^{159}Gd β^- decay (18.479 h)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 157 (2012)	31-Dec-2010

Parent: ^{159}Gd: E=0; J$^\pi$=3/2$^-$; T$_{1/2}$=18.479 h *4*; Q(β^-)=970.5 *7*; %β^- decay=100.0

Additional information 1.

The decay scheme is that of 1965Fu14, which is similar to those of 1968Hi03, 1969Br05, 1985Da31, and 1995Mo08.

The following quantities have been measured: Eγ and Iγ (1958Ma53,1958Ni29,1962Su04,1964Ew04,1964Pe07,1965Fu14,1972De67,1975SeZ D); T$_{1/2}$ of levels (1961Go32,1963Go28,1967Ko17,1967Ma33,1969Be54); γ multipolarities and δ (1958Ma53,1958Ni29,1962Su04,1964No08,1964Pe07,1975SeZD); and Eβ^- and Iβ^- (1958Ma53,1962Ta12,1975BaXG).

Searches for parity nonconservation have been carried out (1970Pr13,1971Kr19,1971Li15,1972Li11) by measurements of $\gamma(\theta)$ and circular polarization of 363 G.

^{159}Tb Levels

E(level)†	J$^\pi$‡	T$_{1/2}$#	Comments
0.0	3/2$^+$		
57.9963 *14*	5/2$^+$		
137.5054 *17*	7/2$^+$	≤1.0 ns	T$_{1/2}$: From 1963Go28 by γ(228)γ(79)(t).
348.2830 *15*	5/2$^+$		
363.5451 *14*	5/2$^-$	158 ps *7*	T$_{1/2}$: Weighted average of 160 ps *16* by $\beta\gamma$(t) (1961Go32), 170 ps *70* by $\beta\gamma$(t) (1961Va36), 180 ps *15* by $\beta\gamma$(t) (1967Ko17), 150 ps *10* by βce(t) (1967Ma33), and 152 ps *15* by $\beta\gamma$(t) (1969Be54).
580.808 *6*	1/2$^+$		
617.619 *5*	3/2$^+$		
674.235 *17*	5/2$^+$		
854.960 *7*	(1/2$^-$)		
891.25 *6*	(5/2$^-$)		

† From least-squares fit to the γ energies.
‡ From ^{159}Tb Adopted Levels; also see Adopted Levels for band assignments.
# From measurements from ^{159}Gd β^- decay only; see ^{159}Tb Adopted Levels for all measurements.

β^- radiations

E(decay)†	E(level)	Iβ^-‡#	Log *ft*	Comments
(79.3 *7*)	891.25	0.0011 *4*	7.93 *16*	av Eβ=20.51 *19*
(115.5 *7*)	854.960	0.0162 *5*	7.270 *16*	av Eβ=30.40 *20*
(296.3 *7*)	674.235	0.00387 *10*	9.179 *12*	av Eβ=83.79 *22*
(352.9 *7*)	617.619	0.0301 *9*	8.534 *14*	av Eβ=101.81 *23*
(389.7 *7*)	580.808	0.0635 *9*	8.351 *7*	av Eβ=113.82 *23* Iβ^-: Measured data (1975BaXG) have a component to a level at ≈410 keV with Iβ^-=1%.
(607.0 *7*)	363.5451	12.19 *6*	6.714 *3*	av Eβ=188.9 *3* Iβ^-: Measured Iβ^-=13% *2* (1975BaXG), which would include the 348 level.
(622.2 *7*)	348.2830	0.315 *4*	8.339 *6*	av Eβ=194.4 *3*
(833.0 *7*)	137.5054	0.008 *7*	10.8^{1u} *4*	av Eβ=283.9 *3*
(912.5 *7*)	57.9963	28.8 *10*	6.96 *2*	av Eβ=304.1 *3* Iβ^-: Measured Iβ^-=24% *4* (1975BaXG).
(970.5 *7*)	0.0	58.6 *10*	6.75 *1*	av Eβ=326.9 *3* Iβ^-: Measured Iβ^-=62% *9* (1975BaXG).

Continued on next page (footnotes at end of table)

^{159}Gd β^- decay (18.479 h) (continued)

β^- radiations (continued)

† The measured values from 1975BaXG are about 11 keV lower than those from the Q(β^-) value; they are not given.
‡ From γ(363) emission probability (2001Ma01) and γ intensity balances. The measured values of 1975BaXG are given in comments.
# Absolute intensity per 100 decays.

γ(^{159}Tb)

Iγ normalization: from measured emission probability of 11.78% *5* for the 363 γ (2001Ma01).
Iγ normalization: Additional information 2.

E_γ[†]	I_γ[‡@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[&]	Comments
58.0000 *22*	21.1 *6*	57.9963	5/2$^+$	0.0	3/2$^+$	M1+E2	+0.119 *2*	10.73	α(K)=8.80 *13*; α(L)=1.503 *22*; α(M)=0.333 *5*; α(N+..)=0.0886 *13* α(N)=0.0765 *12*; α(O)=0.01146 *17*; α(P)=0.000663 *10*
79.5132 *27*	0.397 *9*	137.5054	7/2$^+$	57.9963	5/2$^+$	M1+E2	+0.126 *8*	4.28	α(K)=3.55 *5*; α(L)=0.567 *10*; α(M)=0.1249 *22*; α(N+..)=0.0334 *6* α(N)=0.0288 *5*; α(O)=0.00436 *8*; α(P)=0.000265 *4*
137.515 *5*	0.0549 *13*	137.5054	7/2$^+$	0.0	3/2$^+$	[E2]		0.828	α(K)=0.476 *7*; α(L)=0.272 *4*; α(M)=0.0640 *9*; α(N+..)=0.01632 *23* α(N)=0.01440 *21*; α(O)=0.00190 *3*; α(P)=2.49×10^{-5} *4*
210.783 *3*	0.170 *12*	348.2830	5/2$^+$	137.5054	7/2$^+$	[M1,E2]		0.23 *4*	α(K)=0.18 *5*; α(L)=0.039 *7*; α(M)=0.0088 *17*; α(N+..)=0.0023 *4* α(N)=0.0020 *4*; α(O)=0.00029 *4*; α(P)=1.2×10^{-5} *5*
226.0406 *18*	1.842 *18*	363.5451	5/2$^-$	137.5054	7/2$^+$	E1		0.0341	α(K)=0.0289 *4*; α(L)=0.00411 *6*; α(M)=0.000892 *13*; α(N+..)=0.000237 *4* α(N)=0.000204 *3*; α(O)=3.05×10^{-5} *5*; α(P)=1.779×10^{-6} *25*
237.341 *5*	0.0653 *14*	854.960	(1/2$^-$)	617.619	3/2$^+$	[E1]		0.0301	α(K)=0.0255 *4*; α(L)=0.00361 *5*; α(M)=0.000784 *11*; α(N+..)=0.000208 *3* α(N)=0.000180 *3*; α(O)=2.69×10^{-5} *4*; α(P)=1.576×10^{-6} *22*
273.62 *12*	0.006 *3*	891.25	(5/2$^-$)	617.619	3/2$^+$	[E1]		0.0209	α(K)=0.01770 *25*; α(L)=0.00249 *4*; α(M)=0.000541 *8*; α(N+..)=0.0001437 *21* α(N)=0.0001239 *18*; α(O)=1.86×10^{-5} *3*; α(P)=1.111×10^{-6} *16* I_γ: Weighted average for Iγ(273+274)=0.0544 *23* and division is from 1995Mo08.
274.163 *19*	0.048 *3*	854.960	(1/2$^-$)	580.808	1/2$^+$	[E1]		0.0208	α(K)=0.01762 *25*; α(L)=0.00248 *4*; α(M)=0.000538 *8*; α(N+..)=0.0001429 *20* α(N)=0.0001233 *18*; α(O)=1.85×10^{-5} *3*; α(P)=1.106×10^{-6} *16* I_γ: Weighted average for Iγ(273+274)=0.0544 *23* and division is from 1995Mo08.
290.2865 *25*	0.274 *4*	348.2830	5/2$^+$	57.9963	5/2$^+$	[M1,E2]		0.091 *23*	α(K)=0.074 *22*; α(L)=0.0135 *3*; α(M)=0.00301 *5*; α(N+..)=0.000796 *14* α(N)=0.000690 *10*; α(O)=0.000101 *6*; α(P)=5.1×10^{-6} *20*
305.5492 *20*	0.526 *6*	363.5451	5/2$^-$	57.9963	5/2$^+$	E1		0.01582	α(K)=0.01342 *19*; α(L)=0.00188 *3*; α(M)=0.000407 *6*; α(N+..)=0.0001084 *16* α(N)=9.34×10^{-5} *13*; α(O)=1.409×10^{-5} *20*; α(P)=8.51×10^{-7} *12*

γ(^{159}Tb) (continued)

E_γ†	I_γ‡@	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	δ#	α&	Comments
348.2807 *18*	2.031 *21*	348.2830	5/2$^+$	0.0	3/2$^+$	M1+E2	0.43 *+10−9*	0.0653 *22*	α(K)=0.0548 *20*; α(L)=0.00818 *15*; α(M)=0.00179 *3*; α(N+..)=0.000481 *9* α(N)=0.000414 *8*; α(O)=6.32×10^{-5} *13*; α(P)=3.99×10^{-6} *16*
363.5430 *18*	100	363.5451	5/2$^-$	0.0	3/2$^+$	E1		0.01033	α(K)=0.00878 *13*; α(L)=0.001216 *17*; α(M)=0.000264 *4*; α(N+..)=7.03×10^{-5} *10* α(N)=6.06×10^{-5} *9*; α(O)=9.17×10^{-6} *13*; α(P)=5.64×10^{-7} *8*
^{x}479.84 *6*	0.00206 *19*								E_γ,I_γ: Reported by 1995Mo08 only, so nuclide assignment is questionable.
536.78 *18*	0.0136 *4*	674.235	5/2$^+$	137.5054	7/2$^+$	(M1)		0.0229	α(K)=0.0194 *3*; α(L)=0.00272 *4*; α(M)=0.000591 *9*; α(N+..)=0.0001592 *23* α(N)=0.0001367 *20*; α(O)=2.11×10^{-5} *3*; α(P)=1.417×10^{-6} *20* E_γ: In (n,n′γ), 1987Al07 argue that this placement is not correct, but the alternate placement is from a 9/2$^+$, 536-keV level, which is not expected to be populated here.
559.623 *6*	0.188 *5*	617.619	3/2$^+$	57.9963	5/2$^+$	M1+E2	0.67 *+58−1*	0.018 *3*	α(K)=0.015 *3*; α(L)=0.0022 *3*; α(M)=0.00047 *6*; α(N+..)=0.000127 *16* α(N)=0.000109 *14*; α(O)=1.67×10^{-5} *22*; α(P)=1.07×10^{-6} *21*
580.808 *6*	0.580 *5*	580.808	1/2$^+$	0.0	3/2$^+$	[M1,E2]		0.014 *5*	α(K)=0.012 *4*; α(L)=0.0018 *5*; α(M)=0.00040 *9*; α(N+..)=0.000106 *24* α(N)=9.2×10^{-5} *21*; α(O)=1.4×10^{-5} *4*; α(P)=9.E−7 *3*
616.233 *18*	0.0160 *7*	674.235	5/2$^+$	57.9963	5/2$^+$	(M1)		0.01617	α(K)=0.01373 *20*; α(L)=0.00191 *3*; α(M)=0.000416 *6*; α(N+..)=0.0001120 *16* α(N)=9.61×10^{-5} *14*; α(O)=1.486×10^{-5} *21*; α(P)=9.99×10^{-7} *14*
617.615 *8*	0.135 *4*	617.619	3/2$^+$	0.0	3/2$^+$	(M1)		0.01608	α(K)=0.01365 *20*; α(L)=0.00190 *3*; α(M)=0.000413 *6*; α(N+..)=0.0001113 *16* α(N)=9.56×10^{-5} *14*; α(O)=1.478×10^{-5} *21*; α(P)=9.93×10^{-7} *14*
674.26 *5*	0.00268 *19*	674.235	5/2$^+$	0.0	3/2$^+$	(M1)		0.01292	α(K)=0.01097 *16*; α(L)=0.001522 *22*; α(M)=0.000331 *5*; α(N+..)=8.92×10^{-5} *13* α(N)=7.65×10^{-5} *11*; α(O)=1.184×10^{-5} *17*; α(P)=7.97×10^{-7} *12*
753.74 *6*	0.00153 *17*	891.25	(5/2$^-$)	137.5054	7/2$^+$	[E1]		0.00206	α(K)=0.001760 *25*; α(L)=0.000235 *4*; α(M)=5.07×10^{-5} *7*; α(N+..)=1.359×10^{-5} *19* α(N)=1.168×10^{-5} *17*; α(O)=1.79×10^{-6} *3*; α(P)=1.170×10^{-7} *17* E_γ,I_γ: Reported by 1995Mo08 only.

$^{159}_{65}$Tb$_{94}$-4

^{159}Gd β^- decay (18.479 h) (continued)

γ(^{159}Tb) (continued)

E_γ †	I_γ ‡@	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	α &	Comments
854.947 *20*	0.0209 *12*	854.960	(1/2$^-$)	0.0	3/2$^+$	[E1]	1.61×10^{-3}	α(K)=0.001374 *20*; α(L)=0.000182 *3*; α(M)=3.93×10^{-5} *6*; α(N+..)=1.054×10^{-5} *15* α(N)=9.06×10^{-6} *13*; α(O)=1.391×10^{-6} *20*; α(P)=9.16×10^{-8} *13*

† From 1995Mo08.

‡ Weighted average of values of 1968Hi03, 1969Br05, 1985Da31, 1994St05, 1995Mo08, and 2001Ma01.

From ^{159}Tb Adopted γ radiations. See ^{159}Tb Adopted γ radiations for limits on M2 mixing in E1 transitions from 363 level.

@ For absolute intensity per 100 decays, multiply by 0.1178 *5*.

& 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.

^{x} γ ray not placed in level scheme.

^{159}Gd β^- decay (18.479 h)

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays