^{169}Ho β^- decay 1971Ha42

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 109, 2033 (2008)	15-Jun-2008

Parent: ^{169}Ho: E=0.0; $J^\pi=7/2^-$; $T_{1/2}$=4.72 min *10*; Q(β^-)=2126 *20*; %β^- decay=100.0

The decay scheme and data are from 1971Ha42, except where noted. Sources from ^{170}Er(γ,p), E(bremsstrahlung)=70 MeV; Er metal (natural) and Er oxide (>98% ^{170}Er enrichment) targets; measured Eγ, Iγ (Ge(Li), FWHM=1.8 keV at 100 keV, 2.5 keV at 1 MeV). Some data are from 1963Mi17, 1966Fu09, and 1970Mu15.

^{169}Er Levels

E(level)	J^π†	$T_{1/2}$	E(level)	J^π†	E(level)	J^π†
0.0	$1/2^-$	9.40 d *2*	176.7 *2*	$(7/2)^-$	317.3? *5*	$(9/2^+)$
64.55 *2*	$3/2^-$		224.1 *1*	$7/2^-$	769.6 *1*	$(5/2^-)$
74.6 *1*	$5/2^-$		242.0 *2*	$9/2^-$	853.0 *1*	$5/2^-$
91.9 *2*	$(5/2)^-$		243.6 *2*	$7/2^+$	941.0 *2*	$(7/2)^-$

† From Adopted Levels.

β^- radiations

1963Mi17 report two β^- groups:≈1.20 MeV to≈915 level (75%), and≈1.95 MeV (25%), with both groups feeding close-lying levels. The β^- feedings to the 769.6, 853.0, and 941.0 levels were estimated by dividing the 75% intensity in proportion to the total I(γ+ce) deexciting each level. Because γ-ray intensity data are incomplete, it was not possible to determine β^-feedings to all levels.

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(1185 *20*)	941.0	≈12.2	≈5.4	av Eβ=411 *8*
(1273 *20*)	853.0	≈60	≈4.9	av Eβ=447 *8*
(1356 *20*)	769.6	≈2.7	≈6.3	av Eβ=482 *8*
(1809‡ *20*)	317.3?			
(1882 *20*)	243.6	≈7.2	≈6.4	av Eβ=706 *9*
(1949 *20*)	176.7	≈1.9	≈7.1	av Eβ=735 *9*
(2034‡ *20*)	91.9			

† Absolute intensity per 100 decays.

‡ Existence of this branch is questionable.

γ(^{169}Er)

Iγ normalization: from Iβ to 853.0 level≈60% (see general comment on β^- data). a serious discrepancy is apparent if one calculates the normalization from Σ I(γ+ce) to g.s.=100% (β^- to g.s. not expected because ΔJ=3, total Iγ(73.6γ+74.6γ) assumed for 74.6γ). The resulting Iβ to 853.0 level is 95%.

All unplaced γ rays could alternatively be assigned to ^{168}Ho decay.

Iγ(Er K x ray)≈530, relative to Iγ=100 for 761.0γ (1966Fu09).

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^{169}Ho β^- decay 1971Ha42 (continued)

$\gamma(^{169}Er)$ (continued)

E_γ	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	α[#]	Comments
(10.0 *1*)		74.6	5/2$^-$	64.55	3/2$^-$	[M1]		69.1	Placement proposed by 1963Mi17. E_γ: deduced from energy difference between 74.6 and 64.6 levels.
(17.3 *3*)		91.9	(5/2)$^-$	74.6	5/2$^-$				E_γ: deduced from energy difference between 91.9 and 74.6 levels.
(27.6[†] *2*)		91.9	(5/2)$^-$	64.55	3/2$^-$	[M1]		20.0 *6*	α(L)=15.6 *4*; α(M)=3.47 *9*; α(N+..)=0.931 *25* α(N)=0.808 *21*; α(O)=0.117 *3*; α(P)=0.00639 *17*
64.55[†] *2*	≈28	64.55	3/2$^-$	0.0	1/2$^-$	M1+E2	0.67	12.12	α(K)=6.44 *9*; α(L)=4.37 *7*; α(M)=1.045 *15*; α(N+..)=0.267 *4* α(N)=0.237 *4*; α(O)=0.0288 *4*; α(P)=0.000398 *6* Iγ=33 for 64.6γ and 67.3γ combined (1966Fu09); evaluator estimates Iγ(64.6γ)/Iγ(67.3γ)≈5 from spectrum in 1971Ha42.
67.3 *3*	≈5	243.6	7/2$^+$	176.7	(7/2)$^-$	E1		0.917 *17*	α(K)=0.751 *14*; α(L)=0.1301 *25*; α(M)=0.0289 *6*; α(N+..)=0.00746 *14* α(N)=0.00657 *13*; α(O)=0.000853 *16*; α(P)=3.21×10^{-5} *6* I$_\gamma$: see comment with 64.6γ.
73.6[@] *5*		317.3?	(9/2$^+$)	243.6	7/2$^+$				Iγ=13 for 73.6γ and 74.6γ combined (1966Fu09).
74.6[†] *1*		74.6	5/2$^-$	0.0	1/2$^-$	(E2)		9.23	α(K)=1.87 *3*; α(L)=5.64 *9*; α(M)=1.374 *22*; α(N+..)=0.347 *6* α(N)=0.310 *5*; α(O)=0.0360 *6*; α(P)=8.60×10^{-5} *13* I$_\gamma$: see comment with 73.6γ.
84.9[†] *1*	13	176.7	(7/2)$^-$	91.9	(5/2)$^-$	M1		4.56	α(K)=3.82 *6*; α(L)=0.575 *9*; α(M)=0.1276 *19*; α(N+..)=0.0343 *5* α(N)=0.0298 *5*; α(O)=0.00430 *7*; α(P)=0.000236 *4* I$_\gamma$: from 1966Fu09.
149.6[†] *2*	14 *3*	224.1	7/2$^-$	74.6	5/2$^-$	[M1,E2]		0.79 *12*	α(K)=0.57 *20*; α(L)=0.17 *6*; α(M)=0.041 *16*; α(N+..)=0.011 *4* α(N)=0.009 *4*; α(O)=0.0012 *4*; α(P)=3.2×10^{-5} *16*
151.5[†] *2*	54 *6*	243.6	7/2$^+$	91.9	(5/2)$^-$	E1		0.1079	α(K)=0.0904 *13*; α(L)=0.01372 *20*; α(M)=0.00303 *5*; α(N+..)=0.000797 *12* α(N)=0.000697 *10*; α(O)=9.55×10^{-5} *14*; α(P)=4.32×10^{-6} *7*
159.59[†] *9*	13 *4*	224.1	7/2$^-$	64.55	3/2$^-$	[E2]		0.542	α(K)=0.311 *5*; α(L)=0.178 *3*; α(M)=0.0427 *6*; α(N+..)=0.01089 *16* α(N)=0.00970 *14*; α(O)=0.001174 *17*; α(P)=1.388×10^{-5} *20*
167.4[†] *1*	7.4 *21*	242.0	9/2$^-$	74.6	5/2$^-$	[E2]		0.460	α(K)=0.271 *4*; α(L)=0.1449 *21*; α(M)=0.0348 *5*; α(N+..)=0.00887 *13* α(N)=0.00790 *12*; α(O)=0.000960 *14*; α(P)=1.224×10^{-5} *18*

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^{169}Ho β^- decay 1971Ha42 (continued)

$\gamma(^{169}Er)$ (continued)

E_γ	I_γ‡	E_i(level)	J_i^π	E_f	J_f^π	Comments
x579.6 5	7.2 7					
x609.6 5	5.2 5					
628.9 3	27 4	853.0	5/2$^-$	224.1	7/2$^-$	
x656.4 5	5.2 5					
x663.4 5	1.8 4					
676.5 2	41 4	853.0	5/2$^-$	176.7	(7/2)$^-$	
695.0 2	13 4	769.6	(5/2$^-$)	74.6	5/2$^-$	
697.0@ 5	4 2	941.0	(7/2)$^-$	243.6	7/2$^+$	
698.8 4	9 3	941.0	(7/2)$^-$	242.0	9/2$^-$	
705.0 1	13 3	769.6	(5/2$^-$)	64.55	3/2$^-$	
717.0 2	30.5 21	941.0	(7/2)$^-$	224.1	7/2$^-$	
761.0 2	100	853.0	5/2$^-$	91.9	(5/2)$^-$	
764.9 6	4.8 15	941.0	(7/2)$^-$	176.7	(7/2)$^-$	
x773.3 5	12 3					
778.4 1	98 6	853.0	5/2$^-$	74.6	5/2$^-$	
788.4 1	206 21	853.0	5/2$^-$	64.55	3/2$^-$	
849.4 6	10.1 13	941.0	(7/2)$^-$	91.9	(5/2)$^-$	
852.9 2	109 13	853.0	5/2$^-$	0.0	1/2$^-$	
866.4 2	43 6	941.0	(7/2)$^-$	74.6	5/2$^-$	
876.4 3	20 4	941.0	(7/2)$^-$	64.55	3/2$^-$	I_γ: evaluator assumes Iγ=202 in 1971Ha42 (table 2) to be a misprint of Iγ=20.2 (see authors′ figures 4 and 11).
x1373 1	5.2 5					
x1442 1	1.6 2					
x1517 1	1.4 3					
x1678 1	1.3 3					
x1769 1	0.9 2					
x1850 1	2.1 2					

† From Adopted Gammas.
‡ For absolute intensity per 100 decays, multiply by ≈0.1037.
# 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.
@ Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

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Decay Scheme

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