

¹⁶³Er ε decay (75.0 min) 1972Fu09

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich, Balraj Singh		NDS 111, 1211 (2010)	12-Apr-2010

Parent: ¹⁶³Er: E=0.0; J^π=5/2⁻; T_{1/2}=75.0 min 4; Q(ε)=1210 5; %ε+%β⁺ decay=100.0

¹⁶³Er-J^π,T_{1/2}: From the ¹⁶³Er Adopted Levels.

¹⁶³Er-Q(ε): From 2009AuZZ, 2003Au03.

¹⁶³Er-ν5/2[523] orbital.

Additional information 1.

1972Fu09 (also 1966Fu04): measured K x ray and γ's, γγ-coin.

Others: 1951Bu25, 1953Ha43, 1960Bu27, 1961Ab04, 1961Bj02, 1963Pe16, 1963Gr14, 1965St08, 1971WoZQ, 1973MaYI, 1975Gr44, 1979DzZZ.

¹⁶³Ho Levels

E(level)	J ^π †	T _{1/2}	Comments
0.0 [#]	7/2 ⁻		
100.02 [#] 9	9/2 ⁻		
297.81 [@] 9	1/2 ⁺	1.09 s 3	T _{1/2} : from IT decay.
307.55 [@] 12	3/2 ⁺		
360.30 10	3/2 ⁺		π3/2[411] bandhead.
391.99 [@] 15	5/2 ⁺		
431.14 [@] 12	7/2 ⁺		
439.86 ^{&} 8	7/2 ⁺		
500.2? [‡] 3	(5/2) ⁻		
552.0? [‡] & 3	(9/2) ⁺		Possible 9/2 member of the π7/2[404] band.
614.28 10	(5/2) ⁻		from comparison with the neighboring Ho isotopes, possible member of the K-2 γ vibrational-band built on the g.s. (π7/2[523]).
875.94 9	5/2 ⁺		π5/2[413] bandhead(?). This level deexcites to π7/2[404] and π1/2[411] in a manner similar to that of the π5/2[413] bandhead in ¹⁶⁵ Ho.
1113.56 22	5/2 ⁻		π5/2[532] bandhead (?). Suggested by excitation and deexcitation patterns.

† From Adopted Levels.

‡ Level proposed (evaluators) on the basis of (d,2nγ) results.

Band(A): g.s. band, π7/2[523].

@ Band(B): π1/2[411] band.

& Band(C): π7/2[404] band.

ε,β⁺ radiations

E(decay)	E(level)	Iε [†]	Log ft	I(ε+β ⁺) [†]	Comments
(96 5)	1113.56	0.050 10	5.4 1	0.050 10	εK=0.53 4; εL=0.35 3; εM+=0.122 11
(334 5)	875.94	0.040 8	7.0 1	0.040 8	εK=0.7921 9; εL=0.1590 7; εM+=0.04887 24
(596 5)	614.28	0.0038 8	8.6 1	0.0038 8	εK=0.8154; εL=0.14188 17; εM+=0.04276 6
(658 [‡] 5)	552.0?	0.0010 1	9.1	0.0010 1	
(710 [‡] 5)	500.2?	0.00051 5	9.5	0.00051 5	
(770 [‡] 5)	439.86	0.0014 10	9.3 4	0.0014 10	εK=0.8213; εL=0.1375; εM+=0.04120
(779 [‡] 5)	431.14	0.0012 3	9.4 1	0.0012 3	εK=0.8216; εL=0.1373; εM+=0.04114 Log ft: involves ΔK=2.
(902 [‡] 5)	307.55	0.0114 22	8.5 1	0.0114 22	εK=0.8242; εL=0.1353; εM+=0.04045

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¹⁶³Er ε decay (75.0 min) 1972Fu09 (continued)

ε,β⁺ radiations (continued)

<u>E(decay)</u>	<u>E(level)</u>	<u>Iβ⁺ †</u>	<u>Iε †</u>	<u>Log ft</u>	<u>I(ε+β⁺) †</u>	<u>Comments</u>
1210 6	0.0	0.003	99.888 21	4.84 1	99.891 21	Log ft: involves ΔK=2. av Eβ=98.2 24; εK=0.8283; εL=0.1323; εM+=0.03937 Eβ= 188 6, Iβ=0.004 (1963Pe16).

† Absolute intensity per 100 decays.

‡ Existence of this branch is questionable.

γ(¹⁶³Ho)

I_γ normalization: from I_γ(K x ray)= 6.8×10⁵ 13 relative to I_γ(298γ)=100, ω_k=0.943 21, relative K x ray intensities derived from decay scheme, and theoretical capture fractions.

I_γ(K x ray)=6.8×10⁵ 13, I_γ(γ[±])<106 relative to I_γ(298γ)=100 (1966Fu04). %β⁺=0.004 (1963Pe16).

γ rays of 230 (I_γ≈9) and 348 (I_γ≈2) reported by 1966Fu04 are omitted here, since these are not confirmed in the later work of 1972Fu09.

<u>E_γ</u>	<u>I_γ #</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.</u>	<u>α[@]</u>	<u>Comments</u>
(9.8)		307.55	3/2 ⁺	297.81	1/2 ⁺			
(52.74 10)		360.30	3/2 ⁺	307.55	3/2 ⁺			
(62.48 10)		360.30	3/2 ⁺	297.81	1/2 ⁺			
^x 80.5	≈4							Uncertain γ.
(84.45 10)		391.99	5/2 ⁺	307.55	3/2 ⁺			
100.0 1	14.7 8	100.02	9/2 ⁻	0.0	7/2 ⁻	[M1]	2.61	α(K)=2.19 4; α(L)=0.326 5; α(M)=0.0720 11; α(N+..)=0.0193 3 α(N)=0.01671 24; α(O)=0.00243 4; α(P)=0.0001361 20 I _γ : α=1.65 17 from intensity balance discrepant with α(M1)=2.61 or α(E2)=2.86, implying a missing intensity of 16 2 feeding the 100 level.
123.6 2	1.8 5	431.14	7/2 ⁺	307.55	3/2 ⁺	[E2]	1.295 20	α(K)=0.637 10; α(L)=0.506 8; α(M)=0.1215 20; α(N+..)=0.0307 5 α(N)=0.0274 5; α(O)=0.00330 6; α(P)=2.71×10 ⁻⁵ 4
^x 164.6 2	4.0 5							
192.6 ^{‡&} 2	4.4 4	500.2?	(5/2) ⁻	307.55	3/2 ⁺			
253.9 2	3.3 5	614.28	(5/2) ⁻	360.30	3/2 ⁺	[E1]	0.0272	α(K)=0.0229 4; α(L)=0.00331 5; α(M)=0.000727 11; α(N+..)=0.000192 3 α(N)=0.0001672 24; α(O)=2.35×10 ⁻⁵ 4; α(P)=1.178×10 ⁻⁶ 17
297.8 1	100	297.81	1/2 ⁺	0.0	7/2 ⁻	E3	0.287	α(K)=0.1522 22; α(L)=0.1032 15; α(M)=0.0251 4; α(N+..)=0.00642 9 α(N)=0.00571 8; α(O)=0.000705 10; α(P)=8.93×10 ⁻⁶ 13 Mult.: from IT decay.
331.0 3	1.8 5	431.14	7/2 ⁺	100.02	9/2 ⁻	[E1]	0.01402	α(K)=0.01187 17; α(L)=0.001686 24; α(M)=0.000370 6; α(N+..)=9.79×10 ⁻⁵ 14 α(N)=8.52×10 ⁻⁵ 12; α(O)=1.209×10 ⁻⁵ 18; α(P)=6.24×10 ⁻⁷ 9
339.8 2	29 1	439.86	7/2 ⁺	100.02	9/2 ⁻	[E1]	0.01316	α(K)=0.01114 16; α(L)=0.001579 23; α(M)=0.000346 5; α(N+..)=9.18×10 ⁻⁵ 13

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^{163}Er ε decay (75.0 min) **1972Fu09** (continued) $\gamma(^{163}\text{Ho})$ (continued)

E_γ	I_γ #	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	$\alpha^{\text{@}}$	Comments
								$\alpha(\text{N})=7.98\times 10^{-5}$ 12; $\alpha(\text{O})=1.134\times 10^{-5}$ 16; $\alpha(\text{P})=5.87\times 10^{-7}$ 9
^x 417.1 2	7.6 7							
431.2 2	12.5 9	431.14	7/2 ⁺	0.0	7/2 ⁻	E1 [†]	0.00749	$\alpha(\text{K})=0.00635$ 9; $\alpha(\text{L})=0.000888$ 13; $\alpha(\text{M})=0.000195$ 3; $\alpha(\text{N}+..)=5.17\times 10^{-5}$ 8 $\alpha(\text{N})=4.49\times 10^{-5}$ 7; $\alpha(\text{O})=6.42\times 10^{-6}$ 9; $\alpha(\text{P})=3.41\times 10^{-7}$ 5
436.1 1	248 5	875.94	5/2 ⁺	439.86	7/2 ⁺	[M1]	0.0458	$\alpha(\text{K})=0.0387$ 6; $\alpha(\text{L})=0.00556$ 8; $\alpha(\text{M})=0.001224$ 18; $\alpha(\text{N}+..)=0.000328$ 5 $\alpha(\text{N})=0.000284$ 4; $\alpha(\text{O})=4.15\times 10^{-5}$ 6; $\alpha(\text{P})=2.36\times 10^{-6}$ 4
439.9 1	240 5	439.86	7/2 ⁺	0.0	7/2 ⁻	E1 [†]	0.00715	$\alpha(\text{K})=0.00607$ 9; $\alpha(\text{L})=0.000848$ 12; $\alpha(\text{M})=0.000186$ 3; $\alpha(\text{N}+..)=4.93\times 10^{-5}$ 7 $\alpha(\text{N})=4.29\times 10^{-5}$ 6; $\alpha(\text{O})=6.13\times 10^{-6}$ 9; $\alpha(\text{P})=3.26\times 10^{-7}$ 5
444.8 2	7.9 9	875.94	5/2 ⁺	431.14	7/2 ⁺	[M1]	0.0435	$\alpha(\text{K})=0.0368$ 6; $\alpha(\text{L})=0.00528$ 8; $\alpha(\text{M})=0.001162$ 17; $\alpha(\text{N}+..)=0.000312$ 5 $\alpha(\text{N})=0.000270$ 4; $\alpha(\text{O})=3.94\times 10^{-5}$ 6; $\alpha(\text{P})=2.24\times 10^{-6}$ 4
452.3 [‡] & 2	6.0 6	552.0?	(9/2 ⁺)	100.02	9/2 ⁻			
484.0 3	2.4 5	875.94	5/2 ⁺	391.99	5/2 ⁺	[M1]	0.0350	$\alpha(\text{K})=0.0296$ 5; $\alpha(\text{L})=0.00424$ 6; $\alpha(\text{M})=0.000932$ 14; $\alpha(\text{N}+..)=0.000250$ 4 $\alpha(\text{N})=0.000216$ 3; $\alpha(\text{O})=3.16\times 10^{-5}$ 5; $\alpha(\text{P})=1.80\times 10^{-6}$ 3
552.0 [‡] & 3	2.8 7	552.0?	(9/2 ⁺)	0.0	7/2 ⁻			
^x 558.5 2	5.1 9							
568.4 2	7.5 8	875.94	5/2 ⁺	307.55	3/2 ⁺	[M1]	0.0232	$\alpha(\text{K})=0.0196$ 3; $\alpha(\text{L})=0.00280$ 4; $\alpha(\text{M})=0.000615$ 9; $\alpha(\text{N}+..)=0.0001649$ 24 $\alpha(\text{N})=0.0001429$ 20; $\alpha(\text{O})=2.09\times 10^{-5}$ 3; $\alpha(\text{P})=1.191\times 10^{-6}$ 17
578.1 2	11.6 9	875.94	5/2 ⁺	297.81	1/2 ⁺	[E2]	0.01095	$\alpha(\text{K})=0.00889$ 13; $\alpha(\text{L})=0.001604$ 23; $\alpha(\text{M})=0.000361$ 5; $\alpha(\text{N}+..)=9.52\times 10^{-5}$ 14 $\alpha(\text{N})=8.32\times 10^{-5}$ 12; $\alpha(\text{O})=1.150\times 10^{-5}$ 17; $\alpha(\text{P})=5.00\times 10^{-7}$ 7
614.3 1	29 1	614.28	(5/2 ⁻)	0.0	7/2 ⁻			
^x 711.3 2	10.7 9							
875.8 2	60 3	875.94	5/2 ⁺	0.0	7/2 ⁻			
1013.6 3	7.5 9	1113.56	5/2 ⁻	100.02	9/2 ⁻			
1113.5 3	426 12	1113.56	5/2 ⁻	0.0	7/2 ⁻			

[†] From (d,2n γ).

[‡] Tentative placement (evaluators) based on (d,2n γ) results.

For absolute intensity per 100 decays, multiply by 1.15×10^{-4} 22.

@ 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.

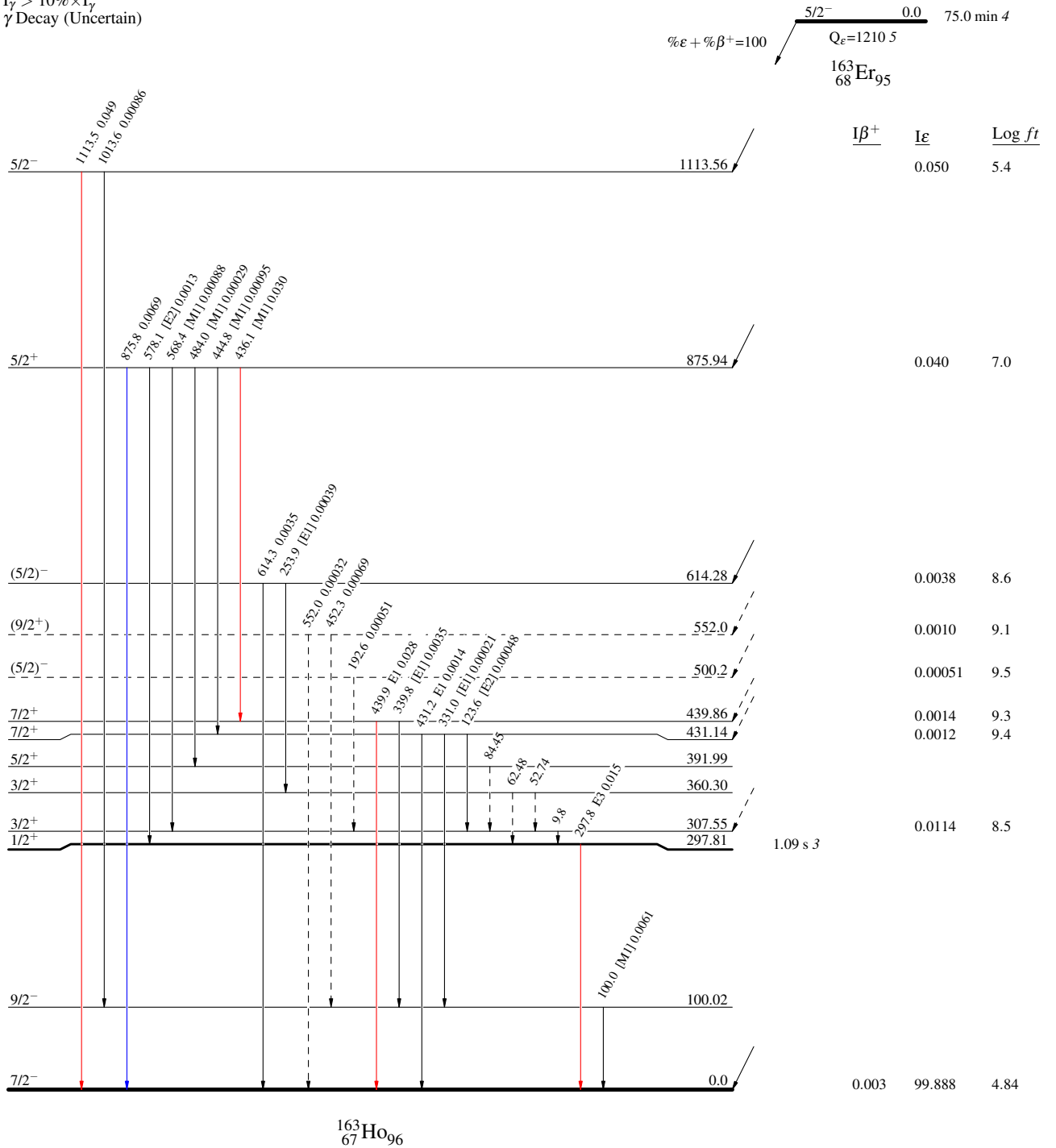
^{163}Er ϵ decay (75.0 min) 1972Fu09

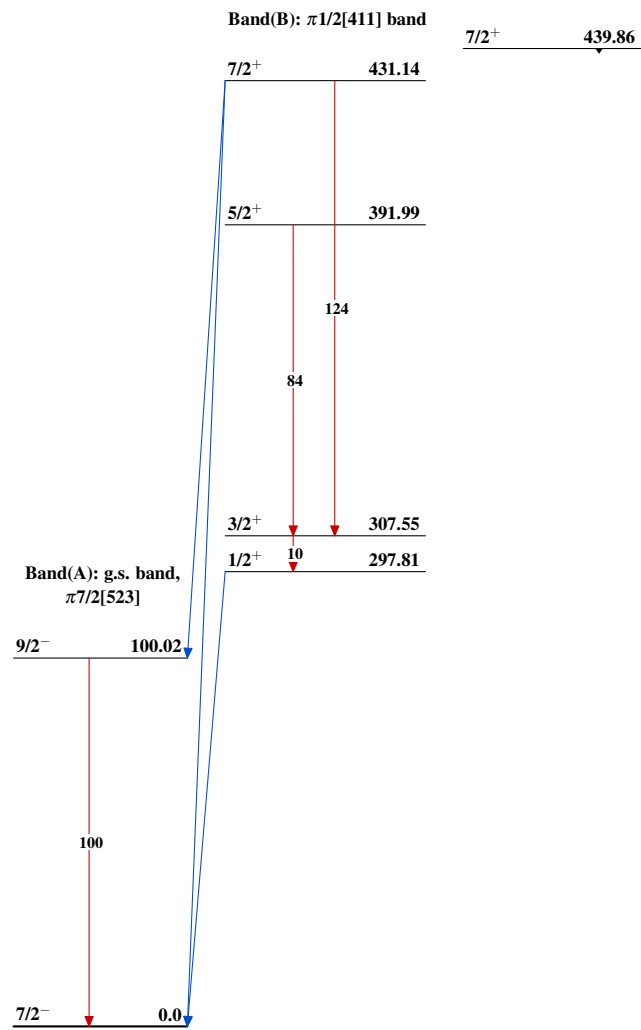
Decay Scheme

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - γ Decay (Uncertain)

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



^{163}Er ε decay (75.0 min) 1972Fu09Band(C): $\pi 7/2[404]$ band $(9/2^+)$ 552.0 $^{163}_{67}\text{Ho}_{96}$