The β-Decay Properties of Scissors Mode 1^+ States in ^{164,166}Er

Z.Yıldırım[1], E.Guliyev[2,3] , A. A. Kuliev[1] and S. Özkan[1]

[1]*Physics Department, Faculty of Arts and Sciences, Sakarya University, Turkey*
[2]*Institute of Physics, Academy of Sciences, H. Cavid Avenue 33, Baku, Azerbaijan*
[3]*Institut fur Kernphysik, Technische Universitat Darmstadt, Darmstadt, Germany*

The beta decay properties of the collective $I^{\pi}K = 1^{+}1$ states in doubly even deformed ^{164,166}Er nuclei are investigated in the framework of the rotational invariant random-phase approximation [1]. The single-particle energies are obtained from the Warsaw deformed Woods–Saxon potential with deformation parameter $\delta_2 = 0.3$. For a more complete comparison with experimental data, we have calculated in addition to the log *ft* values, energies of the excited 1^+ states and B(M1) values. As an example in the figure below, the results of calculations compared with the experimental data [2,3] for the ^{166}Er nucleus. The numerical calculations are carried out, and the decay chain ^{166}Tm $\rightarrow$ ^{166}Er is analyzed. The ground-state configurations of ^{166}Tm have been assigned as 2^{+}[p411↓-n642↑]. The restoration of the broken symmetry or using approaches which are free from the spurious solutions such as the rotational invariant RPA changes somewhat the distribution of the G-T transition strengths $M^2_{\beta}(\omega_i)$ in the spectroscopic energy region and increases the logft value of the scissors mode 1^+ in agreement with the experimental data. The energy of 1^+ scissors mode states, the M1 transition probability and the rate of the allowed G-T β-decay to these states are significantly affected due to the restoring rotational invariance forces while the properties of this vibrational states are practically insensitive to spin-spin forces. The study of 1^+-states in β-decay seems to give some evidence for the importance of separation spurious states. Thus these results indicate a significant role of the consistency of the residual interactions with the given mean-field potentials of the nucleus and importance of the models which are free from low-energy spurious states.

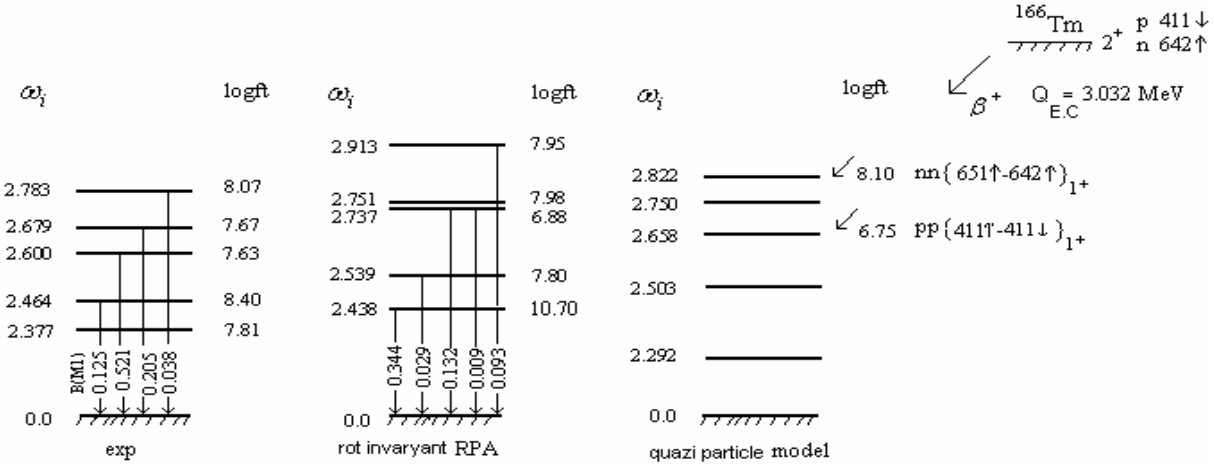

Figure. The energy ω_i (MeV), B(M1) transition probability (in μ_N^2 units) and logft value calculated in single quasi particle and rotational invariant RPA model are compared with the experimental data [2,3].

References

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