Adopted Levels, Gammas

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

Q(β^-)=−6940 *syst*; S(n)=9360 *syst*; S(p)=−204 *14*; Q(α)=4400 *syst* 2021Wa16
ΔQ(β^-)=360, ΔS(n)=250, ΔQ(α)=280 (syst,2021Wa16).
S(2n)=22390 *280*, S(2p)=2520 *210*, Q(εp)=7020 *200* (syst,2021Wa16).
Additional information 1.
All data are from the ^{154}Lu IT decay, except for three levels populated in the ^{158}Ta α decay.

^{154}Lu Levels

Cross Reference (XREF) Flags

- A ^{154}Lu IT decay (35 μs)
- B ^{158}Ta α decay (55 ms)
- C ^{158}Ta α decay (36.0 ms)
- D ^{158}Ta α decay (6.1 μs)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0	(2$^-$)		B	%ε+%β^+≈100; %α≈0 E(level): Level reported in ^{158}Ta α decay (1997Da07). J$^\pi$: From a consideration of measured and calculated proton emission half-lives for the 10.5 ms state of ^{166}Ir, 1997Da07 conclude that the proton emission is from the π $d_{3/2}$, rather that from a π $s_{1/2}$ or π $h_{11/2}$ orbital. This, together with systematics which indicates that the odd neutron is in the ν $f_{7/2}$ orbital, suggests that this ^{166}Ir state has Configuration=((π $d_{3/2}$)(ν $f_{7/2}$)). For this configuration, the Nordheim strong rule for angular-momentum coupling in odd-odd nuclides indicates that the J$^\pi$=2$^-$ coupling lies lower in energy. Hence, the ^{166}Ir ground state most likely has J$^\pi$=2$^-$. Since this level is fed by a succession of three unhindered (ΔL=0) α decays from the ^{166}Ir ground state, its J$^\pi$ should be the same. %ε+%β^+: Estimated by evaluator from non observation of α decay (1997Da07).
62 *12*	(9$^+$)[#]	1.12 s *8*	A CD	%ε+%β^+≈100 Additional information 2. E(level): From 2021Ko07. %ε+%β^+: Value assumed by evaluator from the lack of reported α decay and the fact that the measured half-life is comparable to that calculated for the ε decay, namely 1.18 s (2019Mo01). Also, α systematics suggest %α≈0.002. E(level): There has been some question as to whether this level is the same as the level that decays via ε to ^{154}Yb. In their study of the ^{154}Lu ε decay, 1988Vi02 assign the ε parent level as (7$^+$). However, the evaluator has concluded, based on the information from the in-beam studies (1993Zh10,1996Zh09) of the ^{154}Yb level scheme, that the J$^\pi$ value of the ^{154}Lu parent in the ε decay is probably not (7$^+$) but rather is (9$^+$) (see the discussion in the ^{154}Lu ε decay dataset). Throughout this evaluation, it has been assumed that the (9$^+$) level reported here is the same as the parent state of the ^{154}Lu ε decay. $T_{1/2}$: From weighted average of 0.96 s *10* (1981Ho10) and 1.16 s *5* (1988Vi02). Other: 1.1 s (1984HaZD). J$^\pi$: 1988Vi02 report significant ε+β^+ feeding from ^{154}Lu to the (6$^+$) and (8$^+$) levels in ^{154}Yb and from this conclude that J$^\pi$ for the ^{154}Lu parent is (7$^+$). They also indicate that this ε+β^+ feeding pattern suggests a similar structure for these two final states. The odd proton and odd neutron in the ^{154}Lu parent state are in the π $h_{11/2}$ and ν $f_{7/2}$ orbitals, respectively. The implied low log *ft* values indicate strong Gamow-Teller transitions, which in this case would be π $h_{11/2}\rightarrow\nu$ $h_{9/2}$. It is now

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Adopted Levels, Gammas (continued)

^{154}Lu Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	XREF	Comments
				believed, however, that the configurations of the two ^{154}Yb final states are quite different (see the discussion in the ^{106}Cd(^{54}Fe,α2pγ) data set, as well as those in the original studies (1993Zh10,1996Zh09)). Only one of these states, the (8^+) level, can be fed by a strong Gamow-Teller transition. The transition to the (6^+) level would be $\pi\ h_{11/2}\rightarrow\nu\ f_{7/2}$. It will be much weaker (and, possibly, may not take place). Thus, the basis for a (7^+) assignment appears to be considerably weakened. The evaluator has chosen to adopt J$^{\pi}$=(9^+) for the ^{154}Lu ε decay parent, in agreement with the systematics of the spins in this mass region.
81.0 *4*	(8^+)[#]		A C	
118.9 *5*	$(8^+,9^+,10^+)$		C	J$^{\pi}$: from prompt 59.9γ compatible with dipole transition and no parity change expected between low-energy $\pi h_{11/2}$ states in ^{154}Lu (2019Pa27).
416.8 *4*	(9^+)[@]		A	
945.8 *4*	(10^+)[@]		A	
1261.8 *4*	(10^-)[&]		A	
1284.4 *4*	(11^-)[&]		A	
1461.4 *4*	(11^+)		A	
1499.8 *5*	(12^-)[a]		A	
1872.8 *6*	(12^-)		A	
1970.6 *5*	(13^-)		A	
2140.3 *5*	(13^+)		A	
2283.8 *5*	(14^-)		A	
2490.3 *5*	(14^+)		A	
2490.3+x	(15^+)		A	Additional information 3.
2620.7+x *3*	(17^+)	35 μs *3*	A	%IT=100 The configurational makeup of this level is discussed in the theoretical study of 2002Ma80.

[†] From a least-squares fit to the γ−ray energies with 59 and 2490.3+x held fixed.

[‡] Unless noted otherwise, the J$^{\pi}$ and configuration assignments for the levels above 70 keV are those suggested from ^{154}Lu IT decay (1990Mc02) and are based on analogy to those in ^{150}Ho and ^{152}Tm.

[#] Configuration=$((\pi\ h_{11/2})(\nu\ f_{7/2}))$.

[@] Configuration=$((\pi\ h_{11/2})(\nu\ h_{9/2}))$.

[&] 3^- octupole vibration built on the g.s. configuration.

[a] Configuration=$((\pi\ h_{11/2})(\nu\ i_{13/2}))$.

$\gamma(^{154}Lu)$

E_i(level)	J_i^{π}	E_{γ}[†]	I_{γ}[†]	E_f	J_f^{π}
81.0	(8^+)	22.2 *5*	100	62	(9^+)
118.9	$(8^+,9^+,10^+)$	59.9 *5*		62	(9^+)
416.8	(9^+)	335.9 *3*	100 *11*	81.0	(8^+)
		358.1 *6*	7 *3*	62	(9^+)
945.8	(10^+)	529.1 *4*	100	416.8	(9^+)
1261.8	(10^-)	316.2 *5*	18 *4*	945.8	(10^+)
		845.2 *4*	86 *8*	416.8	(9^+)
		1202.5 *5*	100 *18*	62	(9^+)
1284.4	(11^-)	(22.6[‡] *6*)		1261.8	(10^-)
		338.7 *4*	100 *10*	945.8	(10^+)
1461.4	(11^+)	1402.3 *4*	100	62	(9^+)

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Adopted Levels, Gammas (continued)

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

E_i(level)	J_i^π	E_γ [†]	I_γ [†]	E_f	J_f^π	Mult.	α [#]	Comments
1499.8	(12^-)	215.4 *3*	100	1284.4	(11^-)	(M1)	0.422	
1872.8	(12^-)	411.6 *5*	100	1461.4	(11^+)			
1970.6	(13^-)	98.0 *6*	23 *13*	1872.8	(12^-)			
		470.7 *4*	100 *10*	1499.8	(12^-)			
2140.3	(13^+)	640.6 *4*	100 *10*	1499.8	(12^-)			
		678.8 *4*	26 *4*	1461.4	(11^+)			
2283.8	(14^-)	313.4 *5*	100 *20*	1970.6	(13^-)			
		784.3 *6*	80 *20*	1499.8	(12^-)			
2490.3	(14^+)	206.8 *4*	18 *2*	2283.8	(14^-)			
		350.0 *3*	100 *10*	2140.3	(13^+)			
		519.5 *4*	37 *4*	1970.6	(13^-)			
2490.3+x	(15^+)	(x)	100	2490.3	(14^+)			
2620.7+x	(17^+)	130.4 *3*	100	2490.3+x	(15^+)	E2	1.238 *21*	B(E2)(W.u.)=0.00391 *+37−32* 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 ^{146}Gd core.

† Values from 1993Mc03, ^{154}Lu IT decay.

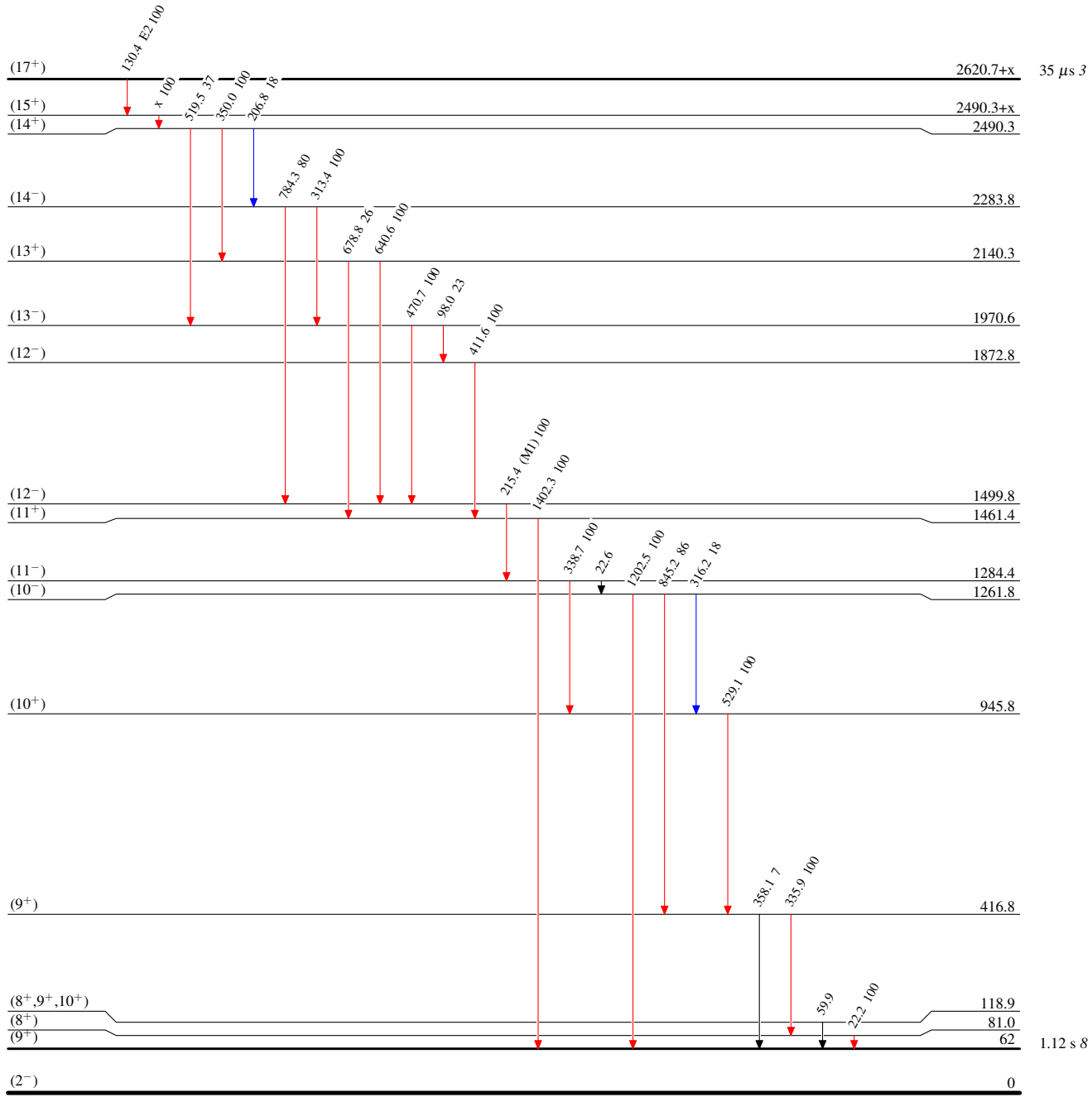
‡ From E(level) differences, transition not observed.

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

Adopted Levels, Gammas

Level Scheme

Intensities: Type not specified



$^{154}_{71}Lu_{83}$