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The $^{155}Tb \rightarrow {}^{155}Gd$ decay was investigated by many authors. The most complete data on the ^{155}Gd level scheme were obtained on the basis of an internal conversion electron investigation by Harmatz et al.[1]. New data concerning ^{155}Gd levels were obtained by Wilsky et al.[2], who for the first time measured the ^{155}Tb γ-ray spectrum in the energy range from zero to 380 keV with the aid of a Ge(Li) semiconductor detector.

We have measured the ^{155}Tb internal conversion electron spectrum using a magnetic two-fold* double focusing β-spectrometer[3]. The γ-ray spectrum was obtained with the aid of a coaxial Ge(Li) semiconductor detector with an effective volume of 5 cm^3.

The ^{155}Tb source for the γ-spectrum measurement was produced by chromatographic separation from the Dy fraction, obtained by chemical separation from the Ta target, which was irradiated by 660 MeV protons on the synchrocyclotron at the JINR in Dubna. The measurements were started 30-40 days after the separation of the Tb from Dy. In the first run of γ-ray spectra measurements a small ^{155}Gd activity admixture was observed as a result of ^{155}Tb decay. Therefore, the Tb source was chemically separated for the second time so that only ^{155}Tb activity was present in the later measurements. A Tb fraction separated from the Ta target was used as the source in our conversion spectrum measurements. The obtained γ-ray spectra are shown in Fig. 1.

The energies and relative intensities of 59 γ-transitions in the ^{155}Gd nucleus were obtained. 44 transitions were obtained in the γ-ray spectrum for the first time, 21 of them were not observed previously at all. 8 of these transitions were also observed in our electron conversion spectrum.

The experimental values of internal conversion coefficients were determined on the basis of the obtained data and those of[1], assuming the 262.45 keV transition to be of a pure M1 type[1]. Conclusions are made on the multipolarities of the most of the transitions. The $^{155}Tb \rightarrow {}^{155}Gd$ decay scheme, suggested on the basis of the energy and intensity balance and the conclusions on the

* The spectrometer was operated as a single double focusing spectrometer.

transition multipolarities are given in Fig. 2. The transition energies and multipolarities are indicated in the scheme. We have included new levels, as compared with the decay scheme proposed by Harmatz [1], with the following energies: 488.8 keV, 592.6 keV, 647.8 keV, 706 keV, and 881 keV. A 138.8 keV level may also exist. The parities of all levels given in the $^{155}Tb \rightarrow {}^{155}Gd$ decay scheme were determined. The possible spin assignments of levels are shown. It was proved in Coulomb excitation experiments that the 60.0 keV and 146.0 keV levels belong to the rotational band of the ^{155}Gd ground state. Similarly as in the previous papers quantum characteristics: 3/2 −[521], 3/2 +[651], 5/2+[642], 5/2−[523], respectively, were attributed to the ground state of ^{155}Gd and its 86.5 keV, 105.3 keV, and 286 keV excited states and the value 3/2+[411] to the ^{155}Tb ground state. In paper [1] the quantum characteristics 3/2−[523] were assigned to the 326.0keV level. However, it follows from our data that this level has of positive parity, as pointed out in the paper of Wilsky et al. [2]. The observed 428 keV transition confirms the previously made assumption on the existence of a positive parity 427.4 keV level.

The character of the 592.6 keV, 647.8 keV, and 706 keV negative parity levels is striking. The experimentally obtained large values of the internal conversion coefficients for the 592.8 keV and 588.2 keV transitions (see Table 1) from the 592.6 keV and 647.8 keV level to the ground state and 60.0 keV level, respectively, indicate that these are either high polarity transitions, or that an EO multipolarity admixture demonstrates itself. The high transition multipolarity assumption leads to high spin values of the respective levels. However, an analysis of the experimental data shows, that the excitation of levels with such spins is practically excluded. This is the reason for our EO+E2 multipolarity mixture assumption. On this basis we suppose that the 592.6 keV level has spin and parity $3/2^-$ and represents a β-vibrational state, related to the ground state. Similarly, we come to the conclusion that the 647.8 keV level has the quantum characteristics $5/2^-$ and is the first rotational state based on the 592.6 keV β-vibrational level. The negative parity and experimentally possible spin assignment (5/2, 7/2) of the 706 keV level indicates that this level could be the second rotational state of this band. However, the large value of the parameter B ($B = -0.227$ keV) in the formula for the rotational band level energies obtained for this kind of interpretation does not exclude a different nature of this level.

Our conclusions on the β-vibrational character of the 592.6 keV level are in good agreement with the ^{155}Gd Coulomb excitation data [4]. The existence of a collective level at ~ 0.6 MeV with the possible quantum characteristics

$(1/2^-, 3/2^-, 5/2^-, 7/2^-)$ was demonstrated in the paper of Yerokhina et al. [4].

More detailed data and conclusions concerning the ^{155}Tb decay made on the basis of our measurements will be published later.

In conclusion the authors thank Drs. K.Ya.Gromov and Z.Zhelev for their interest in this investigation and Drs. S.Bjørnholm, P.Vogel, V.Hnatowicz, V.V.Kuznetsov and N.Pyatov for helpful discussions.

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Table I.

E_γ (keV)		α exper.	α theor.						multipolarity	$\delta^2 = \frac{I_\gamma(E0)}{I_\gamma(E2)}$
			E1	E2	E3	M1	M2	M3		
262.45	K	1.17 (-1)	1.91 (-2)	6.75(-2)	2.14(-1)	1.17(-1)	5.02(-1)	1.91(-1)	M1	-
568.2	K	9.6(-2) ±4.4(-2)	2.82(-3)	7.42(-3)	1.82(-2)	1.41(-2)	4.17(-2)	1.05(-1)	E0+E2	0.09±0.04
592.8	K	1.4(-1)	2.75(-3)	7.67(-3)	1.78(-2)	1.38(-2)	4.67(-2)	1.0(-1)	E0±E2	0.15± 0.07
	L	2.31(-4) ± 1.0(-2)	3.31(-4)	4.32(-3)	2.40(-3)	1.82(-3)	5.98(-3)	1.51(-2)		

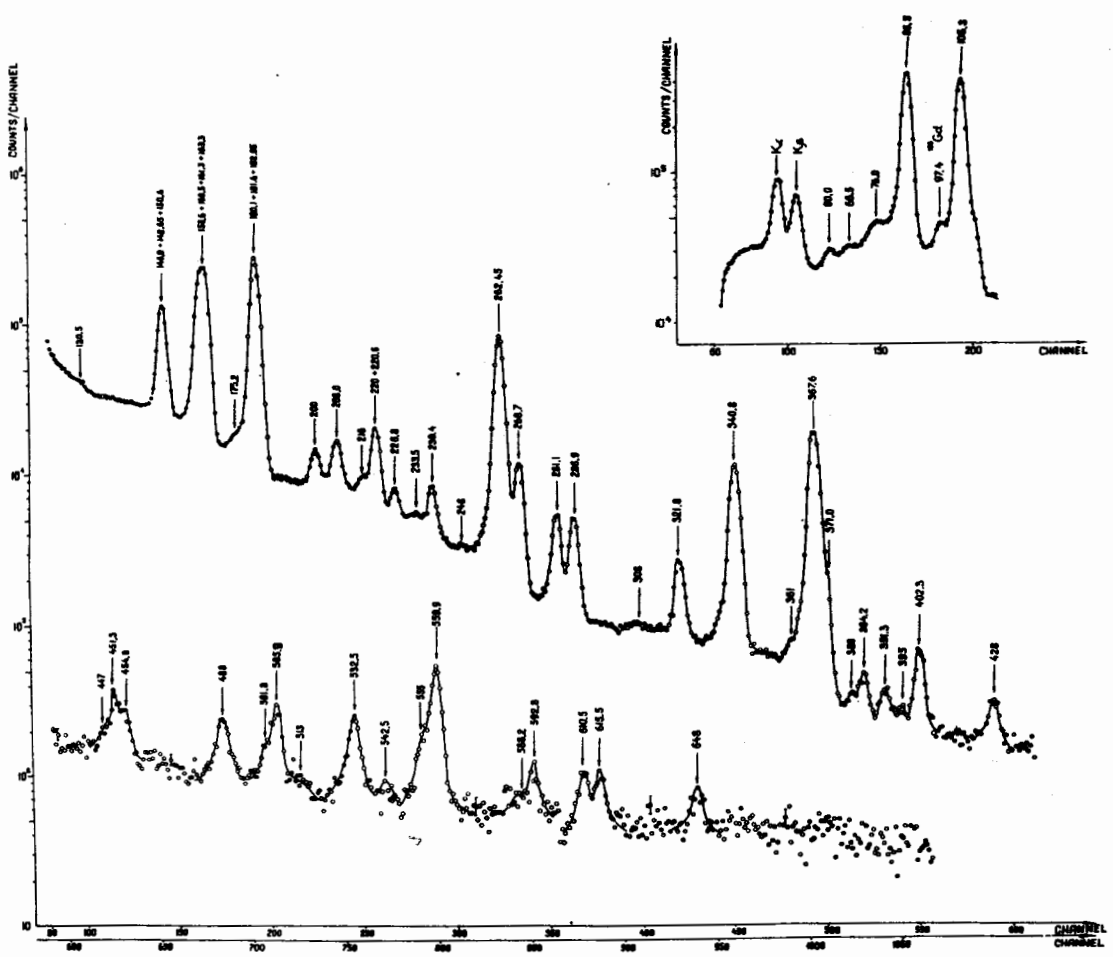

Fig. 1.

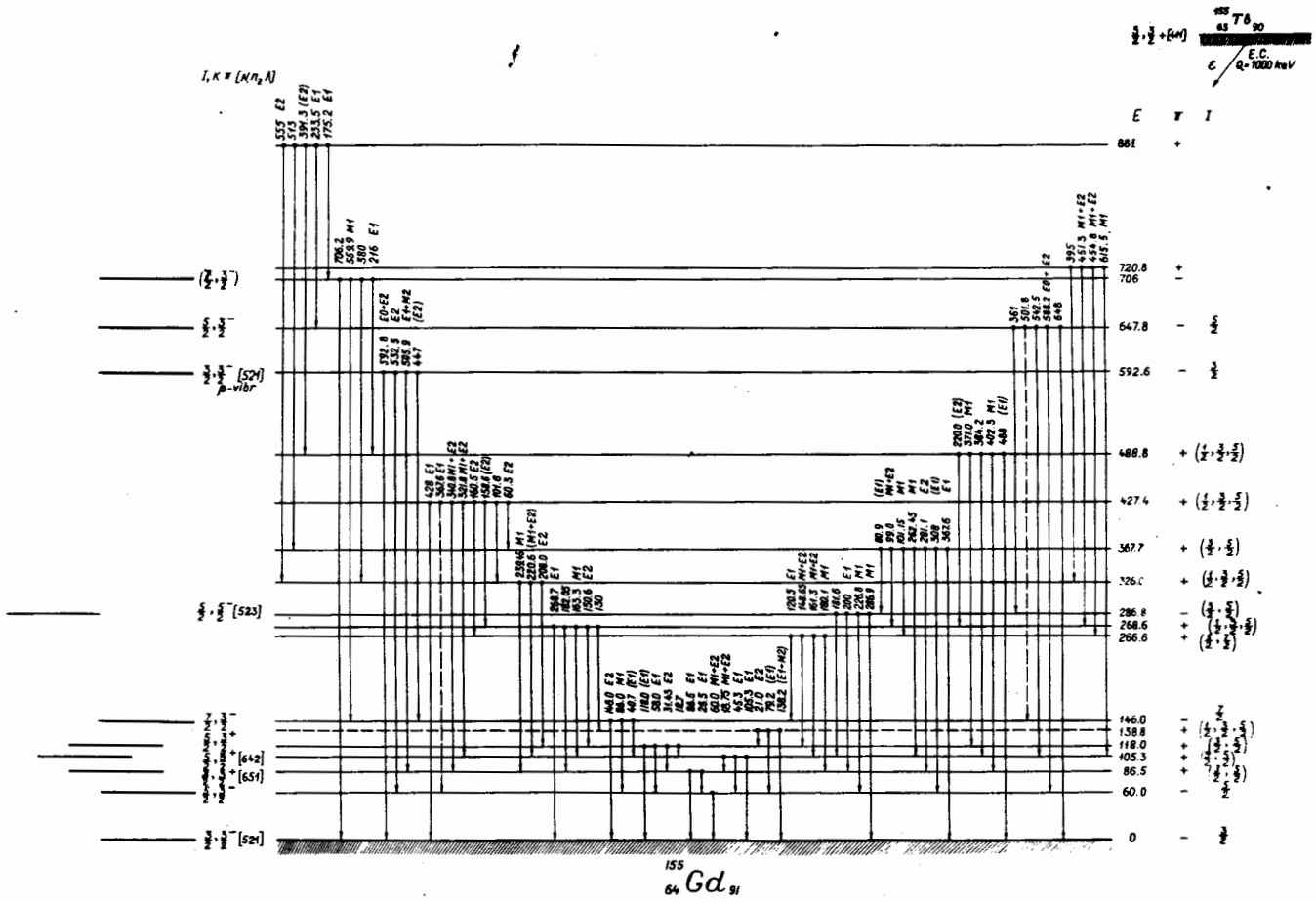
155 Tb 90
65
E.C.
Q=1000 keV
I, K = [N n_z Λ]
E
γ
I
881
720.8
706
647.8
592.6
488.8
427.4
367.7
326.0
286.8
268.6
266.6
146.0
138.8
118.0
105.3
86.5
60.0
0
[521]
[523]
[642]
[651]
β-viol
155 Gd 91
64

Fig. 2.