^{147}Ho ε decay (5.8 s) 1982No08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	N. Nica and B. Singh	NDS 181, 1 (2022)	9-Mar-2022

Parent: ^{147}Ho: E=0.0; J$^\pi$=(11/2$^-$); $T_{1/2}$=5.8 s *4*; Q(ε)=8439 *10*; %ε+%β^+ decay=100.0
^{147}Ho-E,J$^\pi$,$T_{1/2}$: from ^{147}Ho Adopted Levels.
^{147}Ho-Q(ε): From 2021Wa16.
^{147}Ho produced by ^{92}Mo(^{58}Ni,3p).
Measured: γ, Iγ, $\gamma\gamma$, $\gamma\gamma^\pm$, I(ε)/I(β^+).

By using $\gamma\gamma$ coincidences, excitation function and cross bombardments 1982No08 assigned a group of fourteen γ rays in the level scheme populated by the ε+β^+ decay of (11/2$^-$) ^{147}Ho g.s.. All γ rays except 678γ decaying the 55 s, (11/2$^-$) isomer in ^{147}Dy were observed in coincidence with the annihilation radiation (the decay pattern of this isomer was previously known, see the IT decay (55.2 s) dataset).

The completness of the 1982No08 level scheme argument: from the the $\gamma\gamma^\pm$ selection it appers that the set of fourteen γ rays following the ε+β^+ decay is rather complete (at least for Eγ<1400 keV as shown in Fig. 2 but for a different type of $\gamma\gamma$ spectrum − gated on the 72γ). It is unclear if higher energy γ rays exist (probably yes), or if overall the method has enough sensitivity to collect low intensity γ rays (probably no), hence one can deduce that the level scheme is rather incomplete (moreover the known levels occupy only about one fourth of the interval determined by the Q value). However since a ±50% intensity variation of the allowed more intense ε+β^+ feedings to 751, 1632 and 1925 levels does not change significantly their log *ft* values, these values are adopted. Conversely, for the overall smaller feedings of the 956, 1145 and 1336 levels (with calculated I(ε+β^+) of about 6%, 12% and 1% respectively), the corresponding log *ft*'s are too great for the adopted J^π values, which indicates that the intensities in this range should not be adopted. By extension, neither the feedings of 1781 and 2063 levels of about 5% should be adopted.

Systematic behavior: level schemes of the ^{145}Gd, ^{147}Dy and ^{149}Er N=81 isotones from the ε+β^+ decays of the (11/2$^-$) respective parents are very similar.

^{147}Dy Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$[#]	Comments
0.0	(1/2$^+$)	67 s *7*	%ε+%β^+=100 (1983AlZN); %β^+p=5×10^{-2} (1984To07) %ε+%β^+,%β^+p: from Adopted Levels.
72.04 *24*	(3/2$^+$)		
750.5 *4*	(11/2$^-$)	55.2 s *5*	%IT=31.1 *23* (1997Co21); %ε+%β^+=68.9 *23* %IT,%ε+%β^+: from Adopted Levels.
955.96 *24*	(5/2$^+$)		
1145.0 *3*	(7/2$^-$)		
1335.7 *4*	(7/2$^+$)		
1631.8 *4*	(9/2$^-$,11/2$^-$)		
1780.8 *5*			
1924.6 *4*	(9/2$^-$)		
2063.4 *4*			

† From least-squares fit to Eγ's.
‡ Values adopted here (from 1982No08) are those adopted in Adopted Levels dataset. 1982No08 use the following arguments: log *ft* values for allowed transitions from (11/2$^-$) parent g.s. to 751 keV, 1632 keV, and 1925 keV daughter levels; shell-model calculations and systematics of low-lying levels for g.s. and first two excited levels; γ transitions to levels and comparison with the corresponding sequences in ^{145}Gd and ^{149}Er level schemes. All assignments are adopted by evaluator as tentative.
# From Adopted Levels.

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ε,β^+ radiations

For adopted I($\varepsilon+\beta^+$) feedings see the above argument on the completness of the level scheme.

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*†	I($\varepsilon+\beta^+$)‡	Comments
(6514 *10*)	1924.6	13.5 *14*	2.08 *21*	≈5.1	16 *1*	av Eβ=2523.2 *48*; εK=0.1117 *5*; εL=0.01656 *8*; εM+=0.004857 *23* Additional information 1.
(6807 *10*)	1631.8	11.3 *20*	1.5 *3*	≈5.3	13 *1*	av Eβ=2662.2 *48*; εK=0.0981 *5*; εL=0.01453 *7*; εM+=0.004259 *19* Additional information 2.
(7689 *10*)	750.5	39 *3*	3.4 *2*	≈5.0	42 *3*	av Eβ=3082.8 *48*; εK=0.0680 *3*; εL=0.01005 *4*; εM+=0.002946 *12* Additional information 3.

† Values are approximate and can vary for a more complete level scheme.
‡ Absolute intensity per 100 decays.

γ(^{147}Dy)

E$_\gamma$	I$_\gamma$‡	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.	δ	α#	Comments
72.0 *3*	†	72.04	(3/2$^+$)	0.0	(1/2$^+$)	M1(+E2)	<0.4	6.4 *3*	α(K)=4.98 *23*; α(L)=1.11 *34*; α(M)=0.251 *83* α(N)=0.057 *19*; α(O)=0.0078 *21*; α(P)=0.000309 *17* Iγ=11 *1* (1982No08). Mult.,δ: from Adopted Gammas.
189.1 *3*	33 *3*	1145.0	(7/2$^-$)	955.96	(5/2$^+$)	[E1]		0.0564	α(K)=0.0475 *7*; α(L)=0.00692 *11*; α(M)=0.001512 *23* α(N)=0.000346 *5*; α(O)=4.86×10^{-5} *8*; α(P)=2.39×10^{-6} *4*
292.7 *3*	4.3 *8*	1924.6	(9/2$^-$)	1631.8	(9/2$^-$,11/2$^-$)				
394.4 *3*	5.2 *9*	1145.0	(7/2$^-$)	750.5	(11/2$^-$)	[E2]		0.0288	α(K)=0.0226 *4*; α(L)=0.00485 *7*; α(M)=0.001104 *16* α(N)=0.000252 *4*; α(O)=3.40×10^{-5} *5*; α(P)=1.231×10^{-6} *18*
431.6 *3*	2.9 *7*	2063.4		1631.8	(9/2$^-$,11/2$^-$)				
445.1 *3*	5.4 *8*	1780.8		1335.7	(7/2$^+$)				
486.7 *3*	20 *2*	1631.8	(9/2$^-$,11/2$^-$)	1145.0	(7/2$^-$)				
589.0 *3*	5.4 *8*	1924.6	(9/2$^-$)	1335.7	(7/2$^+$)	[E1]		0.00359	α(K)=0.00306 *5*; α(L)=0.000417 *6*; α(M)=9.06×10^{-5} *13* α(N)=2.09×10^{-5} *3*; α(O)=3.02×10^{-6} *5*; α(P)=1.682×10^{-7} *24*
678.4 *3*	†	750.5	(11/2$^-$)	72.04	(3/2$^+$)	(M4)		0.211	α(K)=0.1636 *23*; α(L)=0.0364 *6*; α(M)=0.00843 *12* α(N)=0.00195 *3*; α(O)=0.000276 *4*; α(P)=1.332×10^{-5} *19*

Continued on next page (footnotes at end of table)

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γ(^{147}Dy) (continued)

E_γ	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α[#]	Comments
								Iγ=15 *3* (1982No08). Mult.: from Adopted Gammas.
779.6 *3*	5.8 *10*	1924.6	(9/2$^-$)	1145.0	(7/2$^-$)	[M1]	0.00974	α(K)=0.00827 *12*; α(L)=0.001154 *17*; α(M)=0.000252 *4* α(N)=5.83×10^{-5} *9*; α(O)=8.57×10^{-6} *12*; α(P)=5.01×10^{-7} *7*
883.9 *3*	33	955.96	(5/2$^+$)	72.04	(3/2$^+$)	[M1]	0.00716	α(K)=0.00608 *9*; α(L)=0.000845 *12*; α(M)=0.000184 *3* α(N)=4.27×10^{-5} *6*; α(O)=6.28×10^{-6} *9*; α(P)=3.68×10^{-7} *6*
918.3 *3*	2.0 *5*	2063.4		1145.0	(7/2$^-$)			
956.0 *3*	7.4 *11*	955.96	(5/2$^+$)	0.0	(1/2$^+$)	[E2]	0.00334	α(K)=0.00280 *4*; α(L)=0.000421 *6*; α(M)=9.28×10^{-5} *13* α(N)=2.14×10^{-5} *3*; α(O)=3.07×10^{-6} *5*; α(P)=1.617×10^{-7} *23*
1263.7 *3*	12 *2*	1335.7	(7/2$^+$)	72.04	(3/2$^+$)	[E2]	0.00191	α(K)=0.001605 *23*; α(L)=0.000229 *4*; α(M)=5.01×10^{-5} *7* α(N)=1.155×10^{-5} *17*; α(O)=1.677×10^{-6} *24*; α(P)=9.28×10^{-8} *13*; α(IPF)=1.357×10^{-5} *20*

[†] These transitions follow the decay of 55-s isomer in ^{147}Dy. Their intensities (listed in 1982No08) were not adopted here (given in comments only).

[‡] Absolute intensity per 100 decays.

[#] 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.

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