

Beta-Decay $^{231}\text{Th} \rightarrow ^{231}\text{Pa}$

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On the basis of dynamic collective model (DCM) β^- -decay $^{231}\text{Th} \rightarrow ^{231}\text{Pa}$ is described. In the used method [1] quasiparticle and multiphonon (up to ten phonons) states and vacuum fluctuations of quasiparticles are considered. The energies, spectroscopic factors, magnetic dipole and electric quadrupole moments of the ground and excited states of the daughter nucleus, as well as reduced probabilities of the electromagnetic transitions are calculated.

β decay goes from the ground state $5/2_1^+$ of ^{231}Th in which the contribution give almost all subshells with the even orbital moments from filled shell. The β transitions occur with maximum intensity to $5/2_1^+$ and $7/2_1^+$ states of ^{231}Pa , formed by bonding of one-quasiparticle state $13/2_1^+$ with phonon states of even-even core with full moments $R = 4, 6, 8, 10$.

The comparison of experimental and calculated $\lg ft$ (t – half-life period) is presented in the table. The spins of states on which there are beta transitions are specified in the first line, the energy of states – in the second, the intensity of transitions – in the third, the experimental and calculated $\lg ft$ values – in the fourth and fifth lines.

I^π	$5/2_1^+$	$7/2_1^+$	$3/2_1^+$	$5/2_2^+$
E, keV, exp.	84.2	101.4	102.3	183.5
I, %	35	37	12	12.8
$\lg ft$, exp.	6.0	5.9	6.4	5.9
$\lg ft$, calc.	6.2	5.8	6.4	6.2

The renormalization of the constants of weak interaction in this calculation was the same as for the nuclei with $A \approx 100$ [1]:

$$\frac{g_A}{g_V} = 0.343 \left[\frac{g_A}{g_V} \right]^{\text{free}},$$

where $[g_A/g_V]^{\text{free}}$ means the relation of axial-vector and vector constants for β -decay of a free neutron.

References

- [1] I. N. Vishnevskii, A. A. Kurteva, V. E. Mitroshin et al., “Probabilities of β -transitions and nuclear structure,” *Physics of Atomic Nuclei* **57**, No 1, (1994) 15–30.