Adopted Levels, Gammas

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

Q(β^-)=−9672 *42*; S(n)=10234 *4*; S(p)=4934.4 *26*; Q(α)=−2547.6 *55* 2021Wa16

Q(β^-),Q(α): Deduced by the evaluator using mass excesses of −46806 *42* for ^{65}As measured by 2023Wa10 and −56355.5 *50* for ^{61}Zn measured by 2022Me04, and −56478.2 *22* for ^{65}Ge from 2021Wa16. Values from 2021Wa16: Q(β^-)=−9540 *80*, Q(α)=−2554 *16*.

S(2n)=25643 *15*, from mass excess of −46978 *15* for ^{63}Ge measured by 2023Wa10 and −56478.2 *22* for ^{65}Ge from 2021Wa16. Value from 2021Wa16: 25700 *40*.

S(2p)=8842.7 *27*, Q(ε)=6179.3 *23*, Q(εp)=2236.8 *23* (2021Wa16).

Mass measurements: 2018Ki21 (M.E.=−56465 *20*), 2007Sc24 (M.E.=−56480.6 *12*).

2018Ki21: S(^{36}Ar,X) E=3.3 MeV at RIKEN. Measured σ, time-of-flight. Deduced mass excess using the multireflection time-of-flight mass spectrograph (MRTOF-MS).

2007Sc24: ^{65}Ge ions were produced by fast beam fragmentation and in-flight separation at the LEBIT facility at NSCL. Measured mass excess using the LEBIT Penning trap.

Other measurements:

2006Ya17: ^{9}Be(^{80}Kr,X) E=1.05 GeV/nucleon. Measured σ.

2004Li29: Si(^{65}Ge,X) E=50-60 MeV/nucleon. Measured σ, matter radius.

Theoretical calculations:

2016Al26: calculated charge radius.

2011Gu03: calculated rms radius.

2006Bh02: calculated matter radius.

2006Ba23: calculated binding energy, radius, deformation parameter.

2003Mi23, 1975Sa07: calculated binding energy, quadrupole deformation.

^{65}Ge Levels

Level scheme is adopted from ^{40}Ca(^{28}Si,2pnγ) (1995He27). The level scheme from ^{12}C(^{58}Ni,αnγ) (1997So06) is partially different but less complete and lacks details of the data.

Cross Reference (XREF) Flags

A ^{12}C(^{58}Ni,αnγ)
B ^{40}Ca(^{28}Si,2pnγ)

E(level)[†‡]	J$^\pi$	T$_{1/2}$[#]	XREF	Comments
0	(3/2)$^-$	30.9 s *7*	AB	%ε+%β^+=100; %εp=0.011 *3* (1987Vi01) J$^\pi$: from allowed ε+β (log *ft*<5.9) feedings to (1/2)$^-$ and 1/2$^-$,3/2$^-$ levels and feeding to 5/2$^-$ (log *ft*= 6.3). T$_{1/2}$: weighted average of 31.2 s *7* (1973Jo12), 30.0 s *12* (1974Ro16), 30.8 s *10* (1976Ha29,1981Ha44), and 30.8 s *7* (2000Gi11). Expected configuration=(ν 2p$_{3/2}$) (1995He27).
111.01 *8*	(5/2$^-$)		AB	Expected configuration=(ν 1f$_{5/2}$) (1995He27). J$^\pi$: 111.0γ D+Q, ΔJ=1 to (3/2)$^-$; 5/2$^-$ expected from theoretical predictions (1987Go02,1995He27).
604.50 *9*	(5/2$^-$)		AB	J$^\pi$: 604.5γ D+Q, ΔJ=1 to (3/2)$^-$; 493.5γ (D+Q) to (5/2$^-$); negative parity expected from shell-model predictions (1995He27).
890.09 *7*	(7/2$^-$)		AB	J$^\pi$: 890.1γ Q, ΔJ=2 to (3/2)$^-$.
1077.0? *10*			A	This level and its de-excitation 966γ (reported in 1997So06 with no detailed data) is not seen in any other studies and considered as questionable by the evaluator.
1155.22 *14*	(7/2$^-$)		AB	J$^\pi$: 1155.2γ (Q), ΔJ=2 to (3/2)$^-$.
1215.86 *10*	(9/2$^+$)	7 ns *1*	AB	Expected configuration=(ν 1g$_{9/2}$) (1995He27). J$^\pi$: 1104.8γ M2+E3, ΔJ=2 to 5/2$^-$; 325.8γ E1 to (7/2$^-$).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{65}Ge Levels (continued)

E(level)[†‡]	Jπ	$T_{1/2}$[#]	XREF	Comments
2080.16 *13*	(13/2$^+$)	<2 ns	AB	Jπ: 864.3γ E2, ΔJ=2 to (9/2$^+$), in a yrast cascade of 1254.7γ(E1)−1356.3γ(E2)−864.3γ(E2) to (9/2$^+$). Possible configuration=(ν 1g$_{9/2}$)⊗2$^+$ (1995He27).
2122.1 *2*	(11/2$^+$)		AB	Possible configuration=(ν 1g$_{9/2}$)⊗2$^+$ (1995He27). Jπ: 906.2γ (D+Q) to (9/2$^+$); 11/2$^+$ from theoretical preditions (1995He27).
2146.1 *4*	(11/2$^-$)		B	Jπ: 1255.9γ to (7/2$^-$) and 1697.1γ from (15/2$^-$).
2573.28 *35*	(11/2$^-$)		B	Jπ: 1418.1γ to (7/2$^-$); 462.8γ-1655.1γ cascade from (19/2$^-$).
2837.2 *3*	(13/2$^+$)		AB	Jπ: 715.1γ D+Q, ΔJ=1 to (11/2$^+$); 900.8γ from (17/2$^+$).
3035.7 *2*	(15/2$^+$)		AB	Possible configuration=(ν 1g$_{9/2}$)⊗4$^+$ (1995He27). Jπ: 955.5γ (D+Q), ΔJ=(1) to (13/2$^+$); 400.7γ from (17/2$^+$).
3436.5 *2*	(17/2$^+$)		B	Possible configuration=(ν 1g$_{9/2}$)⊗4$^+$ (1995He27). Jπ: 1356.3γ E2, ΔJ=2 to (13/2$^+$), in a yrast cascade of 1254.7γ(E1)−1356.3γ(E2)−864.3γ(E2) to (9/2$^+$).
3738.0 *3*	(17/2$^+$)		AB	Jπ: 702.3γ (D), ΔJ=(1) to (15/2$^+$); 953.2γ (D), ΔJ=(1) from (19/2$^-$).
3843.28 *27*	(15/2$^-$)		B	Jπ: tentative assignment by 1995He27 based on 1763.1γ to (13/2$^+$) and that both transitions in 187.0γ-660.9γ cascade from (19/2$^-$) are assumed to be ΔJ=1, dipole.
4188.5 *4*	(15/2$^-$)		B	Jπ: 1615.2γ to (11/2$^-$); 502.7γ from (19/2$^-$).
4228.4 *3*	(15/2$^-$)		B	Jπ: 1655.1γ-1418.1γ cascade to (7/2$^-$); 462.8γ from (19/2$^-$).
4504.2 *2*	(17/2$^-$)		B	Jπ: tentative assignment from 1995He27 by assuming both transitions in 187.0γ-660.9γ cascade from (19/2$^-$) are ΔJ=1, dipole.
4691.2 *2*	(19/2$^-$)		AB	Jπ: 1254.7γ E1, ΔJ=1 to (17/2$^+$), in a yrast cascade of 1254.7γ(E1)−1356.3γ(E2)−864.3γ(E2) to (9/2$^+$).
5152.99 *20*	(21/2$^-$)	<2 ns	B	Jπ: 461.8γ D+Q, ΔJ=1 to (19/2$^-$); 57.4γ from (23/2$^-$); 648.8γ to (17/2$^-$).
5210.39 *21*	(23/2$^-$)	<2 ns	AB	Jπ: 519.2γ E2, ΔJ=2 to (19/2$^-$); assuming increasing spin as energy increases.
5580.1 *6*			B	
5739.2 *5*			B	
6329.4 *4*	(25/2$^-$)		AB	Jπ: 1119.0γ (D+Q) to (23/2$^-$). (27/2$^-$) from 1995He27 is in a disagreement.
6348.0 *6*			B	
6348.9 *6*			B	
6555.4 *6*			B	
6689.4? *10*			A	This level from (^{58}Ni,αnγ) (1997So06) is not seen in other studies and considered as questionable by the evaluator.
7789.9 *6*			B	
8152.4 *6*			B	

[†] Additional information 1.

[‡] From a least-squares fit to γ-ray energies, assuming ΔEγ=0.5 keV for Eγ quoted to nearest tenth keV and 1.0 keV for integer Eγ value where not given.

[#] From γ(t) in ^{40}Ca(^{28}Si,2pnγ) (1987Go02) for excited states.

Adopted Levels, Gammas (continued)

γ(^{65}Ge)

Additional information 2.

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[†]	Comments
111.01	(5/2$^-$)	111.0 *1*	100	0	(3/2)$^-$	(D+Q)	+0.25 *4*		Mult.,δ: from γ(θ) in 1987Go02 in (^{28}Si,2pnγ), ΔJ=1.
604.50	(5/2$^-$)	493.5	100	111.01	(5/2$^-$)	(D+Q)[#]			
		604.5 *1*	74 *4*	0	(3/2)$^-$	D+Q	−2.4 *+6−5*		
890.09	(7/2$^-$)	285.6 *2*	18.9 *14*	604.50	(5/2$^-$)	(D+Q)[#]			
		779.1 *1*	100.0 *18*	111.01	(5/2$^-$)	D+Q	−2.58 *+17−19*		
		890.1 *1*	74 *6*	0	(3/2)$^-$	Q			
1077.0?		966[@]		111.01	(5/2$^-$)				E_γ: from (^{58}Ni,αnγ) (1997So06) only; considered as questionable by the evaluator.
1155.22	(7/2$^-$)	1044.2 *2*	58 *4*	111.01	(5/2$^-$)	(D+Q)[#]			
		1155.2 *2*	100 *17*	0	(3/2)$^-$	(Q)[#]			
1215.86	(9/2$^+$)	60.6	12	1155.22	(7/2$^-$)	(E1)[#]		0.309 *4*	α(K)=0.276 *4*; α(L)=0.0289 *4*; α(M)=0.00426 *6* α(N)=0.0002525 *35* B(E1)(W.u.)=1.94×10^{-5} *+49−42* Mult.: Δπ=(yes) from level scheme.
		325.8 *1*	50.2 *5*	890.09	(7/2$^-$)	E1		2.16×10^{-3} *3*	α(K)=0.001934 *27*; α(L)=0.0001979 *28*; α(M)=2.95×10^{-5} *4* α(N)=1.900×10^{-6} *27* B(E1)(W.u.)=5.2×10^{-7} *+9−7*
		1104.8 *1*	100.0 *7*	111.01	(5/2$^-$)	M2+E3	−0.02 *1*	0.000558 *8*	α(K)=0.000499 *7*; α(L)=5.14×10^{-5} *7*; α(M)=7.68×10^{-6} *11* α(N)=5.07×10^{-7} *7*; α(IPF)=7.00×10^{-8} *10* B(M2)(W.u.)=0.100 *+17−13*; B(E3)(W.u.)=0.08 *+11−6*
2080.16	(13/2$^+$)	864.3 *1*	100	1215.86	(9/2$^+$)	E2		0.000505 *7*	α(K)=0.000451 *6*; α(L)=4.65×10^{-5} *7*; α(M)=6.93×10^{-6} *10* α(N)=4.51×10^{-7} *6* B(E2)(W.u.)>0.038
2122.1	(11/2$^+$)	906.2 *2*	100	1215.86	(9/2$^+$)	(D+Q)[#]			
2146.1	(11/2$^-$)	1255.9	100	890.09	(7/2$^-$)				
2573.28	(11/2$^-$)	1418.1	100	1155.22	(7/2$^-$)				A 1417γ is placed from 7088, (27/2$^-$) level in (^{58}Ni,αnγ) (1997So06), and re-placed from 2573 level by the evaluator, but its ΔJ=(1) is in a disagreement with ΔJ=(2) here.
2837.2	(13/2$^+$)	715.1 *2*	100 *5*	2122.1	(11/2$^+$)	D+Q	+0.66 *+9−6*	0.000690 *15*	α(K)=0.000616 *14*; α(L)=6.33×10^{-5} *14*;

Adopted Levels, Gammas (continued)

γ(^{65}Ge) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[‡]	α[†]	Comments
								α(M)=9.45×10^{-6} *21*; α(N+..)=6.19×10^{-7} *1* α(N)=6.19×10^{-7} *13* E_γ,I_γ,δ: from (^{28}Si,2pnγ).
2837.2	(13/2$^+$)	1621.3	<63	1215.86	(9/2$^+$)			
3035.7	(15/2$^+$)	913.6	<22	2122.1	(11/2$^+$)			
		955.5 *2*	100 *12*	2080.16	(13/2$^+$)	(D+Q)[#]		
3436.5	(17/2$^+$)	400.7	<9.4	3035.7	(15/2$^+$)			
		1356.3 *1*	100.0 *14*	2080.16	(13/2$^+$)	E2	0.0002210 *31*	α(K)=0.0001605 *22*; α(L)=1.634×10^{-5} *23*; α(M)=2.438×10^{-6} *34* α(N)=1.601×10^{-7} *22*; α(IPF)=4.16×10^{-5} *6* This γ is placed from 4691 level in (^{58}Ni,αnγ), with a reversed order of 1254.7γ-1356.3γ cascade.
3738.0	(17/2$^+$)	702.3	<100	3035.7	(15/2$^+$)	(D)[#]		
		900.8	<100	2837.2	(13/2$^+$)			
3843.28	(15/2$^-$)	1697.1	<83	2146.1	(11/2$^-$)			
		1763.1	<100	2080.16	(13/2$^+$)			
4188.5	(15/2$^-$)	1615.2	100	2573.28	(11/2$^-$)	(Q)[#]		A 1615γ is placed from a 9206, (33/2$^-$) level in (^{58}Ni,αnγ) (1997So06), and re-placed from 4189 level by the evaluator.
4228.4	(15/2$^-$)	1655.1	<71	2573.28	(11/2$^-$)			A 1656γ is placed from a 7327, (27/2$^-$) level in (^{58}Ni,αnγ) (1997So06), and re-placed from 4228 level by the evaluator, but its ΔJ=(1) is in a disagreement with ΔJ=(2) here.
		2148.2	100	2080.16	(13/2$^+$)			
4504.2	(17/2$^-$)	275.9	59	4228.4	(15/2$^-$)			
		315.7	<42	4188.5	(15/2$^-$)			
		660.9 *2*	100 *4*	3843.28	(15/2$^-$)			A 660γ is placed from a 771, 9/2$^-$ level in (^{58}Ni,αnγ) (1997So06) and re-placed from 4504 level here by the evaluator. Mult.: ΔJ<2 from γ(θ) in (^{28}Si,2pnγ), but ΔJ=2 from γ(θ) in (^{58}Ni,αnγ) is in disagreement.
4691.2	(19/2$^-$)	187.0 *2*	26.4 *8*	4504.2	(17/2$^-$)	(D+Q)[#]		A 187 γ is placed from a 5397, 25/2$^{(-)}$ level in (^{58}Ni,αnγ) (1997So06), and re-placed from 4691 level by the evaluator.
		462.8	18	4228.4	(15/2$^-$)			
		502.7	<5.9	4188.5	(15/2$^-$)			A 503γ is placed from a 7591, (29/2$^-$) level in (^{58}Ni,αnγ) (1997So06), and re-placed from 4691 level here by the evaluator, but its ΔJ=(1) is in a disagreement with ΔJ=(2) here.
		953.2	<9.8	3738.0	(17/2$^+$)	(D)[#]		
		1254.7 *1*	100.0 *14*	3436.5	(17/2$^+$)	E1	0.0001850 *26*	α(K)=9.01×10^{-5} *13*; α(L)=9.11×10^{-6} *13*; α(M)=1.359×10^{-6} *19* α(N)=8.93×10^{-8} *13*; α(IPF)=8.43×10^{-5} *12* A 1254γ is placed from a 3334, 15/2$^{(-)}$ level in (^{58}Ni,αnγ) (1997So06) with a reversed order of 1254.7γ-1356.3γ cascade and is re-placed from 4691 level here by the evaluator.

$^{65}_{32}Ge_{33}$-4

Adopted Levels, Gammas (continued)

γ(^{65}Ge) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[†]	Comments
5152.99	(21/2$^-$)	461.8 *1*	100 *13*	4691.2	(19/2$^-$)	(M1+E2)	−0.03 *1*	1.67×10^{-3} *2*	α(K)=0.001495 *21*; α(L)=0.0001540 *22*; α(M)=2.302×10^{-5} *32* α(N)=1.513×10^{-6} *21* B(M1)(W.u.)>8.1×10^{-5}; B(E2)(W.u.)>2.5×10^{-4} Mult.: D+Q from γ(θ) in (^{28}Si,2pγ); Δπ=(no) from level scheme. A 462γ is place from a 5671, 25/2$^{(-)}$ level in (^{58}Ni,αnγ) (1997So06), and re-placed from 5153 level by the evaluator.
		648.8	<33	4504.2	(17/2$^-$)	[E2]		1.09×10^{-3} *2*	α(K)=0.000969 *14*; α(L)=0.0001008 *14*; α(M)=1.503×10^{-5} *21* α(N)=9.68×10^{-7} *14* A 648γ placed from a 1419 level in (^{58}Ni,αnγ) (1997So06) and re-placed from 5153 level here by the evaluator.
5210.39	(23/2$^-$)	57.4	<6.3	5152.99	(21/2$^-$)	[M1]		0.370 *5*	α(K)=0.329 *5*; α(L)=0.0358 *5*; α(M)=0.00535 *7* α(N)=0.000343 *5*
		519.2 *1*	100.0 *9*	4691.2	(19/2$^-$)	E2		2.09×10^{-3} *3*	α(K)=0.001867 *26*; α(L)=0.0001958 *27*; α(M)=2.92×10^{-5} *4* α(N)=1.862×10^{-6} *26* B(E2)(W.u.)>0.44 Mult.: Q from γ(θ) in (^{28}Si,2pγ); M2 ruled out by RUL.
5580.1		427.1	100	5152.99	(21/2$^-$)				
5739.2		1048.0	100	4691.2	(19/2$^-$)				
6329.4	(25/2$^-$)	1119.0 *3*	100	5210.39	(23/2$^-$)	(D+Q)[#]			
6348.0		1195.0	100	5152.99	(21/2$^-$)				
6348.9		1138.5	100	5210.39	(23/2$^-$)				
6555.4		1345.0	100	5210.39	(23/2$^-$)				
6689.4?		1479[@]		5210.39	(23/2$^-$)				This transition from (^{58}Ni,αnγ) (1997So06) is not seen in other studies and considered as questionable by the evaluator.
7789.9		1460.5	100	6329.4	(25/2$^-$)				
8152.4		1823.0	100	6329.4	(25/2$^-$)				

† Additional information 3.

‡ From ^{40}Ca(^{28}Si,2pnγ) (1995He27), with Mult and δ from measured γ(θ) and γ(lin pol), unless otherwise noted.

Assigned by the evaluator based on a general statement by 1997So06 in ^{12}C(^{58}Ni,αnγ) about their spin and parity assignments based on measured γ(θ), which however are not explicitly given by the authors. Assignments are not given in 1997So06. See detailed comments in (^{28}Si,2pnγ).

@ Placement of transition in the level scheme is uncertain.

$^{65}_{32}Ge_{33}$-5

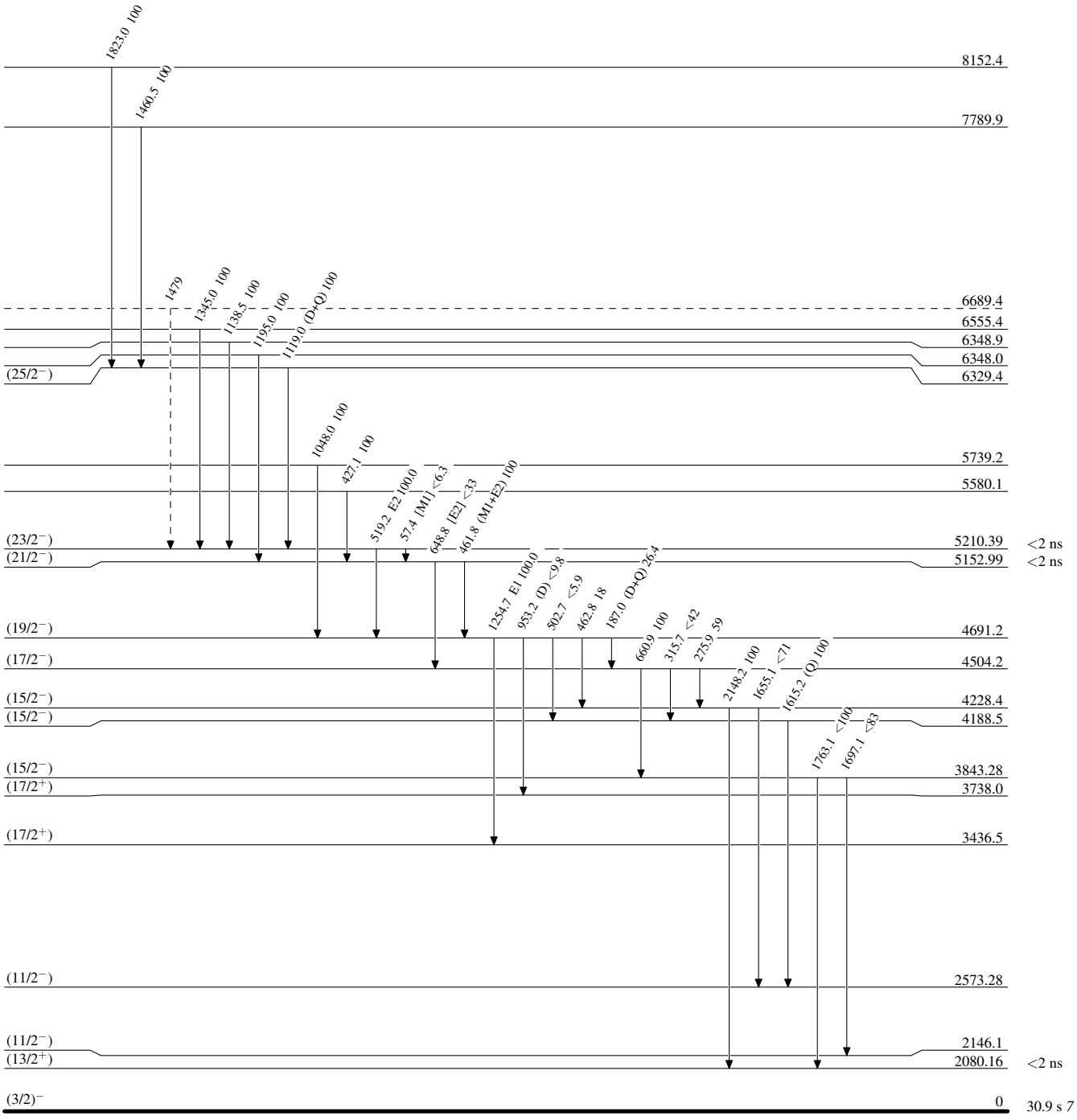
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{65}_{32}Ge_{33}$

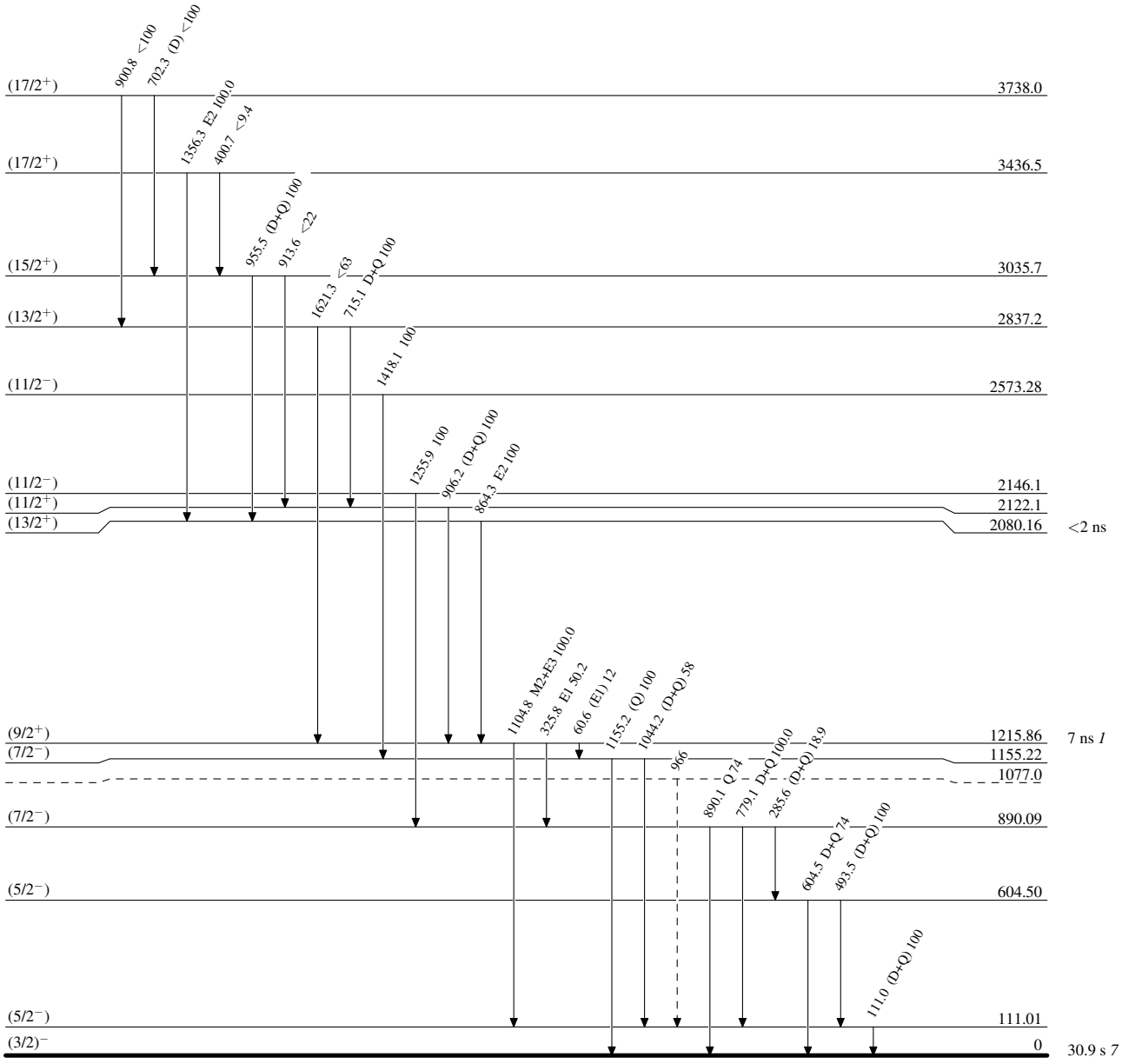
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{65}_{32}Ge_{33}$