

**Adopted Levels, Gammas**

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

Q(β<sup>-</sup>)=-10270 *syst*; S(n)=10840 *syst*; S(p)=3248 21; Q(α)=5474.3 17 2021Wa16

ΔQ(β<sup>-</sup>)=200, ΔS(n)=200 (*syst*,2021Wa16).

S(2n)=19800 150, S(2p)=4010 19, Q(εp)=3246 20 (2021Wa16).

**Additional information 1.**

The information on <sup>154</sup>Yb comes primarily from the study of the <sup>154</sup>Lu ε decay (1988Vi02) and the in-beam studies (1993Zh10 and 1996Zh09). These latter studies make extensive use of multiparticle shell-model calculations to elucidate the properties of the <sup>154</sup>Yb levels.

<sup>154</sup>Yb Levels

α-particle emission from excited levels between 3 and 6 MeV in <sup>154</sup>Yb populated in the <sup>154</sup>Lu ε decay has been reported by 1988Vi02. In addition, these authors report proton emission from <sup>154</sup>Yb states between 6.5 and 9 MeV excitation energy. They measure I<sub>α</sub>=0.03% and I<sub>p</sub>=0.06%. These values were determined from the measured α and proton intensities, respectively, relative to I<sub>γ</sub>(821.3)(1+α), which they assume represents 100% of the <sup>154</sup>Lu decays.

Cross Reference (XREF) Flags

- A <sup>154</sup>Lu ε decay
- B <sup>158</sup>Hf α decay
- C <sup>106</sup>Cd(<sup>54</sup>Fe,α2pγ)

E(level) <sup>†</sup>	J <sup>π‡</sup>	T <sub>1/2</sub>	XREF	Comments
0	0 <sup>+</sup> #@	0.409 s 2	ABC	%ε+%β <sup>+</sup> =7.4 12; %α=92.6 12 Δ<r <sup>2</sup> >( <sup>152</sup> Yb- <sup>154</sup> Yb)=0.357 fm <sup>2</sup> 67 and Δ<r <sup>2</sup> >( <sup>154</sup> Yb- <sup>156</sup> Yb)=0.274 fm <sup>2</sup> 60 (from tabulation in 1994Ma57 and based on data of 1989Sp04 which is only reported in plots); others: see graphs of 1989Sp04 and 1991Ho22. From an evaluation of data on nuclear rms charge radii, 2013An02 report <r <sup>2</sup> > <sup>1/2</sup> =5.088 fm 11. T <sub>1/2</sub> : From 1996Pa01, α(t). Others: 0.39 s 4 (1964Ma45), 0.42 s 2 (1977Ha48), 0.33 s 4 (1978AfZZ), and 0.41 s 3 (1979Ho10) all from α(t); and 0.42 s 5 (1988Vi02) from γ(t) in <sup>154</sup> Yb ε decay. Note that a weighted average of all six values gives 0.409 s 2 with a reduced-χ <sup>2</sup> value of 0.92, the same result for T <sub>1/2</sub> . %α: Weighted average of: 92 2 (1996Pa01); 92.8 20 (1988Vi02) (from <sup>154</sup> Lu ε decay); and 93 2 (1979Ho10). Other: 91 18 (1989Wo02). Eα=5330.9 17 (from 2013Ba31 evaluation recommended by 1991Ry01).
821.3 2	(2 <sup>+</sup> )#@		A C	
1516.0 3	(4 <sup>+</sup> )#@		A C	
1949.6 4	(6 <sup>+</sup> )#@		A C	
2046.2 4	(8 <sup>+</sup> )#&	28 ns 2	A C	T <sub>1/2</sub> : From γγ(t) in <sup>106</sup> Cd( <sup>54</sup> Fe,α2pγ) (1993Zh10). 1988Vi02 report 45 ns 10, from γγ(t) in <sup>154</sup> Lu ε decay.
2914.7	(10 <sup>+</sup> )#a		C	
3228.5	(11 <sup>-</sup> )		C	J <sup>π</sup> : The observed decay mode (a single γ transition to the (10 <sup>+</sup> ) level) is consistent with J <sup>π</sup> =(11 <sup>-</sup> ). Possible octupole vibration built on the (8 <sup>+</sup> ) level (1993Zh10).
3696.4	(12 <sup>+</sup> )#a		C	
4318.8	(14 <sup>+</sup> )#a		C	
4479.1	(16 <sup>+</sup> )#b	18.6 ns 15	C	T <sub>1/2</sub> : From γ(t <sub>tr</sub> ) for the 622, 782 and 869 γ's in <sup>106</sup> Cd( <sup>54</sup> Fe,α2pγ).

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**Adopted Levels, Gammas (continued)**

<sup>154</sup>Yb Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	XREF	Comments
4608.2	(16 <sup>+</sup> ) <sup>a</sup>	C	J <sup>π</sup> : Maximum-aligned state of the (π h <sub>11/2</sub> ) <sub>10+</sub> <sup>2</sup> (ν f <sub>7/2</sub> ) <sup>2</sup> configuration (1993Zh10).
4996.1	(17 <sup>+</sup> ) <sup>#b</sup>	C	
5178.0	(18 <sup>+</sup> ) <sup>#b</sup>	C	
5370.1		C	
5382.8		C	
5517.5		C	
5537.2		C	
5738.2		C	
5878.1		C	
6178.2		C	
6283.3	(20 <sup>+</sup> ) <sup>#</sup>	C	
6342.9	(20)	C	
6666.3		C	
6796.5	(21 <sup>+</sup> ) <sup>#</sup>	C	
6984.5	(22 <sup>+</sup> ) <sup>#</sup>	C	
7187.2	(22)	C	
7245.9		C	
7439.6		C	
7609.9	(24) <sup>#</sup>	C	

<sup>†</sup> Computed from the listed γ-ray energies.

<sup>‡</sup> From systematics of the yrast levels in the N=84 nuclides and theoretical calculations in <sup>106</sup>Cd(<sup>54</sup>Fe,α2pγ) dataset (1996Zh09, 1993Zh10). There are only three multipolarity values measured in this dataset, therefore the proposed J<sup>π</sup> values are highly tentative.

# yrast sequence of positive-parity levels.

@ Configuration=((πh<sub>11/2</sub><sup>6</sup>)(νf<sub>7/2</sub><sup>2</sup>)).

& Configuration=((πh<sub>11/2</sub><sup>6</sup>)(νh<sub>9/2</sub>)(νf<sub>7/2</sub>)).

<sup>a</sup> Configuration= ((πh<sub>11/2</sub><sup>4</sup>)<sub>0+</sub>(πh<sub>11/2</sub><sup>2</sup>)<sub>10+</sub>(νf<sub>7/2</sub><sup>2</sup>)).

<sup>b</sup> Configuration= ((πh<sub>11/2</sub><sup>4</sup>)<sub>0+</sub>(πh<sub>11/2</sub><sup>2</sup>)<sub>10+</sub>(νh<sub>9/2</sub>)(νf<sub>7/2</sub>)).

γ(<sup>154</sup>Yb)

E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>γ</sub> <sup>†</sup>	I <sub>γ</sub>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>	Mult.	α <sup>#</sup>	Comments
821.3	(2 <sup>+</sup> )	821.3 <sup>‡</sup>	2	0	0 <sup>+</sup>	[E2]		
1516.0	(4 <sup>+</sup> )	694.7 <sup>‡</sup>	2	821.3	(2 <sup>+</sup> )	[E2]		
1949.6	(6 <sup>+</sup> )	433.6 <sup>‡</sup>	2	1516.0	(4 <sup>+</sup> )	[E2]	0.0259	
2046.2	(8 <sup>+</sup> )	96.6 <sup>‡</sup>	2	1949.6	(6 <sup>+</sup> )	E2	3.67	B(E2)(W.u.)=10.5 +8-7 Mult.: From α <sub>K</sub> (exp)=1.3 3 in <sup>154</sup> Lu ε decay (1988Vi02).
2914.7	(10 <sup>+</sup> )	868.5	100	2046.2	(8 <sup>+</sup> )			
3228.5	(11 <sup>-</sup> )	313.8	100	2914.7	(10 <sup>+</sup> )			
3696.4	(12 <sup>+</sup> )	781.7	100	2914.7	(10 <sup>+</sup> )			
4318.8	(14 <sup>+</sup> )	622.4	100	3696.4	(12 <sup>+</sup> )			
4479.1	(16 <sup>+</sup> )	160.3	100	4318.8	(14 <sup>+</sup> )	(E2)	0.571	B(E2)(W.u.)=3.73 +34-29 Mult.: From intensity balance and level T <sub>1/2</sub> in <sup>106</sup> Cd( <sup>54</sup> Fe,α2pγ).
4608.2	(16 <sup>+</sup> )	129.1	100	4479.1	(16 <sup>+</sup> )			
4996.1	(17 <sup>+</sup> )	517.0	100	4479.1	(16 <sup>+</sup> )			
5178.0	(18 <sup>+</sup> )	181.8		4996.1	(17 <sup>+</sup> )	(M1)	0.620	Mult.: From <sup>106</sup> Cd( <sup>54</sup> Fe,α2pγ).

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**Adopted Levels, Gammas (continued)** $\gamma(^{154}\text{Yb})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma$	$E_f$	$J_f^\pi$	$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma$	$E_f$	$J_f^\pi$
5178.0	(18 <sup>+</sup> )	698.9		4479.1	(16 <sup>+</sup> )	6666.3		323.4		6342.9	(20)
5370.1		374.0	100	4996.1	(17 <sup>+</sup> )			383.0		6283.3	(20 <sup>+</sup> )
5382.8		903.7	100	4479.1	(16 <sup>+</sup> )	6796.5	(21 <sup>+</sup> )	513.2	100	6283.3	(20 <sup>+</sup> )
5517.5		339.5	100	5178.0	(18 <sup>+</sup> )	6984.5	(22 <sup>+</sup> )	188.0		6796.5	(21 <sup>+</sup> )
5537.2		1058.1	100	4479.1	(16 <sup>+</sup> )			318.3		6666.3	
5738.2		560.2	100	5178.0	(18 <sup>+</sup> )	7187.2	(22)	390.7	100	6796.5	(21 <sup>+</sup> )
5878.1		139.9	100	5738.2		7245.9		579.6	100	6666.3	
6178.2		300.1	100	5878.1		7439.6		1156.3	100	6283.3	(20 <sup>+</sup> )
6283.3	(20 <sup>+</sup> )	545.1	100	5738.2		7609.9	(24)	625.4	100	6984.5	(22 <sup>+</sup> )
6342.9	(20)	604.7	100	5738.2							

<sup>†</sup> From [1993Zh10](#) in  $^{106}\text{Cd}(^{54}\text{Fe},\alpha 2p\gamma)$ , unless noted otherwise.

<sup>‡</sup> From  $^{154}\text{Lu}$   $\epsilon$  decay ([1988Vi02](#)).

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

Adopted Levels, GammasLevel Scheme

Intensities: Relative photon branching from each level

