ON THE γ - SOFT LIMIT IN THE SO_8 SYMMETRY OF FERMION DYNAMICAL SYMMETRY MODEL

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Bosonic and fermionic descriptions for the nuclear many body system are complementary. Without distinguishing between proton and neutron bosons, it gave rise to a successful phenomenology for medium and heavy nuclei, and is built from the concept of dynamical symmetry whose genesis is a group chain. The fermionic algebra, on the other hand, such as the fermion dynamical symmetry model (FDSM) [1], is necessarily more complex because it originates from the shell structure and uses protons and neutrons as building blocks. In this picture, it lacks the phenomenological freedom to separate the normal states from the exotic states and they should all be eigenstates of a Hamiltonian whose dominate feature must emphasize the intricate interplay between the long–range n–p quadrupole force and the short–range n–n and p–p pairing forces. Therefore the Hamiltonian is not symmetric under proton–neutron exchange. In the fermion description, the n–p quadrupole interaction responsible for splitting these types of state and give rise to two classes of states. One class is invariant under the exchange of the protons and neutrons. These states are referred as "normal". Another class is not invariant under the exchange and they are referred to as "exotic" or "mixed–symmetry" states.

As an example, we examine the spectrum and electromagnetic properties of ^{134}Ba and ^{196}Os.

Reference:

1. X-W. Pan, D. H. Feng, //Phys. Rev. 1994 C50, p.818.

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COLLECTIVE-SINGLE-PARTICLE EXCITED STATES OF DEFORMED ODD ^{155}Eu AND ^{161}Tm NUCLEI WITH SMALL TRIAXIALITY

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Recently we have developed non-adiabatic approach of deformed odd nuclei with small triaxiality [1]. In this work exponential type of potential for the longitudinal vibrations of the nuclear surface has been used and angular momentum of external nucleon has been considered as good quantum number. This approach has explained a number of regularities observed in the spectra of some deformed nuclei with small triaxiality. Here we apply the same approach for the investigation of the excited states of two deformed ^{155}Eu and ^{161}Tm nuclei.

Values of the parameters are determined from the fittng of the calculated spectra of above nuclei with their experimental counterparts. Then the same values are used for the calculation of reduced E2-transition probablities and quadrupole moments of the excited states of the deformed odd ^{155}Eu and ^{161}Tm nuclei.

Comparison of calculated values of the spectra, the reduced E2-transition probabilities inside the rotationally – single-particle band and the quadrupole moments of the excited states of deformed odd ^{155}Eu and ^{161}Tm nuclei with experimental data shows that the model satisfactorily describes above properties of nuclei through only three parameters of the theory, including states up to high spins.

Reference:

1. Sh. Sharipov, M. J. Ermamatov, Int.J.Mod.Phys., E15, 951 (2006)

ANOMALOUS ASYMPTOTICS OF NUCLEAR WAVE FUNCTIONS WITH ACCOUNT OF THE COULOMB INTERACTION

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The asymptotic terms of the projection of nuclear wave functions onto two-fragment channels (overlap integrals (OI)) determine the cross sections of peripheral astrophysical nuclear reactions, in particular, of radiative capture reactions [1]. The adopted 'normal' type of the asymptotic behavior of the radial OI for the virtual $a \to b+c$ process is determined by the binding energy of the composite system a in the $b+c$ channel. It was stated in the earlier work [2] that if a consists of three or more constituents, then the asymptotic behavior of the OI may differ from that 'normal' form. In the given work, the asymptotic behavior of the OI's for charged particles has been derived by relating the asymptotic form with the singular points of the form factor corresponding to the $a \to b+c$ vertex. The nearest to the physical region singular point of the form factor leads to the 'anomalous' asymptotic term which fades off most slowly with r, r being the distance between b and c. This singular point represents the proper singularity of the triangle Feynman diagram. If one writes the $a \to b+c$ process as $\{cdf\} \to \{df\}+c$ where braces denote a bound state of the corresponding constituents (fragments), then this diagram includes three inner lines d, $e = \{cf\}$, and f and three vertices $a \to d+e$ (vertex 1), $e \to c+f$ (vertex 2), and $d+f \to b$ (vertex 3). Singling out the singular part of the amplitude of that diagram has been done by direct investigation of the corresponding Feynman integral taking into account the Coulomb effects in the vertices of the diagram. The sought-for asymptotic behavior of the OI $I(r)$ is obtained in the form

$$I(r)\,(r \to \infty) = Ce^{-\kappa r}/r^{1+\eta} + \widetilde{C}e^{-\kappa_1 r}/r^{2+\eta_1+\eta_3}, \quad \kappa_1 = (m_b/m_d)(\kappa_1+\kappa_3). \tag{1}$$

In eq.(1) C is the so-called asymptotic normalization coefficient (ANC) for the $a \to b+c$ process, m_i is the mass of the particle (fragment) i, κ_j and η_j are respectively the bound-state wave number and the Coulomb (Sommerfeld) parameter for the vertex j and $\kappa(\eta)$ is the bound-state wave number (the Coulomb parameter) for the $a \to b+c$ vertex. An explicit form for the $\widetilde{C}$ coefficient is obtained in terms of m_i, $\kappa_j, \eta_j, \kappa, \eta$, and C_j, C_j being the ANC for the j-th vertex. Two terms in the r.h.s. of eq.(1) correspond to the normal and anomalous asymptotic