physik Department E12, TU München — [2]NSD Lawrence Berkeley National Laboratory, Berkeley, USA — [3]Dipartimento di Fisica Galileo Galilei, INFN Sez. di Padova, Padova, Italy

We present an approximate solution of the collective pairing hamiltonian that desribes behavior of nuclei at the critical point of the pairing transition from harmonic vibration to deformed rotation in gauge space [1]. This description is analogous to the critical point description of the shape-/phase- transition of nuclei from spherical shapes to quadrupole deformed shapes. Eigenvalues are expressed in terms of zeros of Bessel dunctions of integer order. The results are compared to experimental data, obtained from the ground state masses of even-even nuclei near doubly magic nuclei. [1] R.M. Clark et al., Physical Review Letters, in press

HK 24.4 Di 18:00 C

Test of Pseudospin Symmetry through l-Forbidden Gamow-Teller Transitions.* — •B. Özel[1], A. Byelikov[1], P. von Neumann-Cosel[1], and J. N. Ginocchio[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Therotical Division, Los Alamos National Laboratory

The idea of pseudospin was introduced to explain the quasidegeneracy in spherical nuclei between single-nucleon states with quantum numbers $(n, l, j = l+1/2)$ and $(n-1, l+2, j = l+3/2)$. Transitions between pseudospin partners are of so-called l-forbidden GT or M1 type. Pseudospin symmetry has been shown to be a relativistic SU(2) symmetry of the Dirac Hamiltonian [1]. Application of relativistic SU(2) symmetry leads to specific predictions for the strengths of M1 and GT transitions between them depending only on the magnetic moments. It has been tested for M1 transitions against experimental data with overall good agreement [2]. This motivates an analogous test for GT transitions, pursued in this work.

[1] J. N. Ginocchio, Phys. Rev. Lett. 78, 436 (1997)
[2] P. von Neumann-Cosel and J.N. Ginocchio, Phys. Rev. C62 (2000)
*Supported by the DFG under SFB 634.

HK 24.5 Di 18:15 C

Role of the clusterization of heavy nuclei for fusion reactions — •genevieve mouze — University of Nice, France

There is no need of a repulsive potential in the amalgamation stage for explaining the small fusion cross sections. The repulsive potential proposed by A. Adamian et al.(1) can advantageously be replaced by the affinity of the reaction of re-dissociation of the compound nucleus into its entrance-channel configuration. This reaction, which occurs after the penetration of the Coulomb barrier, is an equilibrium between dual and compact form of the compound nucleus. The energy Q released in the dissociation is equal to the energy required for amalgamating and is a measure of the fusion barrier. The total energy of the confined system being equal to the height B of the Coulomb barrier, the intrinsic excitation energy of the compact nucleus is equal to (B - Q).This energy decides on the number of emitted neutrons and on the remaining excitation energy after evaporation. This new, mass-data-based model of fusion is completely parameter-free. In fusions leading to superheavy nuclei the redissociation energy (clusterization) becomes extremely great and can be equal to B or greater than B: Thus new phenomena can be observed, e.g. cluster-fission (2). B -C , a kind of cluster-fission barrier, plays a major role for the feasibility of superheavy syntheses. (1): G.G. Adamian et al., PRC 69 (2004) 044601. (2): G. Mouze, Europhys. Lett. 58 (2002)362.