

$^{154}\text{Lu}$  IT decay (35  $\mu\text{s}$ ) [1993Mc03,1990Mc02](#)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

Parent:  $^{154}\text{Lu}$ :  $E=2620.7+x$  3;  $J^\pi=(17^+)$ ;  $T_{1/2}=35 \mu\text{s}$  3; %IT decay=100

Additional information 1.

This  $^{154}\text{Lu}$  isomer was produced in the  $^{102}\text{Pd}(^{54}\text{Fe},\text{pn})$  reaction with  $E(^{54}\text{Fe})=245$  MeV. The recoil-product  $^{154}\text{Lu}$  isomer was mass-analyzed in the Daresbury Recoil Separator and collected on an Al catcher foil.  $\gamma$  singles and  $\gamma\gamma$  coincidences were measured using several Ge detectors and a LEPS detector.

 $^{154}\text{Lu}$  Levels

There may be some question as to whether the lowest level reported here (the  $(9^+)$  level) is the same as the level that decays via  $\varepsilon$  to  $^{154}\text{Yb}$ . In their study of the  $^{154}\text{Lu}$   $\varepsilon$  decay, [1988Vi02](#) assign the  $\varepsilon$  parent level as  $(7^+)$ . With this in mind, [1990Mc02](#) state that their results shed no light on this question, since a low-energy, highly converted transition (from  $(9^+)$  to  $(7^+)$ ) would not have been detected in their work. However, the evaluator has concluded, based on the information from the in-beam studies ([1993Zh10,1996Zh09](#)) of the  $^{154}\text{Yb}$  level scheme, that the  $J^\pi$  value of the  $^{154}\text{Lu}$  parent in the  $\varepsilon$  decay is probably not  $(7^+)$  but rather is  $(9^+)$ . Throughout this evaluation, it has been assumed that the  $(9^+)$  level seen here is the same as the parent state of the  $^{154}\text{Lu}$   $\varepsilon$  decay.

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$	Comments
62.12	$(9^+)^\#$	1.12 s 8	
81.04	$(8^+)^\#$		
416.84	$(9^+)^\@$		
945.84	$(10^+)^\@$		
1261.84	$(10^-)^\&$		
1284.44	$(11^-)^\&$		
1461.44	$(11^+)^\&$		
1499.85	$(12^-)^\@$		
1872.86	$(12^-)$		
1970.65	$(13^-)$		
2140.35	$(13^+)$		
2283.85	$(14^-)$		
2490.35	$(14^+)$		
2490.3+x 5	$(15^+)$		
2620.7+x 3	$(17^+)$	35 $\mu\text{s}$ 3	The configurational makeup of this level is discussed in the theoretical study of <a href="#">2002Ma80</a> .

<sup>†</sup> From Adopted Levels.

<sup>‡</sup> The  $J^\pi$  values and configuration assignments are those suggested by [1990Mc02](#) and are based on analogy to those in  $^{150}\text{Ho}$  and  $^{152}\text{Tm}$ . Assignments agree with those in  $^{154}\text{Lu}$  Adopted Levels.

<sup>#</sup> Configuration= $((\pi h_{11/2})(\nu f_{7/2}))$ .

<sup>@</sup> Configuration= $((\pi h_{11/2})(\nu h_{9/2}))$ .

<sup>&</sup>  $3^-$  octupole vibration built on the g.s. configuration.

<sup>a</sup> Configuration= $((\pi h_{11/2})(\nu i_{13/2}))$ .

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γ(<sup>154</sup>Lu)

I<sub>γ</sub> normalization: Computed by requiring that I(γ+ce)(130.4γ)=100%. If it is required that the sum of the I(γ+ce) values of the transitions feeding the g.s. be 100%, I<sub>γ</sub> normalization=0.62 4 is obtained. The listed uncertainty includes only the uncertainty in the internal-conversion coefficient of the isomeric transition. The uncertainty in the I<sub>γ</sub> value of this transition is not included.

<u>E<sub>γ</sub><sup>†</sup></u>	<u>I<sub>γ</sub><sup>‡</sup>&amp;</u>	<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup>π</sup></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup>π</sup></u>	<u>Mult.</u>	<u>α<sup>a</sup></u>	<u>I<sub>(γ+ce)</sub><sup>&amp;</sup></u>	<u>Comments</u>
(x)		2490.3+x	(15 <sup>+</sup> )	2490.3	(14 <sup>+</sup> )				E <sub>γ</sub> : γ is unobserved, but populates 2490.3+x level.
22.2 5		81.0	(8 <sup>+</sup> )	62	(9 <sup>+</sup> )			75 @ 8	E <sub>γ</sub> : from Adopted Gammas.
(22.6 # 6)		1284.4	(11 <sup>-</sup> )	1261.8	(10 <sup>-</sup> )			103 @ 15	
98.0 6	7 4	1970.6	(13 <sup>-</sup> )	1872.8	(12 <sup>-</sup> )				
130.4 3	72 7	2620.7+x	(17 <sup>+</sup> )	2490.3+x	(15 <sup>+</sup> )	E2	1.238 21		The large hindrance of this transition, as well as those of a number of other such transitions in neutron-deficient nuclides in this mass region, has been discussed by 2002Ma80 in the framework of an extended seniority reduction formalism involving three valence orbitals, together with significant proton excitation out of the <sup>146</sup> Gd core.
									Mult.: From intensity balance, α(exp)=1.14 21 (1990Mc02). This indicates that mult=E2.
206.8 4	18 2	2490.3	(14 <sup>+</sup> )	2283.8	(14 <sup>-</sup> )				
215.4 3	100 10	1499.8	(12 <sup>-</sup> )	1284.4	(11 <sup>-</sup> )	(M1)	0.422		Mult.: Shown by 1990Mc02 as M1 in their level scheme and presumably based on intensity-balance considerations, although this point is not specifically addressed by these authors. From intensity-balance considerations at the 1225+x, (11 <sup>-</sup> ) level, the evaluator computes α(exp)=0.41 13. This is consistent with mult=M1, although an admixture of E2 (for which α=0.217) is not ruled out.
313.4 5	10 2	2283.8	(14 <sup>-</sup> )	1970.6	(13 <sup>-</sup> )				
316.2 5	9 2	1261.8	(10 <sup>-</sup> )	945.8	(10 <sup>+</sup> )				
335.9 3	75 8	416.8	(9 <sup>+</sup> )	81.0	(8 <sup>+</sup> )				
338.7 4	39 4	1284.4	(11 <sup>-</sup> )	945.8	(10 <sup>+</sup> )				
350.0 3	99 10	2490.3	(14 <sup>+</sup> )	2140.3	(13 <sup>+</sup> )				
358.1 6	5 2	416.8	(9 <sup>+</sup> )	62	(9 <sup>+</sup> )				
411.6 5	10 2	1872.8	(12 <sup>-</sup> )	1461.4	(11 <sup>+</sup> )				
470.7 4	31 3	1970.6	(13 <sup>-</sup> )	1499.8	(12 <sup>-</sup> )				
519.5 4	37 4	2490.3	(14 <sup>+</sup> )	1970.6	(13 <sup>-</sup> )				
529.1 4	34 5	945.8	(10 <sup>+</sup> )	416.8	(9 <sup>+</sup> )				
640.6 4	70 7	2140.3	(13 <sup>+</sup> )	1499.8	(12 <sup>-</sup> )				
678.8 4	18 3	2140.3	(13 <sup>+</sup> )	1461.4	(11 <sup>+</sup> )				
784.3 6	8 2	2283.8	(14 <sup>-</sup> )	1499.8	(12 <sup>-</sup> )				
845.2 4	43 4	1261.8	(10 <sup>-</sup> )	416.8	(9 <sup>+</sup> )				
1202.5 5	50 9	1261.8	(10 <sup>-</sup> )	62	(9 <sup>+</sup> )				
1402.3 4	31 3	1461.4	(11 <sup>+</sup> )	62	(9 <sup>+</sup> )				

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$\gamma(^{154}\text{Lu})$  (continued)

† From [1993Mc03](#), unless noted otherwise.

‡ From [1993Mc03](#).

# From level-energy difference.  $\gamma$  not observed.

@ From intensity balance.

& For absolute intensity per 100 decays, multiply by 0.621 6.

<sup>a</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with “Frozen Orbitals” approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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Decay Scheme

Intensities:  $I_\gamma$  per 100 parent decays  
%IT=100

Legend

- ▶  $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- ▶  $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- ▶  $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - - -▶  $\gamma$  Decay (Uncertain)

