

⁸¹Ge β⁻ decay (7.6 s): (9/2⁺) **1981Ho24**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 109, 2257 (2008)	15-Aug-2008

Parent: ⁸¹Ge: E=0; J^π=(9/2⁺); T_{1/2}=7.6 s; Q(β⁻)=6242.4; %β⁻ decay=100.0

Others: [1972De43](#), [1981A120](#), [1981ZeZY](#), [1990Ru05](#).

See also [1980HoZN](#), in which E_γ, I_γ and γγ coin data used in [1981Ho24](#) are tabulated (without differentiation between their ⁸¹Ge parentages).

Source: from mass-separated fission products.

[1981Ho24](#), [1980HoZN](#): single γ and γγ-coincidences measured with Ge(Li); x-ray detector for low energy γ search (E_γ≥15 keV); Si(Li) detector for simultaneous measurement of ce and γ spectra (for α(K)exp determination).

From analysis of ⁸¹Ga decay and βγ-coin measurements, it is evident that there are two β⁻ decaying isomers of ⁸¹Ge; but, in a multispectrum analysis of mass number 81, [1981Ho24](#) were unable to differentiate between their half-lives. Hence, [1981Ho24](#) conclude that there exist two isomers of ⁸¹Ge which possess similar T_{1/2} values. The evaluator, therefore, assigns T_{1/2} from [1981Ho24](#) to each isomer. Presumably other authors also report T_{1/2} relevant to a mixture of these isomers.

[1981Ho24](#) propose tentative decay schemes for the two isomers, consistent with γγ and βγ coin data and supported by arguments based on the large spin differences of the decaying isomers and on analogies with ⁸³Se decay. However, J^π based on the resulting log ft values and observed γ deexcitation patterns are in conflict with L(t,α) for the 758 and 1613 levels unless separate levels with almost identical energies are assumed to be excited in β⁻ decay and In (t,α).

⁸¹As Levels

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
0	3/2 ⁻		
93.09 5	1/2 ⁻ , 3/2 ⁻ , 5/2 ⁻		
290.40 4	(3/2) ⁻		
335.96 4	(5/2) ⁻	<0.7 ns	T _{1/2} : from γγ(t) (1981Ho24).
737.71 4	(5/2) ⁻		
758.42 7	(3/2 ⁺ , 5/2 ⁻)		
1041.99 7	(7/2) ⁻		
1083.36 6	(3/2 ⁺ , 5/2, 7/2 ⁻)		
1128.94 6	(7/2, 9/2 ⁻)		
1195.02 9			
1613.54 9			
1914.95 15	(7/2, 9/2 ⁻)		
2142.07 9	(7/2 ⁺ , 9/2 ⁺)		
2250.84 23			
2624.50 6	(7/2 ⁺)		
2758.25 8	(7/2 ⁺ , 9/2 ⁺ , 11/2 ⁺)		
2965.90 9	(7/2 ⁺)		
3290.4 3	(7/2 ⁺ , 9/2 ⁺ , 11/2 ⁺)		

[†] From least-squares fit to E_γ.

[‡] From Adopted Levels.

β⁻ radiations

From γ gated β⁻ endpoint measurements, [1981A120](#) determine Q(β) values of 6220 130 and 6930 280 for g.s. and isomeric state β⁻ decay, respectively. These imply E(isomeric state, ⁸¹Ge)=710 310, consistent with its identification as the 679 level of ⁸¹Ge.

Assuming E(isomer)=679, the weighted average Q is 6230 120 for ⁸¹Ge g.s. β⁻ decay, as quoted in [2003Au03](#).

Measured average E_β=1580 150 ([1990Ru05](#)).

${}^{81}\text{Ge}$ β^- decay (7.6 s): (9/2⁺) 1981Ho24 (continued) β^- radiations (continued)

<u>E(decay)</u>	<u>E(level)</u>	<u>$I\beta^-$[†]</u>	<u>Log ft</u>	<u>Comments</u>
(2952 4)	3290.4	3.55	5.4	av $E\beta=1254.2$ 19
(3276 4)	2965.90	21.5 13	4.80 3	av $E\beta=1409.0$ 20
(3484 4)	2758.25	20.5 13	4.93 3	av $E\beta=1508.5$ 20
(3618 4)	2624.50	39.7 23	4.72 3	av $E\beta=1572.7$ 20
(4100 4)	2142.07	5.8 12	5.79 9	av $E\beta=1804.8$ 20
(4327 4)	1914.95	3.9 13	6.07 15	av $E\beta=1914.4$ 20
(5113 4)	1128.94	2.3 11	6.62 21	av $E\beta=2294.6$ 20
(5200 4)	1041.99	4.5 9	6.36 9	av $E\beta=2336.7$ 20
(6149 [‡] 4)	93.09	<4	>6.7	av $E\beta=2796.8$ 20

[†] Absolute intensity per 100 decays.

[‡] Existence of this branch is questionable.

⁸¹Ge β⁻ decay (7.6 s): (9/2⁺) **1981Ho24** (continued)

γ(⁸¹As)

I_γ normalization: From Σ (I(γ+ce) to g.s.)=100% (no g.s. β feeding expected because ΔJ=(3), Δπ=(yes)).

Measured average E_γ=2000 222 (1990Ru05).

E _γ [†]	I _γ ^{†&}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [‡]	δ	α ^a	Comments
93.10 10	19 4	93.09	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻	0	3/2 ⁻	M1+E2	0.24 6	0.16 3	α(K)exp=0.141 21 α(K)=0.140 23; α(L)=0.017 4; α(M)=0.0025 5; α(N+..)=0.00018 4 α(N)=0.00018 4 %I _γ = 13.4 24 based on proposed decay-scheme normalization. δ: from α(K)exp.
133.70 6	6.2 4	2758.25	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	2624.50	(7/2 ⁺)				
197.30 5	13.4 10	290.40	(3/2) ⁻	93.09	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻	(M1)		0.01490	α(K)exp=0.010 5 α(K)=0.01326 19; α(L)=0.001411 20; α(M)=0.000215 3; α(N+..)=1.633×10 ⁻⁵ 23 α(N)=1.633×10 ⁻⁵ 23
242.84 9	3.4 4	335.96	(5/2) ⁻	93.09	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻				
290.35 5	7.0 7	290.40	(3/2) ⁻	0	3/2 ⁻				
335.98 5	83 3	335.96	(5/2) ⁻	0	3/2 ⁻	M1,E2		0.007 3	α(K)exp=0.0064 32 α(K)=0.0059 24; α(L)=0.0006 3; α(M)=0.00010 4; α(N+..)=7.E-6 3 α(N)=7.E-6 3 %I _γ = 58.6 23 based on proposed decay-scheme normalization. δ: both α(K)(M1) and α(K)(E2) lie within limits of experimental uncertainty.
391.34 11	3.3 3	1128.94	(7/2,9/2 ⁻)	737.71	(5/2 ⁻)				
401.75 5	5.9 5	737.71	(5/2 ⁻)	335.96	(5/2 ⁻)				
^x 463.1 3	1.9 4								
467.98 6	3.7 10	758.42	(3/2 ⁺ ,5/2 ⁻)	290.40	(3/2) ⁻				
482.4 1	11 1	2624.50	(7/2 ⁺)	2142.07	(7/2 ⁺ ,9/2 ⁺)				
507.4 3	2.0 5	2758.25	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	2250.84					E _γ : from 1980HoZN (E=507.2 on drawing in 1981Ho24).
^x 609.1 3	1.9 4								
616.3 2	2.6 5	2758.25	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	2142.07	(7/2 ⁺ ,9/2 ⁺)				
637.3 3	2.4 5	2250.84		1613.54					
665.9 ^{b#} 3	3 ^b	758.42	(3/2 ⁺ ,5/2 ⁻)	93.09	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻				
665.9 ^{b#} 3	5 ^b	3290.4	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	2624.50	(7/2 ⁺)				
706.07 10	8.7 7	1041.99	(7/2 ⁻)	335.96	(5/2) ⁻				
709.1 3	6.3 15	2624.50	(7/2 ⁺)	1914.95	(7/2,9/2 ⁻)				
737.74 5	17 1	737.71	(5/2) ⁻	0	3/2 ⁻				
747.41 10	10.3 7	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	335.96	(5/2) ⁻				

3

$^{81}\text{Ge} \beta^-$ decay (7.6 s): (9/2⁺) 1981Ho24 (continued) $\gamma(^{81}\text{As})$ (continued)

E_γ^\dagger	$I_\gamma^{\ddagger\&}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
751.51 10	9.7 7	1041.99	(7/2 ⁻)	290.40	(3/2 ⁻)	
758.5 6	8.0 7	758.42	(3/2 ⁺ ,5/2 ⁻)	0	3/2 ⁻	
792.94 ^{b@} 6	7 ^b	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	290.40	(3/2 ⁻)	
792.94 ^{b@} 6	48 ^b	1128.94	(7/2,9/2 ⁻)	335.96	(5/2 ⁻)	
859.13 10	11.3 9	1195.02		335.96	(5/2 ⁻)	
875.84 10	16.0 12	1613.54		737.71	(5/2 ⁻)	
990.3 4	2 1	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	93.09	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻	
1013.0 2	13.4 11	2142.07	(7/2 ⁺ ,9/2 ⁺)	1128.94	(7/2,9/2 ⁻)	
^x 1038.5 4	1.7 5					
^x 1056.5 2	4.2 4					
1058.6 2	5.1 3	2142.07	(7/2 ⁺ ,9/2 ⁺)	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	
1083.2 3	4 1	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	0	3/2 ⁻	
^x 1095.5 3	3.0 3					
1100.3 2	3.2 4	2142.07	(7/2 ⁺ ,9/2 ⁺)	1041.99	(7/2 ⁻)	
1144.75 15	11.5 8	2758.25	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	1613.54		
1156.41 15	11.8 8	1914.95	(7/2,9/2 ⁻)	758.42	(3/2 ⁺ ,5/2 ⁻)	
^x 1225.8 2	4.1 5					
^x 1238.9 3	2.4 4					
^x 1256.1 2	1.1 3					
^x 1297.4 3	2.8 4					
1352.3	1	2965.90	(7/2 ⁺)	1613.54		Not in table 11 (1980HoZN) but shown in drawing (1981Ho24).
1429.53 10	11.3 6	2624.50	(7/2 ⁺)	1195.02		
^x 1435.7 2	4.5 5					
1495.53 5	28.0 9	2624.50	(7/2 ⁺)	1128.94	(7/2,9/2 ⁻)	
1582.27 15	8.9 6	2624.50	(7/2 ⁺)	1041.99	(7/2 ⁻)	
1629.45 13	6.6 5	2758.25	(7/2 ⁺ ,9/2 ⁺ ,11/2 ⁺)	1128.94	(7/2,9/2 ⁻)	
^x 1686.5 3	1.1 2					
1882.51 8	18.4 8	2965.90	(7/2 ⁺)	1083.36	(3/2 ⁺ ,5/2,7/2 ⁻)	
1886.8 2	1.6 2	2624.50	(7/2 ⁺)	737.71	(5/2 ⁻)	
2207.5 3	3.0 4	2965.90	(7/2 ⁺)	758.42	(3/2 ⁺ ,5/2 ⁻)	
2228.2 5	2.0 4	2965.90	(7/2 ⁺)	737.71	(5/2 ⁻)	
2629.9 2	5.9 6	2965.90	(7/2 ⁺)	335.96	(5/2 ⁻)	
^x 2754.8 3	4.5 5					

[†] All data for unplaced γ rays and all uncertainties are from 1980HoZN (table 11); other data are from 1981Ho24, except as noted.

[‡] From $\alpha(\text{K})\text{exp}$ (1981Ho24).

[#] I_γ from drawing in 1981Ho24; E_γ from table 11 in 1980HoZN. $I_\gamma=11.0$ 20 for multiplet (1980HoZN, both isomers combined).

[@] I_γ from drawing in 1981Ho24; E_γ from table 11 in 1980HoZN. $I_\gamma=55$ 2 for doublet (1980HoZN).

[&] For absolute intensity per 100 decays, multiply by 0.71 3.

$^{81}\text{Ge} \beta^-$ decay (7.6 s): (9/2⁺) **1981Ho24** (continued)

$\gamma(^{81}\text{As})$ (continued)

^a 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.

^b Multiply placed with intensity suitably divided.

^x γ ray not placed in level scheme.

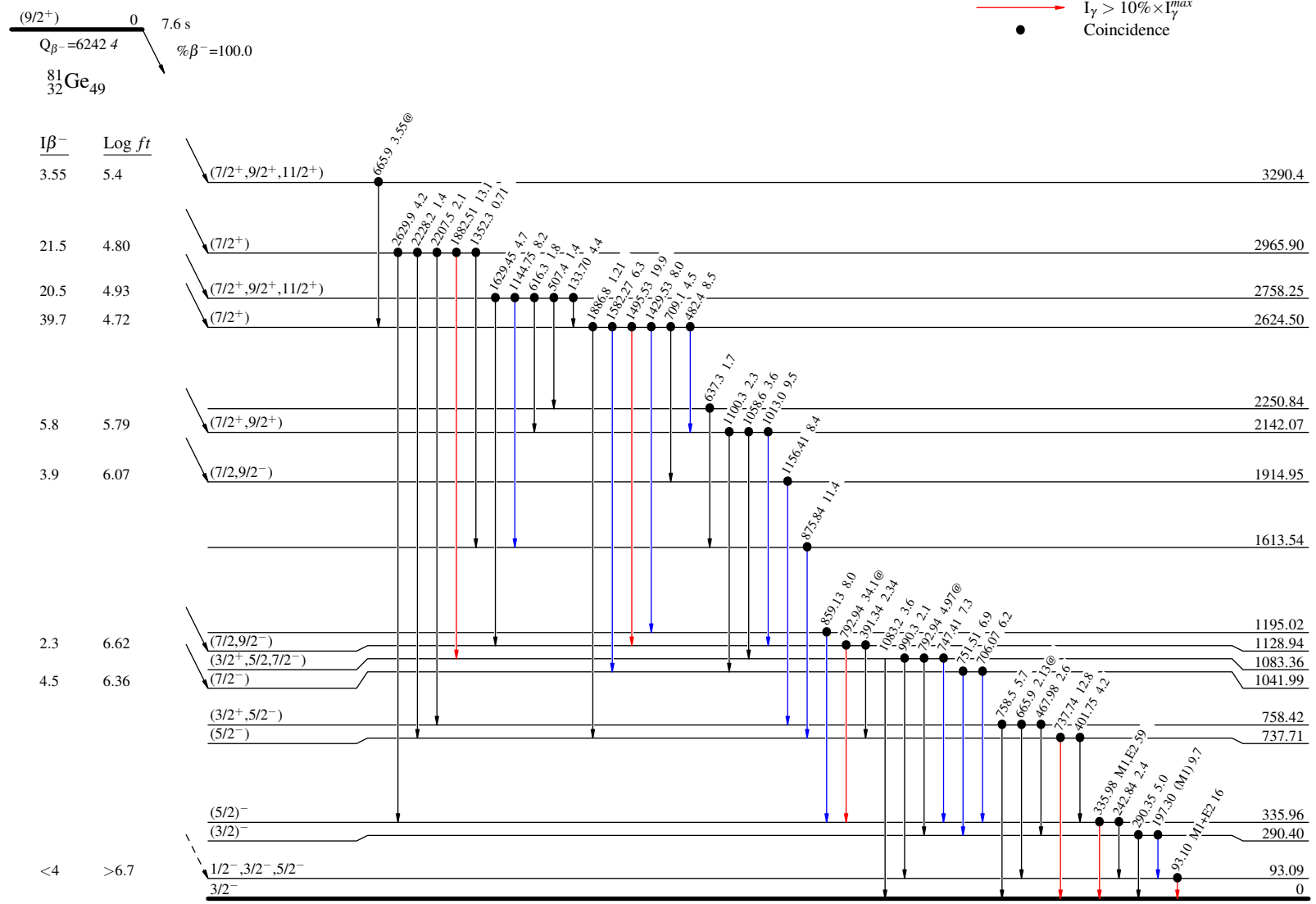
81Ge β⁻ decay (7.6 s): (9/2⁺) 1981Ho24

Decay Scheme

Intensities: I_(γ+ce) per 100 parent decays
 @ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence



< 0.7 ns

81As48