^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 202,59 (2025)	25-Feb-2025

Parent: ^{65}Ga: E=0; $J^\pi=3/2^-$; $T_{1/2}$=15.133 min *28*; Q($\varepsilon+\beta^+$)=3254.5 *6*; %$\varepsilon+\beta^+$ decay=100

^{65}Ga-J^π,$T_{1/2}$: From Adopted Levels of ^{65}Ga.

^{65}Ga-Q($\varepsilon+\beta^+$): From 2021Wa16.

1972Du03: ^{65}Ga source was produced via ^{64}Zn(d,n) with E(d)=5 MeV beam on an enriched ^{64}Zn target at the Natuurkundig Laboratorium Amsterdam. γ rays were detected with Ge(Li), Si(Li) and NaI detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels, J, π, decay branching ratios, log *ft*.

1975Ch27: ^{65}Ga source was produced via ^{64}Zn(p,γ) with E(p)=3 MeV beam from the 3 MeV Van de Graaff of the Tsing Hua University on a natural Zn target. γ rays were detected with a Ge(Li) and a NaI(Tl) detector. Measured Eγ, Iγ , $\gamma\gamma$-coin. Deduced levels, J, π, decay branching ratios, log *ft*.

1972Nu02: ^{65}Ga source was produced via ^{64}Zn(p,γ) with E(p)=3.5 MeV from the 4-MeV Van de Graaff of Tokyo Institute of technology on a natural Zn target. γ rays were detected with Ge(Li) and NaI detectors. Measured Eγ, Iγ and $\gamma\gamma$-coin. Deduced levels, J, π, log *ft*.

1972Ba42: ^{65}Ga source was produced via ^{64}Zn(p,γ) with E(p)=3.8 MeV from the cyclotron at the Saha Institute of Nuclear Physics, Calcutta, on an enriched ^{64}Zn target. γ rays were detected with a Ge(Li) detector. Measured Eγ, Iγ. Deduced levels, J, π, decay branching ratios, log *ft*.

1957Da07,1957Ma11: ^{64}Zn(d,n) E(d)≈7 MeV, Measured Eγ, Iγ, $\gamma\gamma$- and $\beta^+\gamma$-coin, Eβ+, Iβ^+, Ice and $T_{1/2}$ of ^{65}Ga parent with a magnetic spectrometer and scintillators.

1975Ro25: ^{64}Zn(d,n) E(d)=5 MeV from Natuurkundig laboratorium. Measured delayed $\beta^+\gamma$(t) with Ge(Li) and NaI(Tl) detectors for γ rays and a E-ΔE telescope for β^+. Deduced $T_{1/2}$.

Additional information 1.

1969Ba37: ^{63}Cu(α,2n) Eα=25 MeV. Measured Ice(K), Ice(L) and α(K)/(α(L)+α(M)) with a β spectrometer.

1968Li05: measured Eγ, Iγ, $\gamma\gamma$-coin and Ice(K).

1960Au03: measured Eγ, Iγ, prompt and delayed $\gamma\gamma$- and $\beta^+\gamma$-coin.

1971Sh36: measured Eγ, Iγ and delayed $\gamma\gamma$-coin.

2019Gy04: measured ^{65}Ga half-life at Atomki.

Others: 1952At33, 1953Cr15, 1958Au82, 1970Ho13, 1971Dz03.

Note: unplaced γ rays account for only 0.30% *3* of the total γ intensity.

The decay scheme is considered fairly complete.

^{65}Zn Levels

E(level)[†‡]	J^π[#]	$T_{1/2}$[#]	Comments
0	$5/2^-$	243.93 d *9*	
54.0 *1*	$1/2^-$	1.62 μs *6*	$T_{1/2}$: adopted value is from weighted average of 1.65 μs *5* (1960Au03) and 1.52 μs *9* (1975Ro25), both from delayed $\beta^+\gamma$(t).
115.2 *1*	$3/2^-$	0.444 ns *9*	$T_{1/2}$: values from this dataset: 0.44 ns *2* from ce-β^+(t) (1975Ro25), 0.46 ns *7* (1968Li05) and 0.49 ns *9* (1971Sh36) from delayed $\gamma\gamma$(t).
207.0 *1*	$3/2^-$	150 ps *7*	$T_{1/2}$: <0.2 ns from $\gamma\gamma^\pm$(t) (1975Ro25).
768.9 *1*	$5/2^-$	1.3 ps *+7–6*	
864.6 *3*	$7/2^-$	3.4 ps *+42–17*	
867.0 *1*	$1/2^-$	0.55 ps *+35–21*	$T_{1/2}$: value from this dataset: <0.2 ns from $\gamma\gamma^\pm$(t) (1975Ro25).
909.8 *1*	$3/2^-$	1.4 ps *+7–6*	
1047.6 *1*	$5/2^-$	0.38 ps *11*	
1344.0 *1*	$5/2^-$	0.8 ps *+11–6*	
1469.8 *1*	$3/2^-$	147 fs *58*	
1576.9 *4*	$3/2^-$	173 fs *48*	Level proposed by 1972Nu02 and confirmed by reaction data.
1588.2 *4*	$7/2^-$	152 fs *62*	Level proposed by 1972Ba42, 1975Ch27 and confirmed by reaction data.
2081.6 *3*	$(1/2^-,3/2^-)$		Level proposed by 1972Ba42, 1972Nu02, 1975Ch27 and confirmed by reaction data.

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^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

^{65}Zn Levels (continued)

E(level)[†‡]	Jπ[#]	Comments
2419.5 *2*	1/2⁻	
2549.5? *3*	(3/2⁻,5/2,7/2⁻)	Level proposed by 1972Nu02 and 1975Ch27.

† Additional information 2.
‡ From a least-squares fit to γ-ray energies.
# From Adopted Levels. Supporting arguments or $T_{1/2}$ values from this dataset are given under comments where available.

ε,β^+ radiations

av Eβ: Additional information 3.

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)[†‡]	Comments
(835.0 *12*)	2419.5		0.19 *4*	5.1 *1*	0.169 *18*	εK=0.88223 *23*; εL=0.09990 *14*; εM+=0.017872 *67*
(1172.9[#] *12*)	2081.6	1.3×10⁻⁴ *2*	0.112 *20*	5.7 *1*	0.112 *20*	av Eβ=68.86 *28*; εK=0.88185 *24*; εL=0.09929 *14*; εM+=0.017749 *67*
(1666.3[#] *12*)	1588.2	0.0012 *6*	0.023 *11*	7.7 *+3−2*	0.024 *11*	av Eβ=300.37 *32*; εK=0.8370 *14*; εL=0.09500 *21*; εM+=0.016988 *70*
(1677.6 *12*)	1576.9	0.007 *5*	0.023 *18*	6.7 *+5−2*	0.030 *19*	av Eβ=280.71 *31*; εK=0.6755 *50*; εL=0.07573 *57*; εM+=0.01353 *10*
(1784.7 *12*)	1469.8	0.45 *4*	0.88 *11*	5.13 *5*	1.33 *12*	av Eβ=326.56 *26*; εK=0.5824 *61*; εL=0.06526 *69*; εM+=0.01166 *12*
(1910.5 *12*)	1344.0	0.52 *6*	0.61 *11*	5.35 *6*	1.13 *12*	av Eβ=380.93 *26*; εK=0.4741 *66*; εL=0.05309 *75*; εM+=0.00949 *13* E(decay): measured value: 820 *80* (1957Da07). Iβ+: Iβ+/Iβ+(total)=10% *4* (1957Da07).
(2206.9 *12*)	1047.6	1.74 *23*	0.78 *8*	5.37 *5*	2.52 *24*	av Eβ=510.99 *27*; εK=0.2748 *56*; εL=0.03073 *63*; εM+=0.00549 *11*
(2344.7 *12*)	909.8	0.73 *9*	0.23 *2*	5.95 *5*	0.96 *9*	av Eβ=572.29 *27*; εK=0.2128 *47*; εL=0.02380 *53*; εM+=0.00425 *9*
(2387.5 *12*)	867.0	6.2 *8*	1.8 *2*	5.08 *5*	8.0 *8*	av Eβ=591.43 *27*; εK=0.1969 *45*; εL=0.02201 *50*; εM+=0.003932 *84* E(decay): measured value: 1390 *40* (1957Da07). Measured Iβ+/Iβ+(total)=19% *6* (1957Da07).
(2389.9[#] *12*)	864.6	0.014 *7*	0.014 *4*	8.5 *+2−1*	0.028 *8*	av Eβ=620.21 *30*; εK=0.4373 *65*; εL=0.04927 *74*; εM+=0.00881 *13* Log *ft*: 7.32 *10* is in disagreement with adopted $J^\pi=7/2^-$ indicating the presence of unobserved transitions. See ^{65}Zn Adopted Gammas.
(2485.6 *12*)	768.9	1.76 *24*	0.40 *5*	5.76 *6*	2.16 *24*	av Eβ=635.46 *27*; εK=0.1654 *39*; εL=0.01848 *44*; εM+=0.003301 *73*
(3047.5 *12*)	207.0	11.0 *15*	0.92 *12*	5.58 *6*	11.9 *15*	av Eβ=891.42 *28*; εK=0.0684 *18*; εL=0.00764 *20*; εM+=0.001365 *34*
(3139.3 *12*)	115.2	59 *12*	4.3 *8*	4.9 *1*	63 *12*	av Eβ=933.75 *28*; εK=0.0604 *16*; εL=0.00674 *18*; εM+=0.001203 *30* E(decay): measured value: 2113 *20* (1957Da07). Measured Iβ+/Iβ+(total)=56% *3* (1957Da07).
(3200.5 *12*)	54.0	8 *6*	0.5 *4*	5.9 *+6−3*	8 *6*	av Eβ=962.04 *28*; εK=0.0556 *15*; εL=0.00621 *17*; εM+=0.001109 *28*
(3254.5[#] *16*)	0	<2.2	<0.1	>6.5	<2.3	av Eβ=987.04 *28*; εK=0.0519 *14*; εL=0.00579

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^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Comments
		16; εM+=0.001034 *26* E(decay): measured value: 2237 *15* (1957Da07). I($\varepsilon+\beta^+$): from the error in the intensity of the annihilation, 1972Du03 find the g.s. feeding <2.3%. Other: 1968Li05 report a g.s. feeding <10%, but it is unclear how this limit is obtained; based on that 1972Ba42 assume 10% and it is probably the same for 10% reported in 1975Ch27.

† From γ+ce intensity balance at each level for excited level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$

Iγ normalization: Deduced by the evaluator from Σ%I(γ+ce to g.s.)=100−%Iβ(g.s.)=98.85 *115*, with %Iβ(g.s.)=1.15 *115* from the upper limit of 2.3 estimated by 1972Du03 (see more details in comments for %Iβ(g.s.)). Other: 0.57 *9*, deduced from I$\gamma(\gamma^{\pm})$/Iγ(751.8)=21.9 *21* (1972Du03; the ratio deduced by the evaluators using their relative intensities), relative $\varepsilon+\beta^+$ feeding from γ+ce intensity balance at each level, and theoretical ε/β^+ ratio at each level. Based on this normalization factor of 0.57 *9*, a total $\varepsilon+\beta^+$ feeding of 108 *20* is deduced based on γ+ce intensity balance at each level, indicating the completeness of the decay scheme.
Iβ^+(total)/Iγ(115)=1.7 from 1968Li05 is in an agreement.
Iγ normalization: Additional information 5.

E_γ[‡]	I_γ[#&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[†]	Comments
53.8 *2*	9.0 *9*	54.0	1/2−	0	5/2−	E2		6.72 *13*	α(K)=5.71 *11*; α(L)=0.883 *19*; α(M)=0.1236 *26* α(N)=0.00279 *5* %Iγ=4.8 *6* E_γ: other: 54 *1* from 1972Ba42. I_γ: also from 1972Ba42. α(K)/(α(L)+α(M))=5.6 *6* (1969Ba37). α(K)/(α(L)+α(M))≈3.8 and Ice/Iβ^+(total)=0.1 (1957Da07).
61.1 *2*	23.2 *28*	115.2	3/2−	54.0	1/2−	M1+E2	+0.07 *5*	0.26 *4*	%Iγ=12.3 *18* α(K)=0.228 *32*; α(L)=0.025 *5*; α(M)=0.0036 *7* α(N)=0.000133 *16* E_γ: other: 61 *1* from 1972Ba42. I_γ: weighted average of 27.0 *27* (1972Ba42) and 21.1 *20* (1972Du03). α(K)/(α(L)+α(M))=6.0 *15* (1969Ba37).
92[a]	≤0.74	207.0	3/2−	115.2	3/2−				%Iγ≤0.39 E_γ,I_γ: from 1972Du03 only.
115.1 *2*	100 *10*	115.2	3/2−	0	5/2−	M1+E2	−0.27 *5*	0.065 *9*	%Iγ=53 *7* α(K)=0.058 *8*; α(L)=0.0064 *9*; α(M)=0.00091 *13* α(N)=3.3×10^{-5} *4* E_γ: others: 115.1 *4* (1975Ch27), 115 *1* (1972Ba42). I_γ: from 1975Ch27. Other: 100 *15* (1972Du03). α(K)/(α(L)+α(M))=7.1 *10* (1969Ba37).
153.0 *2*	16.8 *15*	207.0	3/2−	54.0	1/2−	M1+E2	+0.19 *5*	0.0237 *22*	α(K)=0.0212 *20*; α(L)=0.00222 *22*; α(M)=0.000319 *31* α(N)=1.22×10^{-5} *10* %Iγ=8.9 *11* E_γ: from 1972Nu02. Others: 153 *1* (1972Ba42) and 153.0 *4* (1975Ch27). I_γ: weighted average of 15.3 *15* (1972Ba42), 16.4 *16* (1972Du03), 21.0 *19* (1972Nu02), and 15.8 *16* (1975Ch27). α(K)/(α(L)+α(M))=7.1 *10* (1969Ba37).
206.9 *2*	6.1 *10*	207.0	3/2−	0	5/2−	M1+E2	+0.56 *17*	0.017 *4*	%Iγ=3.2 *6* α(K)=0.0153 *32*; α(L)=0.00161 *35*; α(M)=0.00023 *5*

$^{65}_{30}Zn_{35}$-4

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ[‡]	I_γ[#&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[†]	Comments
									α(N)=8.6×10^{-6} *17* E_γ: from 1972Nu02. Others: 207 *1* (1972Ba42) and 206.9 *4* (1975Ch27). I_γ: unweighted average of 4.1 *4* (1972Ba42), 4.7 *5* (1972Du03), 7.8 *7* (1972Nu02), and 7.9 *8* (1975Ch27).
422.2 *3*	0.103 *25*	1469.8	3/2$^-$	1047.6	5/2$^-$	[M1+E2]	<0.5	0.00181 *18*	%Iγ=0.055 *14*
[x]479.5 *6*	0.036 *25*								%Iγ=0.019 *13*
560.1 *2*	0.154 *15*	1469.8	3/2$^-$	909.8	3/2$^-$				%Iγ=0.082 *10* E_γ: from 1972Du03. Other: 560.3 *4* (1975Ch27). I_γ: weighted average of 0.20 *5* (1972Du03) and 0.150 *15* (1975Ch27).
574.8 *5*	0.05 *5*	1344.0	5/2$^-$	768.9	5/2$^-$				%Iγ=0.027 *27*
602.7 *3*	0.121 *12*	1469.8	3/2$^-$	867.0	1/2$^-$				%Iγ=0.064 *8* E_γ: other: 602.7 *4* (1975Ch27). I_γ: weighted average of 0.117 *18* (1972Du03) and 0.123 *12* (1975Ch27).
653.7 *2*	1.68 *25*	768.9	5/2$^-$	115.2	3/2$^-$	M1+E2	−0.40 *7*	0.000650 *15*	%Iγ=0.89 *15* α(K)=0.000583 *14*; α(L)=5.85×10^{-5} *14*; α(M)=8.39×10^{-6} *20* α(N)=3.37×10^{-7} *8* E_γ: from 1972Du03. Others: 654 *1* (1972Ba42), 653.7 *2* (1972Nu02), and 653.6 *4* (1975Ch27). I_γ: unweighted average of 1.55 *16* (1972Ba42), 1.39 *14* (1972Du03), 2.4 *2* (1972Nu02), and 1.37 *14* (1975Ch27).
660.1 *2*	0.33 *9*	867.0	1/2$^-$	207.0	3/2$^-$				%Iγ=0.18 *5* E_γ: weighted average of 660 *1* (1972Ba42), 659.9 *3* (1972Du03), 660.2 *2* (1972Nu02), and 660.2 *4* (1975Ch27). I_γ: unweighted average of 0.60 *6* (1972Ba42), 0.234 *24* (1972Du03), 0.25 *4* (1972Nu02), and 0.234 *24* (1975Ch27).
702.9 *2*	0.22 *3*	909.8	3/2$^-$	207.0	3/2$^-$				%Iγ=0.117 *18* E_γ: weighted average of 702.7 *2* (1972Du03), 703.1 *2* (1972Nu02), and 702.5 *4* (1975Ch27). Other: 703 *1* (1972Ba42). I_γ: unweighted average of 0.30 *3* (1972Ba42), 0.193 *32* (1972Du03), 0.23 *3* (1972Nu02), and 0.148 *15* (1975Ch27).
714.8 *2*	0.29 *3*	768.9	5/2$^-$	54.0	1/2$^-$	[E2]		0.000695 *10*	α(K)=0.000622 *9*; α(L)=6.30×10^{-5} *9*; α(M)=9.01×10^{-6} *13* α(N)=3.56×10^{-7} *5* %Iγ=0.154 *20* E_γ: weighted average of 714.8 *2* (1972Du03), 714.9 *2* (1972Nu02), and 714.8 *4* (1975Ch27). Other: 715 *1* (1972Ba42). I_γ: weighted average of 0.31 *3* (1972Ba42), 0.30 *3* (1972Du03), 0.30 *3* (1972Nu02), and 0.25 *3* (1975Ch27).
751.9 *2*	14.4 *9*	867.0	1/2$^-$	115.2	3/2$^-$				%Iγ=7.6 *8*

$^{65}_{30}Zn_{35}$-5

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ ‡	I_γ #&	E_i(level)	J_i^π	E_f	J_f^π	Mult. @	δ @	α †	Comments
769.0 *2*	2.15 *19*	768.9	5/2$^-$	0	5/2$^-$	M1+E2	+0.27 *7*	0.000441 *8*	E_γ: weighted average of 751.8 *2* (1972Du03), 751.9 *2* (1972Nu02), and 751.9 *4* (1975Ch27). Other: 752 *1* (1972Ba42). I_γ: weighted average of 13.4 *14* (1972Ba42), 15.0 *9* (1972Du03), 14.3 *11* (1972Nu02), and 14.3 *14* (1975Ch27). %Iγ=1.14 *13* α(K)=0.000395 *7*; α(L)=3.96×10^{-5} *7*; α(M)=5.67×10^{-6} *10* α(N)=2.29×10^{-7} *4*
794.6 *2*	0.45 *4*	909.8	3/2$^-$	115.2	3/2$^-$	M1+E2	+0.44 *12*	0.000422 *11*	E_γ: weighted average of 768.9 *2* (1972Du03), 769.0 *2* (1972Nu02), and 769.0 *4* (1975Ch27). Other: 769 *1* (1972Ba42). I_γ: weighted average of 1.84 *19* (1972Ba42), 2.35 *20* (1972Du03), 2.2 *2* (1972Nu02), and 2.27 *23* (1975Ch27). %Iγ=0.239 *28* α(K)=0.000378 *10*; α(L)=3.79×10^{-5} *10*; α(M)=5.43×10^{-6} *14* α(N)=2.19×10^{-7} *5*
813.0 *2*	0.23 *2*	867.0	1/2$^-$	54.0	1/2$^-$	[M1]		0.000383 *5*	E_γ: from 1972Du03. Others: 795 *1* (1972Ba42), 794.6 *2* (1972Nu02), and 794.7 *4* (1975Ch27). I_γ: unweighted average of 0.330 *33* (1972Ba42), 0.49 *5* (1972Du03), 0.49 *4* (1972Nu02), and 0.49 *5* (1975Ch27). α(K)=0.000344 *5*; α(L)=3.44×10^{-5} *5*; α(M)=4.93×10^{-6} *7* α(N)=1.991×10^{-7} *28* %Iγ=0.122 *14*
855.8 *2*	0.32 *3*	909.8	3/2$^-$	54.0	1/2$^-$	M1+E2	−0.85 *20*	0.000381 *12*	E_γ: from 1972Du03. Others: 813 *1* (1972Ba42), 813.0 *2* (1972Nu02), and 813.0 *4* (1975Ch27). I_γ: weighted average of 0.250 *25* (1972Ba42), 0.237 *34* (1972Du03), 0.21 *2* (1972Nu02), and 0.223 *22* (1975Ch27). %Iγ=0.170 *21* α(K)=0.000342 *11*; α(L)=3.42×10^{-5} *11*; α(M)=4.91×10^{-6} *16* α(N)=1.97×10^{-7} *6*
864.9 *4*	0.082 *9*	864.6	7/2$^-$	0	5/2$^-$	M1+E2	−2.14 *13*	0.000405 *6*	E_γ: from 1972Du03. Others: 856 *1* (1972Ba42), 855.9 *2* (1972Nu02), and 855.4 *4* (1975Ch27). I_γ: weighted average of 0.30 *3* (1972Ba42), 0.32 *3* (1972Du03), 0.30 *3* (1972Nu02), and 0.39 *4* (1975Ch27). %Iγ=0.044 *6* α(K)=0.000363 *5*; α(L)=3.65×10^{-5} *5*; α(M)=5.23×10^{-6} *8* α(N)=2.087×10^{-7} *30*
867.1 *3*	0.29 *6*	867.0	1/2$^-$	0	5/2$^-$	[E2]		0.000417 *6*	E_γ: weighted average of 864.7 *4* (1972Du03), 865.2 *4* (1972Nu02), and 864.7 *4* (1975Ch27). I_γ: weighted average of 0.081 *25* (1972Du03), 0.06 *3* (1972Nu02), and 0.084 *9* (1975Ch27). α(K)=0.000374 *5*; α(L)=3.77×10^{-5} *5*; α(M)=5.39×10^{-6} *8*

$^{65}_{30}Zn_{35}$-6

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ[‡]	I_γ[#&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[†]	Comments
									α(N)=2.147×10^{-7} *30* %Iγ=0.154 *34* E_γ: weighted average of 867 *1* (1972Ba42), 866.8 *4* (1972Du03), 867.3 *3* (1972Nu02), and 866.9 *4* (1975Ch27). I_γ: unweighted average of 0.47 *5* (1972Ba42), 0.22 *5* (1972Du03), 0.22 *2* (1972Nu02), and 0.240 *24* (1975Ch27).
909.9 *2*	0.98 *7*	909.8	3/2$^-$	0	5/2$^-$	M1+E2	+0.25 *4*	0.000307 *4*	α(K)=0.000276 *4*; α(L)=2.75×10^{-5} *4*; α(M)=3.94×10^{-6} *6* α(N)=1.594×10^{-7} *23* %Iγ=0.52 *6* E_γ: weighted average of 909.7 *2* (1972Du03), 910.0 *2* (1972Nu02), and 910.0 *4* (1975Ch27). Other: 910 *1* (1972Ba42). I_γ: weighted average of 1.03 *10* (1972Ba42), 0.94 *9* (1972Du03), 0.90 *7* (1972Nu02), and 1.19 *12* (1975Ch27).
932.4 *2*	3.19 *25*	1047.6	5/2$^-$	115.2	3/2$^-$	M1+E2	−0.42 *5*	0.000297 *5*	α(K)=0.000267 *4*; α(L)=2.66×10^{-5} *4*; α(M)=3.82×10^{-6} *6* α(N)=1.542×10^{-7} *23* %Iγ=1.69 *19* E_γ: weighted average of 932.2 *2* (1972Du03), 932.7 *2* (1972Nu02), and 932.0 *4* (1975Ch27). Other: 932 *1* (1972Ba42). I_γ: weighted average of 3.0 *3* (1972Ba42), 3.32 *25* (1972Du03), 3.1 *3* (1972Nu02), and 3.29 *33* (1975Ch27).
993.8 *4*	0.078 *8*	1047.6	5/2$^-$	54.0	1/2$^-$				%Iγ=0.041 *5* E_γ: weighted average of 993.7 *4* (1972Du03), 993.7 *4* (1972Nu02), and 993.9 *4* (1975Ch27). I_γ: weighted average of 0.092 *14* (1972Du03), 0.07 *2* (1972Nu02), and 0.074 *8* (1975Ch27).
1047.5 *2*	1.58 *10*	1047.6	5/2$^-$	0	5/2$^-$	M1+E2		0.000246 *18*	α(K)=0.000220 *16*; α(L)=2.20×10^{-5} *17*; α(M)=3.15×10^{-6} *24* α(N)=1.27×10^{-7} *9* %Iγ=0.84 *8* E_γ: weighted average of 1047.4 *2* (1972Du03), 1047.6 *2* (1972Nu02), and 1047.3 *4* (1975Ch27). Other: 1047 *1* (1972Ba42). I_γ: weighted average of 1.61 *16* (1972Ba42), 1.66 *11* (1972Du03), 1.5 *1* (1972Nu02), and 1.59 *16* (1975Ch27). δ: −0.40 *7* or +6.4 *+15−19* from Adopted Gammas.
1137.1 *2*	0.34 *6*	1344.0	5/2$^-$	207.0	3/2$^-$	(M1+E2)		0.000208 *13*	α(K)=0.000185 *12*; α(L)=1.84×10^{-5} *12*; α(M)=2.64×10^{-6} *17* α(N)=1.06×10^{-7} *6*; α(IPF)=1.99×10^{-6} *35* %Iγ=0.180 *35* E_γ: weighted average of 1135 *1* (1972Ba42), 1137.0 *2* (1972Du03), 1137.1 *2* (1972Nu02), and 1137.4 *4* (1975Ch27). I_γ: unweighted average of 0.50 *5* (1972Ba42), 0.269 *23* (1972Du03), 0.26 *2* (1972Nu02), and 0.349 *35* (1975Ch27). δ: +0.16 *20* or ≤−3.2 from Adopted Gammas.

$^{65}_{30}Zn_{35}$-7

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ‡	I_γ#&	E_i(level)	J_i^π	E_f	J_f^π	Mult.@	δ@	α†	Comments
x1214.7[a] 8	≤0.02								%Iγ≤0.011
1228.9 2	1.29 9	1344.0	5/2−	115.2	3/2−	M1+E2	−0.34 3	0.0001777 25	%Iγ=0.68 7 α(K)=0.0001504 21; α(L)=1.496×10^{-5} 21; α(M)=2.145×10^{-6} 30 α(N)=8.69×10^{-8} 12; α(IPF)=1.010×10^{-5} 16 E_γ: weighted average of 1227 1 (1972Ba42), 1228.8 2 (1972Du03), 1229.0 2 (1972Nu02), and 1228.7 4 (1975Ch27). I_γ: weighted average of 1.14 12 (1972Ba42), 1.32 9 (1972Du03), 1.3 1 (1972Nu02), and 1.37 14 (1975Ch27).
x1247.8 8	0.009 2								%Iγ=0.0048 11
1262.7 2	0.18 5	1469.8	3/2−	207.0	3/2−				%Iγ=0.095 28 E_γ: weighted average of 1261 1 (1972Ba42), 1262.9 2 (1972Du03), 1262.5 2 (1972Nu02), and 1262.9 4 (1975Ch27). I_γ: unweighted average of 0.09 2 (1972Ba42), 0.141 14 (1972Du03), 0.17 1 (1972Nu02), and 0.318 32 (1975Ch27).
1289.8 7	0.041 25	1344.0	5/2−	54.0	1/2−				%Iγ=0.022 14 E_γ: weighted average of 1288 1 (1972Ba42), 1290.6 6 (1972Du03), and 1289.7 7 (1972Nu02). I_γ: unweighted average of 0.09 2 (1972Ba42), 0.022 7 (1972Du03), and 0.011 8 (1972Nu02).
1343.9 2	0.41 3	1344.0	5/2−	0	5/2−	M1+E2		0.000179 11	α(K)=0.000131 6; α(L)=1.30×10^{-5} 6; α(M)=1.86×10^{-6} 8 α(N)=7.53×10^{-8} 32; α(IPF)=3.4×10^{-5} 5 %Iγ=0.217 23 E_γ: from 1972Du03. Others: 1342 1 (1972Ba42), 1343.7 2 (1972Nu02), and 1344.5 4 (1975Ch27). I_γ: weighted average of 0.54 6 (1972Ba42), 0.40 6 (1972Du03), 0.37 3 (1972Nu02), and 0.42 4 (1975Ch27).
1354.6 2	1.41 10	1469.8	3/2−	115.2	3/2−	M1+E2	+2.1 3	0.0001863 28	%Iγ=0.75 8 α(K)=0.0001318 19; α(L)=1.313×10^{-5} 19; α(M)=1.881×10^{-6} 28 α(N)=7.59×10^{-8} 11; α(IPF)=3.95×10^{-5} 8 E_γ: weighted average of 1353 1 (1972Ba42), 1354.7 2 (1972Du03), 1354.4 2 (1972Nu02), and 1355.1 4 (1975Ch27). I_γ: weighted average of 1.31 13 (1972Ba42), 1.46 16 (1972Du03), 1.4 1 (1972Nu02), and 1.54 16 (1975Ch27).
x1368[a]	≤0.013								%Iγ≤0.0069
x1408.8[a] 4	0.060 6								%Iγ=0.032 4 E_γ: weighted average of 1408 1 (1972Ba42) and 1408.9 4 (1975Ch27). Placed from a 1524 level in 1975Ch27 and 1972Ba42. I_γ: weighted average of 0.07 2 (1972Ba42) and 0.059 6 (1975Ch27).
1415.8 2	0.41 4	1469.8	3/2−	54.0	1/2−	M1+E2	+0.24 5	0.0001715 25	α(K)=0.0001137 16; α(L)=1.129×10^{-5} 16; α(M)=1.619×10^{-6} 23

$^{65}_{30}Zn_{35}$-8

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ[‡]	I_γ[#&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[†]	Comments
									α(N)=6.57×10^{-8} *9*; α(IPF)=4.48×10^{-5} *7* %Iγ=0.217 *27* E_γ: weighted average of 1414 *1* (1972Ba42), 1415.9 *2* (1972Du03), 1415.6 *2* (1972Nu02), and 1416.2 *4* (1975Ch27). I_γ: weighted average of 0.40 *4* (1972Ba42), 0.41 *5* (1972Du03), 0.41 *4* (1972Nu02), and 0.42 *4* (1975Ch27).
1469.8 *2*	0.130 *13*	1469.8	3/2$^-$	0	5/2$^-$				%Iγ=0.069 *9* E_γ: from 1972Du03. Others: 1468 *1* (1972Ba42), 1469.5 *4* (1972Nu02), and 1470.1 *4* (1975Ch27). I_γ: weighted average of 0.19 *2* (1972Ba42), 0.134 *23* (1972Du03), 0.12 *1* (1972Nu02), and 0.123 *12* (1975Ch27).
[x]1502.5 *8*	0.018 *5*								%Iγ=0.0095 *28*
1523.9 *8*	0.039 *31*	1576.9	3/2$^-$	54.0	1/2$^-$	M1+E2	−2.5 *3*	0.0002086 *31*	α(K)=0.0001041 *15*; α(L)=1.035×10^{-5} *15*; α(M)=1.484×10^{-6} *21* α(N)=5.99×10^{-8} *8*; α(IPF)=9.26×10^{-5} *15* %Iγ=0.021 *17* E_γ: weighted average of 1524 *1* (1972Ba42), 1524.0 *8* (1972Du03), and 1523.8 *8* (1972Nu02). Placed from a 1524 level in 1972Ba42. I_γ: unweighted average of 0.10 *2* (1972Ba42), 0.009 *7* (1972Du03), and 0.007 *7* (1972Nu02).
1576.6 *4*	0.017 *7*	1576.9	3/2$^-$	0	5/2$^-$	M1+E2	+1.2 *+12−7*	0.000213 *13*	%Iγ=0.009 *4* α(K)=9.58×10^{-5} *26*; α(L)=9.52×10^{-6} *26*; α(M)=1.36×10^{-6} *4* α(N)=5.52×10^{-8} *14*; α(IPF)=0.000107 *10* E_γ: weighted average of 1576.5 *4* (1972Du03) and 1576.9 *8* (1972Nu02). I_γ: weighted average of 0.018 *9* (1972Du03) and 0.016 *7* (1972Nu02).
1588.2 *4*	0.045 *18*	1588.2	7/2$^-$	0	5/2$^-$	M1+E2	+0.31 *2*	0.0002000 *28*	α(K)=9.17×10^{-5} *13*; α(L)=9.10×10^{-6} *13*; α(M)=1.304×10^{-6} *18* α(N)=5.29×10^{-8} *7*; α(IPF)=9.78×10^{-5} *14* %Iγ=0.024 *10* E_γ: from 1975Ch27. Others: 1589 *1* (1972Ba42) and 1587.8 *8* (1972Du03). I_γ: unweighted average of 0.06 *2* (1972Ba42), 0.009 *5* (1972Du03), and 0.066 *7* (1975Ch27).
1685.3[a] *4*	0.029 *7*	2549.5?	(3/2$^-$,5/2,7/2$^-$)	864.6	7/2$^-$				%Iγ=0.015 *4*

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ‡	I_γ#&	E_i(level)	J_i^π	E_f	J_f^π	Comments
						E_γ: weighted average of 1685.4 *4* (1972Du03) and 1685.2 *6* (1972Nu02). I_γ: weighted average of 0.034 *9* (1972Du03) and 0.026 *7* (1972Nu02).
[x]1740.6 *4*	0.030 *3*					%Iγ=0.0159 *20*
						E_γ: unweighted average of 1740.1 *2* (1972Du03), 1740.2 *8* (1972Nu02), and 1741.4 *4* (1975Ch27). I_γ: weighted average of 0.025 *12* (1972Du03), 0.024 *6* (1972Nu02), and 0.032 *3* (1975Ch27).
[x]1826.8 *2*	0.16 *10*					%Iγ=0.09 *5*
						E_γ: from 1972Du03. Others: 1826.8 *4* (1972Nu02) and 1827.0 *4* (1975Ch27). I_γ: unweighted average of 0.067 *7* (1972Du03), 0.046 *8* (1972Nu02), and 0.36 *4* (1975Ch27).
[x]1866 *1*	0.050 *15*					%Iγ=0.027 *8*
						E_γ,I_γ: from 1972Ba42, placed from a tentative 2077 level.
1874.6[a] *3*	0.103 *19*	2081.6	(1/2$^-$,3/2$^-$)	207.0	3/2$^-$	%Iγ=0.055 *11*
						E_γ: weighted average of 1872 *1* (1972Ba42), 1874.6 *2* (1972Du03), 1874.3 *4* (1972Nu02), and 1875.1 *4* (1975Ch27). I_γ: unweighted average of 0.050 *15* (1972Ba42), 0.137 *16* (1972Du03), 0.12 *1* (1972Nu02), and 0.103 *10* (1975Ch27).
[x]1887.8 *2*	0.016 *5*					%Iγ=0.0085 *27*
[x]1959 *1*	0.080 *15*					%Iγ=0.042 *9*
						E_γ,I_γ: from 1972Ba42, placed from a tentative 2077 level.
1966.4[a] *4*	0.108 *10*	2081.6	(1/2$^-$,3/2$^-$)	115.2	3/2$^-$	%Iγ=0.057 *7*
						E_γ: from 1972Du03. Others: 1965 *1* (1972Ba42), 1966.2 *4* (1972Nu02), and 1966.8 *4* (1975Ch27). I_γ: weighted average of 0.080 *15* (1972Ba42), 0.119 *14* (1972Du03), 0.11 *1* (1972Nu02), and 0.112 *11* (1975Ch27).
[x]2009.7 *6*	0.011 *7*					%Iγ=0.006 *4*
[x]2081.4 *8*	0.013 *7*					%Iγ=0.007 *4*
[x]2087.5 *8*	0.011 *7*					%Iγ=0.006 *4*
[x]2102.1 *2*	0.025 *5*					%Iγ=0.0133 *28*
[x]2105.0 *4*	0.211 *21*					%Iγ=0.112 *14*
						E_γ,I_γ: from 1975Ch27.
[x]2164.2 *6*	0.025 *4*					%Iγ=0.0133 *24*
						E_γ: weighted average of 2163.7 *8* (1972Du03), 2165.5 *6* (1972Nu02), and 2163.7 *4* (1975Ch27). I_γ: weighted average of 0.027 *7* (1972Du03), 0.015 *5* (1972Nu02), and 0.0270 *27* (1975Ch27).
2212.4 *3*	0.228 *20*	2419.5	1/2$^-$	207.0	3/2$^-$	%Iγ=0.121 *14*
						E_γ: weighted average of 2212 *1* (1972Ba42), 2212.1 *3* (1972Du03), 2212.9 *4* (1972Nu02), and 2212.6 *4* (1975Ch27). I_γ: weighted average of 0.220 *22* (1972Ba42), 0.246 *20* (1972Du03), 0.23 *2* (1972Nu02), and 0.211 *21* (1975Ch27).
[x]2252.6 *8*	0.014 *2*					%Iγ=0.0074 *12*
						E_γ: unweighted average of 2251.8 *2* (1972Du03) and 2253.3 *4* (1975Ch27). I_γ: from 1975Ch27. Other: 0.009 *9* (1972Du03).
[x]2290.6 *5*	0.014 *2*					%Iγ=0.0074 *12*

$^{65}_{30}Zn_{35}$-10

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ‡	I_γ#&	E_i(level)	J_i^π	E_f	J_f^π	Comments
						E_γ: unweighted average of 2289.8 *4* (1972Du03), 2290.4 *6* (1972Nu02), and 2291.6 *4* (1975Ch27).
						I_γ: weighted average of 0.029 *7* (1972Du03), 0.015 *3* (1972Nu02), and 0.0130 *13* (1975Ch27).
2304.3 *13*	0.018 *9*	2419.5	1/2$^-$	115.2	3/2$^-$	%Iγ=0.010 *5*
x2343.6 *4*	0.0210 *21*					%Iγ=0.0111 *14*
						E_γ: weighted average of 2343.1 *6* (1972Du03) and 2343.8 *4* (1975Ch27).
						I_γ: from 1975Ch27. Other: 0.022 *5* (1972Du03).
2365.6 *3*	0.066 *7*	2419.5	1/2$^-$	54.0	1/2$^-$	%Iγ=0.035 *5*
						E_γ: weighted average of 2365 *1* (1972Ba42), 2365.2 *3* (1972Du03), 2366.2 *4* (1972Nu02), and 2365.8 *4* (1975Ch27).
						I_γ: weighted average of 0.070 *15* (1972Ba42), 0.072 *9* (1972Du03), 0.062 *8* (1972Nu02), and 0.064 *7* (1975Ch27).
x2404.9 *4*	0.0322 *30*					%Iγ=0.0171 *21*
						E_γ: weighted average of 2404.3 *4* (1972Du03), 2405.2 *5* (1972Nu02), and 2405.3 *4* (1975Ch27).
						I_γ: weighted average of 0.045 *7* (1972Du03), 0.030 *3* (1972Nu02), and 0.0320 *32* (1975Ch27).
2419.7 *8*	0.006 *4*	2419.5	1/2$^-$	0	5/2$^-$	%Iγ=0.0032 *21*
2433.6[a] *4*	0.0081 *8*	2549.5?	(3/2$^-$,5/2,7/2$^-$)	115.2	3/2$^-$	%Iγ=0.0043 *5*
						E_γ: weighted average of 2432.9 *8* (1972Du03), 2434.8 *9* (1972Nu02), and 2433.5 *4* (1975Ch27).
						I_γ: weighted average of 0.011 *5* (1972Du03), 0.008 *3* (1972Nu02), and 0.0080 *8* (1975Ch27).
x2458.3 *5*	0.010 *1*					%Iγ=0.0053 *7*
						E_γ: weighted average of 2458.4 *6* (1972Du03), 2460.3 *10* (1972Nu02), and 2457.9 *4* (1975Ch27).
						I_γ: from 1975Ch27. Others: 0.016 *5* (1972Du03) and 0.012 *3* (1972Nu02).
x2468.6[a] *8*	≤0.004					%Iγ≤0.0021
x2527.1 *4*	0.011 *1*					%Iγ=0.0058 *7*
						E_γ: weighted average of 2526.0 *11* (1972Du03) and 2527.2 *4* (1975Ch27).
						I_γ: weighted average of 0.006 *6* (1972Du03) and 0.011 *1* (1975Ch27).
2549.8[a] *4*	0.048 *5*	2549.5?	(3/2$^-$,5/2,7/2$^-$)	0	5/2$^-$	%Iγ=0.0254 *33*
						E_γ: weighted average of 2549.6 *4* (1972Du03), 2549.8 *7* (1972Nu02), and 2550.0 *4* (1975Ch27).
						I_γ: weighted average of 0.056 *9* (1972Du03), 0.050 *6* (1972Nu02), and 0.044 *5* (1975Ch27).
x2570.8 *3*	0.0076 *29*					%Iγ=0.0040 *16*
x2583.9 *3*	0.0036 *23*					%Iγ=0.0019 *12*
x2627.6 *8*	0.0043 *23*					%Iγ=0.0023 *12*
x2635.7 *3*	0.0090 *23*					%Iγ=0.0048 *13*
x2648.7 *13*	0.0029 *23*					%Iγ=0.0015 *12*
x2678.9 *4*	0.026 *16*					%Iγ=0.014 *9*
						E_γ: weighted average of 2679.4 *8* (1972Du03), 2679.0 *15* (1972Nu02), and 2678.8 *4*

$^{65}_{30}Zn_{35}$-11

^{65}Ga $\varepsilon+\beta^+$ decay (15.133 min) 1972Du03 (continued)

$\gamma(^{65}Zn)$ (continued)

E_γ [‡]	I_γ [#&]	E_i(level)	Comments
			(1975Ch27).
			I_γ: unweighted average of 0.0090 *23* (1972Du03), 0.013 *3* (1972Nu02), and 0.057 *6* (1975Ch27).
[x]2685.6 *13*	0.0036 *18*		%Iγ=0.0019 *10*
[x]2722.0 *8*	0.0025 *11*		%Iγ=0.0013 *6*
[x]2792.3 *3*	0.0081 *8*		%Iγ=0.0043 *5*
			E_γ: weighted average of 2792.4 *3* (1972Du03) and 2792.1 *4* (1975Ch27). Other: 2790.1 *33* (1972Nu02).
			I_γ: weighted average of 0.0090 *23* (1972Du03), 0.009 *3* (1972Nu02), and 0.0080 *8* (1975Ch27).
[x]2801.6 *3*	0.0045 *11*		%Iγ=0.0024 *6*
			E_γ: from 1972Du03. Other: 2798.9 *33* (1972Nu02).
			I_γ: weighted average of 0.0043 *11* (1972Du03) and 0.006 *3* (1972Nu02).
[x]2835.2 *4*	0.018 *2*		%Iγ=0.0095 *13*
			E_γ: weighted average of 2835.5 *3* (1972Du03), 2837.1 *14* (1972Nu02), and 2834.5 *4* (1975Ch27).
			I_γ: weighted average of 0.025 *5* (1972Du03), 0.021 *3* (1972Nu02), and 0.016 *2* (1975Ch27).
[x]2853.2 *4*	0.0025 *7*		%Iγ=0.0013 *4*
[x]2891.2 *17*	0.0018 *7*		%Iγ=1.0×10^{-3} *4*
[x]2901.4 *18*	0.0018 *7*		%Iγ=1.0×10^{-3} *4*
[x]2908.1 *18*	0.0011 *7*		%Iγ=6×10^{-4} *4*
[x]2941.1[a] *18*	≤0.0011		%Iγ≤5.8×10^{-4}
[x]2963.3 *19*	0.0011 *7*		%Iγ=6×10^{-4} *4*
[x]2996.0 *13*	0.0036 *11*		%Iγ=0.0019 *6*
[x]3004.3 *13*	0.0036 *11*		%Iγ=0.0019 *6*
[x]3014.8 *13*	0.0011 *7*		%Iγ=6×10^{-4} *4*
[x]3025.7[a] *20*	≤0.0023		%Iγ≤0.0012
[x]3056.0 *13*	0.0029 *11*		%Iγ=0.0015 *6*
[x]3114.3[a] *13*	≤0.0012		%Iγ≤6.4×10^{-4}

† Additional information 4.
‡ From 1972Du03, unless otherwise noted.
# Intensity relative to Iγ(115γ)=100. Quoted values are deduced by the evaluator from original values in 1972Du03 relative to Iγ(115γ)=446, unless otherwise noted.
@ From Adopted Gammas. Supporting arguments from this dataset are given under comments where available.
& For absolute intensity per 100 decays, multiply by 0.53 *4*.
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

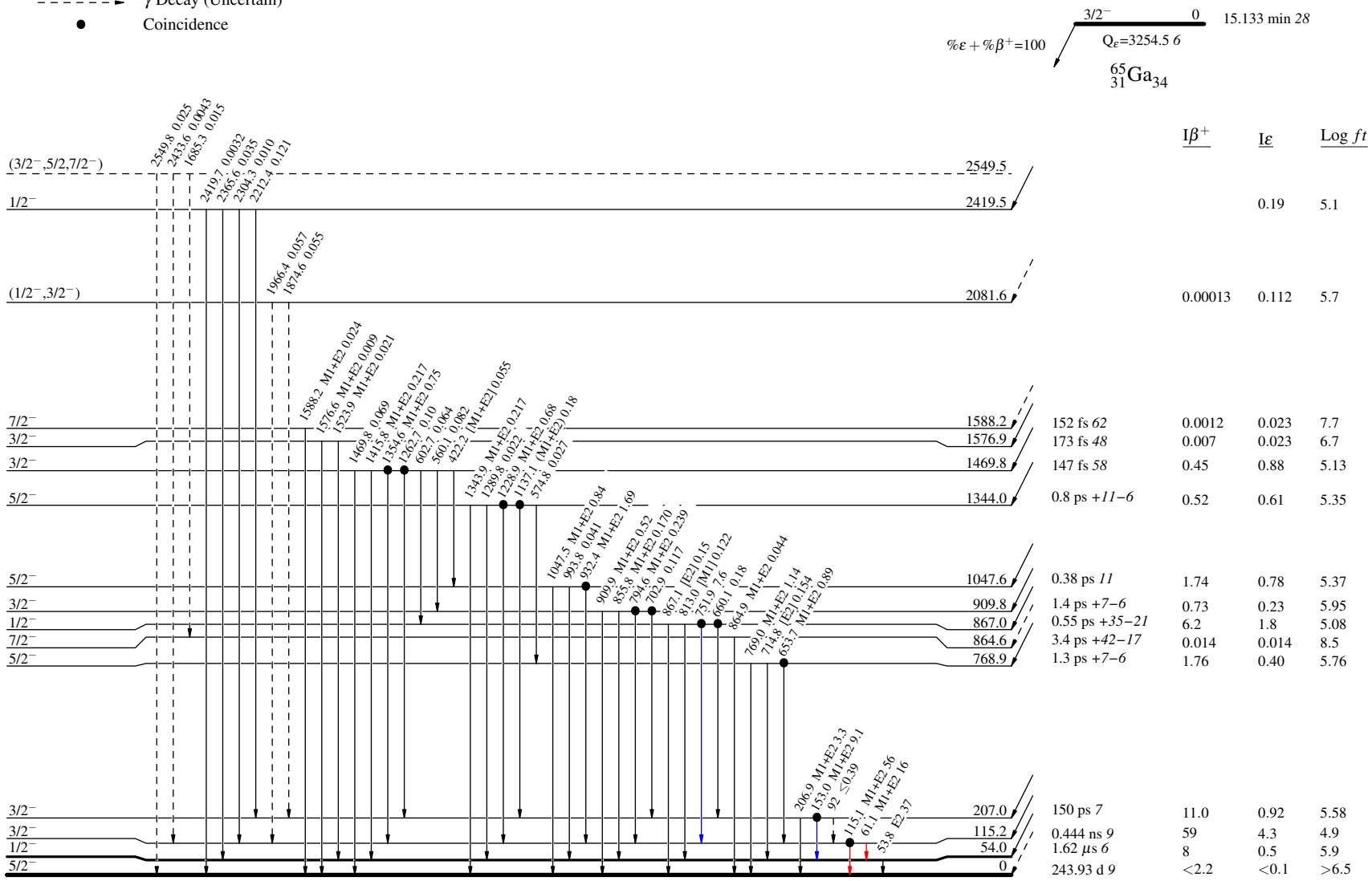
$^{65}_{30}Zn_{35}$-12

^{65}Ga ε+β$^+$ decay (15.133 min) 1972Du03

Decay Scheme

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

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



		Iβ$^+$	Iε	Log *ft*
2549.5				
2419.5			0.19	5.1
2081.6		0.00013	0.112	5.7
1588.2	152 fs *62*	0.0012	0.023	7.7
1576.9	173 fs *48*	0.007	0.023	6.7
1469.8	147 fs *58*	0.45	0.88	5.13
1344.0	0.8 ps *+11−6*	0.52	0.61	5.35
1047.6	0.38 ps *11*	1.74	0.78	5.37
909.8	1.4 ps *+7−6*	0.73	0.23	5.95
867.0	0.55 ps *+35−21*	6.2	1.8	5.08
864.6	3.4 ps *+42−17*	0.014	0.014	8.5
768.9	1.3 ps *+7−6*	1.76	0.40	5.76
207.0	150 ps *7*	11.0	0.92	5.58
115.2	0.444 ns *9*	59	4.3	4.9
54.0	1.62 μs *6*	8	0.5	5.9
0	243.93 d *9*	<2.2	<0.1	>6.5

$^{65}_{30}Zn_{35}$

$^{65}_{30}Zn_{35}$-13