

[02/09/03 - Poster]

The two-level Lipkin model solution within the RPA approach for deformed fermions

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We use a Deformed Algebra formalism, the so-called Quon Algebra, to investigate the role of deformation in an approximate treatment of a many-body system in a simple schematic model. As previously shown, the many-body space for quons can be separated by their permutational symmetry properties [1]. As a further step, a method to build in a systematic way a quonic basis restricted to the antisymmetric subspace was recently developed [2]. We apply the method in order to find the RPA frequency and amplitudes as a function of the deformation parameter. We show that this dependence is very sensitive to small deviations from the pure fermionic case and that the frequency is renormalized by those deviations. Also, we conclude that the well-known RPA collapse still occurs, although the critical value for the interaction constant now depends on the deformation parameter. Finally, we show that it is possible to make our results converge to the exact solution, allowing for a dependence of the deformation parameter on the two-body interaction strength of the model.

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New Gamma Transitions in Ir-193 From The Beta Decay Of Os-193

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The population and the mode of decay of the excited levels of ^{193}Ir have been subjected of several gamma spectroscopy investigations using Na(Tl) and Ge(Li) detectors, but the beta decay scheme of ^{193}Os ($T_{1/2} = 30, 6h$) is yet very incomplete. As the nucleus ^{193}Os occupies a central position in the complex transitional region between the deformed rare-earth nuclei and the spherical nuclei near Pb the investigation this beta decay suggest the opportunity to study the extent to which susceptibility to deformation affects the low-lying states of this transitional nucleus. These measurements were performed by using 5mg samples of metallic ^{192}Os enriched to 99% irradiated for a period of 20 minutes in the IEA-R1 reactor at IPEN (São Paulo), under a thermal neutron flux of $5 \times 10^{12} n.cm^{-2}.s^{-1}$. The direct gamma-ray spectrum from about 30keV to 1,6MeV was recorded over more than 900 hours of live counting using a high-energy-resolution ($FWHM \approx 1.8keV$) HPGe spectrometer. In order to positively identify the origin of the γ -rays, spectra were accumulated through two successive half-lives. The precise energy calibration of γ transitions' spectra were taken with standard sources of ^{109}Cd , ^{133}Ba , ^{137}Cs and ^{152}Eu . The sources of ^{133}Ba and ^{152}Eu were also used for the relative efficiency calibration of the detector. Peak areas were evaluated by using the Idefix (IDF) computer code.

From singles spectra analysis the energies of 74 gamma rays have been determined with a better overall precision than previously, 16 of them at the first time. In addition, a number of γ -transitions were confirmed. Particularly, the energy of 1316,63(18)keV, observed for the first time in this work, suggests that end point energy $Q_{\beta_{max}} = 1140,5(24)keV$ must be investigated.

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Angular correlation measurements in a ^{155}Eu nucleus

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The Eu nuclei are in the transitional deformation region and, therefore, it is of great theoretical interest to study their deformation changes as a function of the mass number and excitation energy, as well as to investigate the structure of their excited states. A recent bibliographic research shows that the levels of the ^{155}Eu nucleus were studied via β^- decay first by Ungrin et al [1] in 1969 using Ge(Li) and NaI(Tl) detectors, determining the most part part of levels of this nucleus. Only two studies that performed angular correlation measurements were found, the most recent was done in 1974 by Begzhanov et al. [2]. This indicated the need for further measurements. We performed angular correlation measurements with a system installed at the Linear Accelerator Laboratory of the Instituto de Física da Universidade de São Paulo. This is composed by four Ge detectors with the active volumes ranging from 50 to 190 cm^3 . The fast-slow electronics associated to each detector was composed by a linear amplifier, a fast amplifier and a constant fraction discriminator. The linear outputs were fed to a four-input CAMAC analog-to-digital converter. The fast electronics output was fed to a home-made CAMAC module named as Multi, projected to manage signals of up to eighth detectors, which generates a strobe to ADC and a start to time-to-difference converter. Our samples were composed of 5 mg of Samarium oxide, enriched to 98.7 % of ^{154}Sm .

They were submitted to a thermal neutron flux of $10^{13} \text{ n/cm}^2 \cdot \text{s}$ in the IEA-R1m reactor of IPEN/CNEN-SP during 1 minute. A total of 103 sources was produced. Spectra were measured for a period of time of 1.3 hours for each source produced, totalling 137 hours of measurement. The multipole mixing ratios for 26 gamma transitions were determined; 19 for the first time.

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Application of Pseudo-SU(4) Model to Beta Decay of Medium Mass Nuclei

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The original Wigner Supermultiplet SU(4) model is based on the spin-isospin symmetry of the nucleon-nucleon interaction. The SU(4) symmetry works well in the p-shell, but it is heavily broken for nuclei beyond ds shell due to large l-s coupling. The pseudo-SU(4) model [1] incorporates this coupling by adopting the concept of pseudo-spin and pseudo-orbit. As a combination of the pseudo-spin symmetry and the isospin symmetry, the pseudo-SU(4) symmetry keeps all the technical features of the SU(4) model while incorporating large l-s coupling. A brief analysis in ref.[1] indicates that the pseudo-SU(4) model works fairly well for the pf shell nuclei, especially for $N \cong Z$ nuclei with $N, Z > 28$. We modify the pseudo-SU(4) model by introducing a coupling between the pf space and the $g_{9/2}$ space. The initial and final states can be written as a mixing between the states $(pf)^{N_{pf}}$ and $(g)^{N_g}$, where N_{pf} and N_g are the nucleon numbers in the pf- and the g-space, respectively. The N_{pf} and N_g are determined following a procedure similar to the one used in the pseudo-SU(3) model. The pf-space is assumed to be ruled by the pseudo-SU(4) symmetry, whereas the g-space governed by the seniority model. This assumption is also in line with the Fermion Dynamical Symmetry Model (FDSM) [2]. We apply this extended pseudo-SU(4) model to the β decay in the mass region $28 \leq N, Z \leq 50$. We determine the hindrance factor (the ratio between the experimental single beta decay rate and that calculated from nuclear models) by a comparison between the systematics of experiments [3] and calculations, and the results are to be applied to the $2\nu\beta\beta$ which is viewed as a process of two sequential single beta decays.

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Gamma transitions from the Beta-decay of ^{155}Sm

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The purpose of this work is to investigate the states in ^{155}Eu by beta decay of ^{155}Sm to obtain complementary experimental information to elucidate the population of low energy levels (below 2MeV) in this nucleus. This includes an extensive gamma-ray measurement, using high resolution detectors, with high statistics in the region from 30 keV to 1.5 MeV. According to the last compilation by Firestone [1] basically, the results of two studies [2,3] established the features of the beta (-) decay scheme of ^{155}Sm . Analyzing these works, some controversy, regarding the presence and subsequent placement, of gamma transitions in the level scheme were not solved when the data from beta decay are compared with nuclear reactions studies [1]. Besides a number of gamma transitions must be confirmed and nuclear parameters such as energy, spin and parity of excited levels as well as energy and intensity of gamma transition still need verification. In an attempt to propose a well established decay schema of ^{155}Sm motivated us to perform an investigation of excited levels in ^{155}Eu . The energies of 80 gamma rays have been determined, several for the first time. These results were compared with those published [1] and our gamma-rays energies are given more accurate values.

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