

^{163}Lu ε decay (3.97 min) [1980Be39](#),[1983Ge08](#),[1980AdZU](#)

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich, Balraj Singh		NDS 111, 1211 (2010)	12-Apr-2010

Parent: ^{163}Lu : $E=0.0$; $J^\pi=1/2^{(+)}$; $T_{1/2}=3.97$ min $I3$; $Q(\varepsilon)=4510$ 30 ; $\% \varepsilon + \% \beta^+$ decay=100.0

^{163}Lu - $J^\pi, T_{1/2}, Q(\varepsilon)$: From the ^{163}Lu Adopted Levels.

Additional information 1.

[1980Be39](#): W(p,X) $E=1$ GeV. Mass separation. Measured K x ray's, γ' s, K x ray(t), γ (t).

[1983Ge08](#) (also [1981RaZH](#), [1982RaZI](#)): $^{155}\text{Gd}(^{14}\text{N},6n)$ and $^{151}\text{Eu}(^{16}\text{O},4n)$ $E(\text{max})=154$ MeV. Measured excitation functions, x-rays, γ' s, X γ coin, $\gamma\gamma$ -coin, K x ray(t), γ (t).

[1980AdZU](#): W(p,X) $E=660$ MeV. Measured γ' s, ce' s, $\gamma\gamma$ - and $\text{ce}\gamma$ -coin, $\gamma\gamma$ (t).

Others:

[1994MoZY](#): $\gamma\gamma$ (t), $\text{ce}\gamma$ (t).

[1993AI03](#): measured total γ spectra, deduced Q value= 4600 200 .

[1981By04](#): measured $E\beta$, $I\beta$, β strength functions.

[1979AI16](#): production, identification and $T_{1/2}$.

[1975Ad09](#): tentative isotopic assignment with $T_{1/2}(^{163}\text{Lu}) < 3$ min.

The level scheme is as proposed by [1980Be39](#) and [1983Ge08](#). Due to several discrepancies between the two studies, the level scheme given here is considered as tentative.

 ^{163}Yb Levels

E(level) [†]	J^π [‡]	$T_{1/2}$	Comments
0.0	$3/2^-$		Configuration= $\nu 3/2[521]$.
53.88 5	$5/2^-$	3.8 ns 3	Unfavored ($\alpha=+1/2$) member of $\nu 3/2[521]$ band. $T_{1/2}$: from 1980AdZU .
58.1 [#]	$(3/2^-, 5/2, 7/2^-)$	>10 ns	$T_{1/2}$: $\gamma\gamma$ (t) or $\text{ce}\gamma$ (t) (1994MoZY).
133.08 $@$ 6	$7/2^-$		Member of $\nu 3/2[521]$ band.
156.21 $@$ 5			
221.12 4	$\leq 7/2$		
371.80 5	$\leq 7/2$		
450.02 $@$ 10			
465.09 9			
474.23 8	$\leq 7/2$		E(level): level not reported by 1980AdZU .
514.6 $@$ 3			
537.98 13			
578.49 [#] 16			
620.6 $@$ 4			
674.46 11			
749 $@$ 1			
768.59 11			E(level): the 772 level in 1983Ge08 may be the same as 768 level.
855.29 [#] 19			
870.63 $&$ 25	$\leq 7/2$		
938.82 $&$ 12			

[†] From least-squares fit to $E\gamma$'s, keeping 58.1 level fixed in energy.

[‡] From Adopted Levels.

[#] Level from [1980AdZU](#) and [1983Ge08](#), not reported by [1980Be39](#).

$@$ From [1983Ge08](#) only.

$&$ From [1980Be39](#) only.

$\gamma(^{163}\text{Yb})$									
$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	δ	$\alpha^\&$	Comments
4.2 54.00 10	88 8	58.1 53.88	(3/2 ⁻ , 5/2, 7/2 ⁻) 5/2 ⁻	53.88 0.0	5/2 ⁻ 3/2 ⁻	M1+E2	≈ -1.5	≈ 29.5	E_γ : from 1980AdZU and 1983GeO8. $\alpha(L) \approx 22.5$; $\alpha(M) \approx 5.54$; $\alpha(N+..) \approx 1.405$ $\alpha(N) \approx 1.261$; $\alpha(O) \approx 0.1435$; $\alpha(P) \approx 0.000434$ Mult., δ : from adopted gammas.
58 $\frac{\ddagger}{\ddagger}$ 75.00# 10 79.19# 5	44 $\frac{\ddagger}{\ddagger}$ 2.2 7 3.8 7	58.1 133.08 133.08	(3/2 ⁻ , 5/2, 7/2 ⁻) 7/2 ⁻ 7/2 ⁻	0.0 58.1 53.88	3/2 ⁻ (3/2 ⁻ , 5/2, 7/2 ⁻) 5/2 ⁻	M1(+E2)	+0.03	6.61	$\alpha(K)=5.51$ 8; $\alpha(L)=0.853$ 12; $\alpha(M)=0.191$ 3; $\alpha(N+..)=0.0516$ 8 $\alpha(N)=0.0449$ 7; $\alpha(O)=0.00640$ 9; $\alpha(P)=0.000339$ 5 Mult., δ : from adopted gammas.
93.33 10 94.17@ 5 x96.49 5	5.4 10 12.0 20 9.6 18	465.09 768.59		371.80 674.46	$\leq 7/2$				
98.11# 5 102.50 10 150.74 5	5.4 10 7.4 15 45 5	156.21 474.23 371.80		58.1 371.80 221.12	(3/2 ⁻ , 5/2, 7/2 ⁻) $\leq 7/2$ $\leq 7/2$				
x152.82 10 163.08# 5 167.26 5	5.0 15 100 10 22 3			58.1 53.88	(3/2 ⁻ , 5/2, 7/2 ⁻) 5/2 ⁻				
170.26@ 5 206.69# 15 209.40@ 15	1.5 5 8.2 20 2.6 8	938.82 578.49 674.46		768.59 371.80 465.09	$\leq 7/2$				
220.93 10 x221.62 15 x239.68 10	18 4 12 3 18 4	221.12	$\leq 7/2$	0.0	3/2 ⁻				
243.91 15 253.00 10 302.90 15	6.2 15 7.1 15 28 4	465.09 474.23	$\leq 7/2$	221.12 221.12	$\leq 7/2$ $\leq 7/2$				
313.83 15 317.00 20 318.0@ 3	24 3 11 3 6.0 20	371.80 537.98	$\leq 7/2$	58.1 221.12	(3/2 ⁻ , 5/2, 7/2 ⁻) $\leq 7/2$				
371.73 10 381 $\frac{\ddagger}{\ddagger}c$ 391.10# 20	62 10 10 $\frac{\ddagger}{\ddagger}$ 20 3	371.80 514.6 450.02	$\leq 7/2$	53.88 133.08 58.1	5/2 ⁻ 7/2 ⁻ (3/2 ⁻ , 5/2, 7/2 ⁻)				I_γ : 5.9 (1983GeO8). E_γ : level-energy difference=391.9. Placed from 768 level (1980Be39).
396.34a# 10 396.34ac 10	63a 7 63a 7	450.02 768.59		53.88 371.80	5/2 ⁻ $\leq 7/2$				I_γ : 7.8 for a 395 γ (1983GeO8). A 395 γ placed from a 450 level and a 400 γ placed from a 772 level in 1983GeO8.

¹⁶³Lu ε decay (3.97 min) [1980Be39](#),[1983Ge08](#),[1980AdZU](#) (continued)

γ(¹⁶³Yb) (continued)

E _γ [†]	I _γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
400.30 [@] 20	16.0 20	938.82		537.98		I _γ : 4.2 (1983Ge08). Placed from a 772 level in 1983Ge08 .
^x 448.80 20	30 5					
453.5 3	17 3	674.46		221.12	≤7/2	
456.6 [#] 4	11 3	514.6		58.1	(3/2 ⁻ ,5/2,7/2 ⁻)	I _γ : 6.4 (1983Ge08).
460.7 [#] 4	16 3	514.6		53.88	5/2 ⁻	I _γ : 7.2 (1983Ge08).
474.8 4	12 4	474.23	≤7/2	0.0	3/2 ⁻	
483.50 ^b 20	24 ^b 5	537.98		53.88	5/2 ⁻	
483.50 ^{b#} 20	8 ^b 2	855.29		371.80	≤7/2	I _γ : divided on the basis of I _γ (483γ)=6.4 and I _γ (484γ)=19.2 (1983Ge08). γ placed from 538 level only by 1980Be39 , unplaced in 1980AdZU , probable doublet from 1983Ge08 .
498.9 [@] 3	15 5	870.63	≤7/2	371.80	≤7/2	
537.5 5	5.0 20	537.98		0.0	3/2 ⁻	I _γ : 12.4 (1983Ge08).
^x 553.0 3	32 5					
562.5 [#] 4	16 3	620.6		58.1	(3/2 ⁻ ,5/2,7/2 ⁻)	
566.4 [#] 5	11.0 20	620.6		53.88	5/2 ⁻	Placed from 939 level in 1980Be39 .
566.4 ^{a@c} 5	11.0 ^a 20	938.82		371.80	≤7/2	I _γ : 6.9 (1983Ge08). Placed from a 620 level (1983Ge08).
621.0 5	16 4	674.46		53.88	5/2 ⁻	
634.1 [#] 5	14 4	855.29		221.12	≤7/2	
^x 644.4 4	18 3					
695 [‡]	15 [‡]	749		53.88	5/2 ⁻	
870.5 [@] 4	15 4	870.63	≤7/2	0.0	3/2 ⁻	

[†] From [1980Be39](#), except as noted. I_γ's from [1983Ge08](#), renormalized to 100 for 163γ are generally consistent with those from [1980Be39](#).

[‡] γ from [1983Ge08](#). I_γ renormalized (evaluators).

[#] Placement from [1983Ge08](#) and/or [1980AdZU](#), unplaced or differently placed in [1980Be39](#).

[@] Placement from [1980Be39](#).

[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^a Multiply placed with undivided intensity.

^b Multiply placed with intensity suitably divided.

^c Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

Decay Scheme

Intensities: Relative I_γ

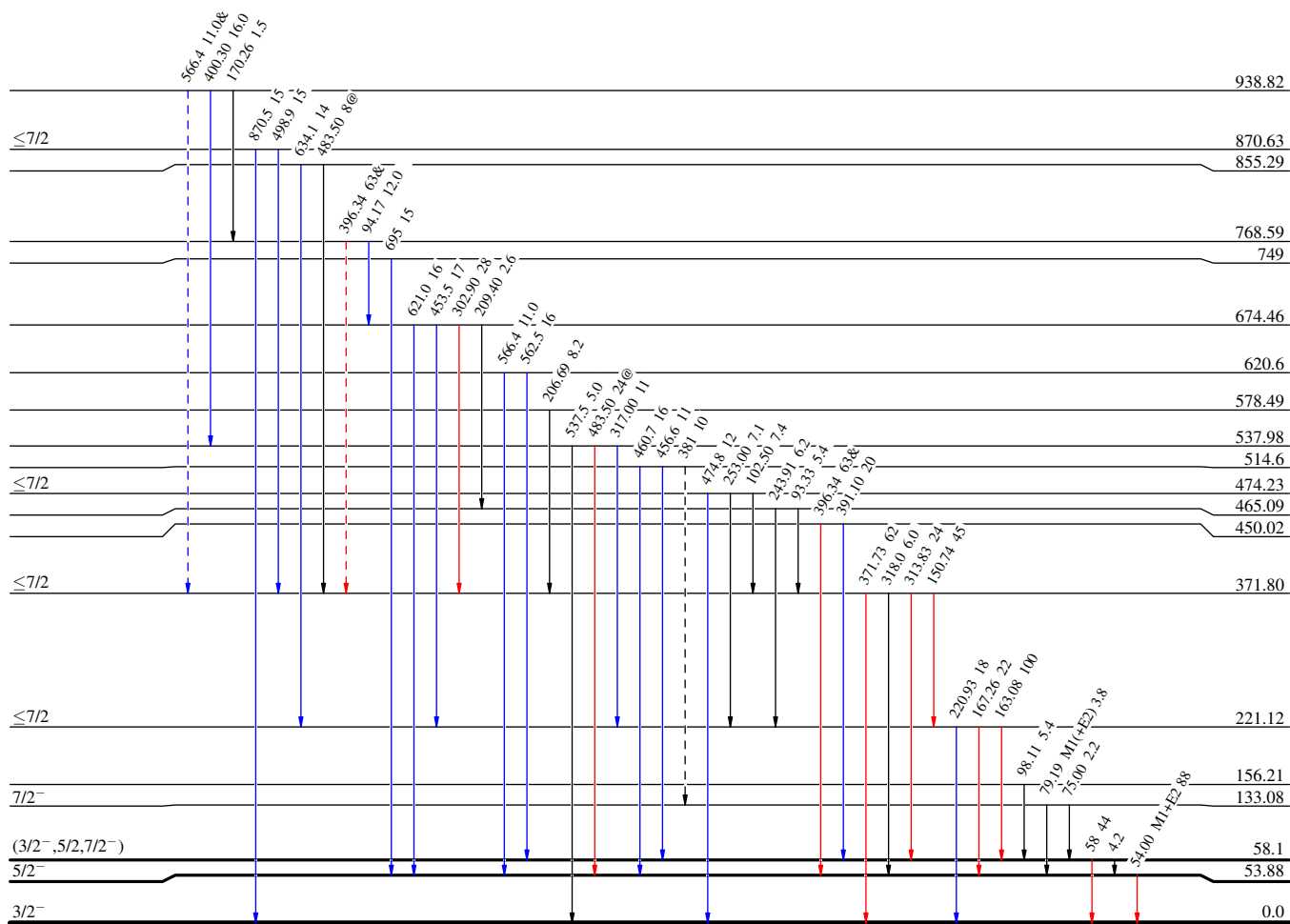
& Multiply placed: undivided intensity given

@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)

1/2⁽⁺⁾ 0.0 3.97 min 13
Q_ε=4510.30
¹⁶³₇₁Lu₉₂
%ε + %β⁺=100.0



> 10 ns
3.8 ns 3

¹⁶³₇₀Yb₉₃

¹⁶³₇₀Yb₉₃-4

From ENSDF

¹⁶³₇₀Yb₉₃-4