Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 188,1 (2023)	17-Jan-2023

Q(β^-)=−232.47 *9*; S(n)=9300.3 *14*; S(p)=7863.3 *21*; Q(α)=−5244.5 *12* 2021Wa16
S(2n)=16953.9 *14*, S(2p)=18980.8 *16* (2021Wa16).
^{71}Ga identified by 1923As03 through mass spectroscopy.
Mass measurement: 2016Al30, 2013Fr13, 1991Zl01.
Other reaction: ^{70}Zn(^{16}O,^{15}N): 1973Ko01.
Theoretical calculations:
2021Ro19: calculated energy and spin of the ground state, and energy of the first excited states.
2012Sr01: shell model calculations of level energies, J^π, B(E2), and moments.
2012Ve03: projected shell-model calculations (with deformed basis from Nilsson model) of level energies, J^π, positive and negative parity yrast bands, backbending, moments of inertia, B(E2), quadrupole moments.

^{71}Ga Levels

B(E2)↑ values given under comments are from Coulomb excitation, unless otherwise noted.

Cross Reference (XREF) Flags

A	^{71}Zn β^- decay (2.42 min)	F	^{70}Zn(pol p,p),(p,n):res	K	^{71}Ga(n,n′γ)
B	^{71}Zn β^- decay (4.140 h)	G	^{70}Zn(^{3}He,d)	L	Coulomb excitation
C	^{71}Ge ε decay (11.43 d)	H	^{70}Zn(^{7}Li,α2nγ)	M	^{72}Ge(d,^{3}He)
D	^{68}Zn(α,p)	I	^{71}Ga(γ,γ')	N	^{74}Ge(p,α)
E	^{69}Ga(t,p)	J	^{71}Ga(e,e′)	O	^{238}U(^{76}Ge,Xγ)

E(level)[†]	J$^\pi$	T$_{1/2}$ or Γ[@]	XREF	Comments
0.0[b]	3/2$^-$	stable	ABCDE GHIJKLMNO	μ=+2.56033 *9* (1954Wa37,2019StZV) Q=+0.107 *1* (1972St38,2018Py01,2016St14,2021StZZ) Nuclear rms charge radius <r^2>$^{1/2}$=4.0118 fm *18* (2013An02 evaluation). J$^\pi$: spin from optical spectroscopy (1932Ja04,1933Ca02) and collinear laser spectroscopy (2010Ch16). Parity from L(t,p)=0 from 3/2$^-$ target. Theoretical calculation of percentage occupation of the πp$_{3/2}$ and πf$_{5/2}$ orbitals in the ground state of ^{71}Ga (2011Ma45). μ: NMR method (1954Wa37), evaluated by 2019StZV. Other: 1948Be17. Q: +0.106 *3* (1972St38,atomic beam magnetic resonance), 0.10 *2* (1983Jo02,atomic beam laser fluorescence). Values recalculated as +0.109 *2* (1998To31), +0.1040 *8* (1998Pe11), and +0.107 *1* (2018Py01). In 2010Ch16 and 2012Pr11, μ and Q values, isotope shifts and change in radius values for the g.s. of ^{71}Ga were used as calibrants for measurement of static moments of ground states of other odd-A Ga isotopes. Magnetic octupole moment=+0.180 *5* (1957Sc28 recalculated original measurement of 0.146 *20* in 1954Da26 by atomic and molecular beams).
389.983 *8*	1/2$^-$	0.40 ps *+28−12*	AB D GHIJKLMNO	B(M1)↑=0.83 *34* (1991Ri08); B(E2)↑=0.00017 *14* (1994Ri07) J$^\pi$: 389.98γ ΔJ=1 to 3/2$^-$; L(d,^{3}He)=1 from 0$^+$. T$_{1/2}$ or Γ: deduced by the evaluators from B(M1)↑=0.83 *34*

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Adopted Levels, Gammas (continued)

^{71}Ga Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$ or Γ[@]	XREF	Comments
				(1991Ri08) in (e,e′) and deduced δ(E2/M1)=0.0047 *+35−30* based on B(M1)↑ and B(E2)↑ in (e,e′). It should be mentioned that deduction of B(M1)↑ value in (e,e′) data may be model dependent. It is also of some concern that B(M1) values were not reported in authors′ later work in 1994Ri07. Other: >2.8 ps from (γ,γ′). B(M1)↑ and B(E2)↑ from (e,e′). Other: B(E2)↑<0.00017 in Coulomb excitation.
487.401[b] *7*	5/2−	62 ps *38*	AB D GHIjKLMNO	B(E2)↑<0.00034 (1972An17) XREF: j(502). Jπ: 487.4γ D+Q, ΔJ=1 to 3/2−; L(d,^{3}He)=3 from 0^+. $T_{1/2}$ or Γ: from <0.1 ns from βγ(t) in β− decay (4.140 h) and >23 ps from measured width in (γ,γ′).
511.563 *7*	3/2−	1.5 ps *7*	AB DE GHIjKLMNO	B(E2)↑=0.0080 *13* (1972An17) XREF: j(502). Jπ: L(t,p)=0 from 3/2−. $T_{1/2}$ or Γ: from DSAM in Coulomb excitation. Others: 22 ps *+12−9* from B(E2)↑=0.0080 *13* in Coulomb excitation with adopted branching and δ=−0.37 *6* for 512γ; >4.7 ps from measured width in (γ,γ′), both in disagreement with DSAM value from Coulomb excitation. Either level $T_{1/2}$ or δ(E2/M1) may be in error if B(E2) values from Coulomb excitation are considered correct.
714?			G J	E(level): weak population in ^{70}Zn(^{3}He,d).
910.164 *12*	3/2−	0.46 ps *22*	AB E G IJKLMN	B(E2)↑=0.0013 *7* Jπ: 3/2 from γ excitation function in (n,n′γ); L(p,α)=1 from 0^+. $T_{1/2}$ or Γ: weighted average of 0.24 ps *16* from DSAM in Coulomb excitation and 0.67 ps *6* from width in (γ,γ′). B(E2)↑: unweighted average of 0.0020 *3* from Coulomb excitation and 0.00056 *33* in (e,e′).
964.695[c] *8*	5/2−	1.3 ps *2*	AB E GHIJKLMNO	B(E2)↑=0.022 *6* Jπ: L(d,^{3}He)=3 from 0^+; 964.7γ M1+E2 to 3/2−. $J^\pi=7/2^{(-)}$ assigned in (^{7}Li,α2nγ) is inconsistent; Mult=Q with ΔJ=2 for 453γ to 3/2− and 965γ to 3/2− in (^{7}Li,α2nγ) could imply a different level with close energy. $T_{1/2}$ or Γ: from measured width in (γ,γ′). Others: 2.2 ps *+14−9* from adopted B(E2)↑=0.022 *6*, δ=+1.3 *3* and branching=76.5% *15* for 964.7γ; >0.76 ps from DSAM in Coulomb excitation. B(E2)↑: unweighted average of 0.032 *5* (1972An17) and 0.024 *13* (2010Di14) in Coulomb excitation, and 0.0112 *37* in (e,e′).
1107.497[b] *7*	7/2−	0.48 ps *+14−10*	B De HIjKL nO	B(E2)↑=0.0029 *5* (1972An17) XREF: e(1110)j(1112)n(1110). Jπ: 595.9γ E2, ΔJ=2 to 3/2−; 620.1γ M1+E2 to 5/2−. $T_{1/2}$ or Γ: from B(E2)↑ in Coulomb excitation (1972An17), and adopted branching=2.05% *9* for 1107.3γ. Other: >0.21 ps from DSAM in ^{68}Zn(α,pγ); <0.1 ns from βγ(t) in β− decay (4.140 h).
1109.31 *20*	1/2−	95 fs *12*	A De G IjKLMn	B(E2)↑=0.0063 *9* (1972An17) XREF: e(1110)j(1112)n(1110). Jπ: L(d,^{3}He)=1 from 0^+; spin=1/2 from γ excitation function in (n,n′γ). $T_{1/2}$ or Γ: from measured width in (γ,γ′). Other: 0.13 ps *+8−4* from DSAM in (n,n′γ).
1395.263 *14*	7/2−	0.77 ps *6*	B E G IJKLMN	B(E2)↑=0.0096 *14* (1972An17) Jπ: 1395.3γ E2, ΔJ=2 to 3/2−; L(d,^{3}He)=3 from 0^+.

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Adopted Levels, Gammas (continued)

^{71}Ga Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$ or Γ[@]	XREF	Comments
				$T_{1/2}$ or Γ: weighted average of 0.76 ps *5* from DSAM in Coulomb excitation and 1.1 ps *3* from measured width in (γ,γ'). Other: 1.00 ps *+21−15* from measured B(E2)↑ in Coulomb excitation and adopted branching=44.8% *7* for 1395.3γ;
1476.004 *8*	5/2$^-$	>0.6 ps	B D g I KLMn	B(E2)↑<0.005 (1972An17) XREF: g(1485)n(1480). Jπ: L(d,^{3}He)=3 from 0$^+$; J=5/2 from $\gamma(\theta)$ in (n,n′γ). $T_{1/2}$ or Γ: from measured width in (γ,γ').
1493.864[&] *7*	9/2$^+$	154 ps *15*	B DE gHIjK MnO	XREF: g(1485)j(1497)n(1480). Jπ: L(d,^{3}He)=4 from 0$^+$; 386.4γ D, ΔJ=1 to 7/2$^-$. $T_{1/2}$ or Γ: from $\beta\gamma$(t) in β^- decay (4.140 h).
1498.336[a] *13*	9/2$^-$		B HIjK nO	XREF: j(1497)n(1480). Jπ: ΔJ=2, Q 1010.9γ to 5/2$^-$; 952.4γ from 7/2$^+$; 1010.9γ not M2 since it would require an isomeric $T_{1/2}$>1.5 ns, inconsistent with the observation of very strong prompt 1010.9γ in (^{7}Li,α2nγ) J=5/2,7/2 proposed in (n,n′γ), possibly on the basis of excitation functions and $\gamma(\theta)$, is in disagreement.
1631.43 *5*	3/2$^-$	0.15 ps *+12−6*	A E G IJK M	B(E2)↑=0.0012 *4* (1994Ri07) Jπ: L(t,p)=0 from 3/2$^-$. $T_{1/2}$ or Γ: from DSAM in (n,n′γ). Other: >13 fs from measured width in (γ,γ'). B(E2)↑ from (e,e′).
1699.21 *8*	1/2$^+$	>0.25 ps	G IjK	XREF: G(1713)j(1712). Jπ: L(^{3}He,d)=0 from 0$^+$. Note that L(^{3}He,d)=1+3 has also been suggested by 1974Ze01 for 1713 *15* group. While it is inconsistent with L=0, but it may be a doublet with the other member possibly associated with 1719.6, (5/2)$^-$ level. $T_{1/2}$ or Γ: from measured width in (γ,γ').
1719.567 *14*	5/2$^-$	0.12 ps *+5−2*	B DE IjK	XREF: j(1712). Jπ: 1719.6γ M1+E2 to 3/2$^-$; 527.7γ from 7/2$^+$ cannot be M2 from RUL. (5/2) also from $\gamma(\theta)$ in (n,n′γ). See also comment for 1699 level for possible doublet in (^{3}He,d). $T_{1/2}$ or Γ: weighted average of 0.10 ps *+5−2* from DSAM in (n,n′γ) and 0.16 ps *5* from measured width in (γ,γ').
1752.32 *5*	3/2$^-$	0.26 ps *+24−10*	JK	Jπ: 1362.3γ M1+E2 to 1/2$^-$; spin=3/2 from excitation function in (n,n′γ). $T_{1/2}$ or Γ: from DSAM in (n,n′γ).
1905.39 *4*	5/2$^-$	0.24 ps *+11−6*	E JK MN	Jπ: L(d,^{3}He)=3 from 0$^+$; 1904.8γ M1+E2 to 3/2$^-$. $T_{1/2}$ or Γ: from DSAM in (n,n′γ).
1941.6[c] *5*	(9/2$^-$)		H	Jπ: (11/2)$^-$ assigned in (^{7}Li,α2nγ) with J(964)=7/2$^{(-)}$; evaluators assign (9/2$^-$) from ΔJ=2, Q γ to 964, 5/2$^-$.
1941.71 *5*	(3/2$^-$)		E JK	XREF: E(1937)J(1936). Jπ: (3/2) from excitation function in (n,n′γ); 546.6γ to 7/2$^-$ favors π=−. But π=(+) from L(t,p)=(3) from 3/2$^-$ is in disagreement, which could indicate different level in (t,p).
1992 *6*	5/2$^-$,7/2$^-$		J M	E(level): weighted average of 1989 *6* from (e,e′) and 1995 *7* from (d,^{3}He). Jπ: L(d,^{3}He)=3 from 0$^+$.
2064.16 *21*	1/2$^-$,3/2$^-$	82 fs *40*	A E G I K	XREF: G(2075). Jπ: log *ft*=6.0 for β^- decay from 1/2$^-$ state; L(t,p)=2. $T_{1/2}$ or Γ: $T_{1/2}$/(2J+1)=25.7 fs *45* from measured width

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Adopted Levels, Gammas (continued)

^{71}Ga Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$ or Γ[@]	XREF	Comments
				gives: 51 fs *9* if J=1/2; 103 fs *18* if J=3/2 from (γ,γ′). The adopted value of 82 fs *40* is selected to cover the ranges of both possible $T_{1/2}$.
2069.6[b] *3*	11/2$^{(-)}$		H O	Jπ: 961.9γ Q, ΔJ=2 to 7/2$^-$; 570.7γ D, ΔJ=1 to 9/2$^-$.
2082.461[&] *18*	(13/2$^+$)		B H O	Jπ: 588.6γ Q, ΔJ=2 to 9/2$^+$; band assignment.
2134.12 *4*	5/2$^-$,7/2$^-$		E K	Jπ: 5/2,7/2 from excitation function in (n,n′γ); L(t,p)=2 from 3/2$^-$.
2191 *3*	5/2$^-$,7/2		E G	XREF: G(2206). E(level): from (t,p). Jπ: L(^{3}He,d)=3 from 0$^+$.
2247.269 *8*	7/2$^+$	0.021 ps *+6−5*	B E G K	XREF: G(2260). Jπ: spin=7/2 from γ excitation function in (n,n′γ); 753.4γ M1+E2 to 9/2$^+$; L(t,p)=3 from 3/2$^-$. log *ft*=5.99 from 9/2$^+$ rules out 5/2. $T_{1/2}$ or Γ: from DSAM in (n,n′γ).
2294.41 *23*	1/2$^-$		A E G K	XREF: G(2310). Jπ: L(^{3}He,d)=1 from 0$^+$; spin=1/2 from excitation function in (n,n′γ); also supported by log *ft*=4.9 from 1/2$^-$ parent.
2327 *3*	1/2$^-$,3/2$^-$		E G	XREF: G(2346). E(level): from (t,p). Jπ: L(^{3}He,d)=1 from 0$^+$, also supported by L(t,p)=(2) from 3/2$^-$.
2396 *3*	$^-$		E	Jπ: ≤7/2$^-$ from L(t,p)=2 from 3/2$^-$.
2421 *3*	1/2$^-$,3/2$^-$		E G	XREF: G(2447). E(level): from (t,p). Jπ: L(^{3}He,d)=1 from 0$^+$; L(t,p)=2 from 3/2$^-$.
2450.661 *10*	7/2$^+$		B E K	Jπ: 7/2 from excitation function in (n,n′γ); L(t,p)=3 from 3/2$^-$.
2488.244 *12*	(7/2)$^+$		B E	Jπ: L(t,p)=3 from 3/2$^-$; log *ft*=6.3 from 9/2$^+$ parent; strong 1012.2γ to 5/2$^-$.
2528 *10*	1/2$^-$,3/2$^-$		dE G	XREF: d(2540). E(level): weighted average of 2529 *10* from (t,p) and 2516 *30* from (^{3}He,d). Jπ: L(^{3}He,d)=1 from 0$^+$. But L(t,p)=(4) from 3/2$^-$ seems in disagreement.
2551 *10*	$^+$		dE	XREF: d(2540). Jπ: L(t,p)=3 from 3/2$^-$.
2600.883 *23*	(9/2)$^+$		B	Jπ: log *ft*=5.7 from 9/2$^+$; γ rays to 7/2$^-$ and (13/2$^+$).
2614 *10*	$^+$		E	E(level): could be the same level as the 2601, (9/2)$^+$ level. Jπ: L(t,p)=3 from 3/2$^-$.
2658 *10*	$^-$		E	Jπ: L(t,p)=2 from 3/2$^-$.
2683.72[a] *18*	13/2$^{(-)}$		H O	Jπ: 1185.6γ Q, ΔJ=2 to 9/2$^-$; 613.6γ D, ΔJ=1 to 11/2$^{(-)}$; band assignment.
2720.019 *14*	7/2$^+$		B E	Jπ: log *ft*=6.0 from 9/2$^+$; L(t,p)=3 from 3/2$^-$; strong 1243.99γ to 5/2$^-$.
2747 *10*	$^-$		E	Jπ: L(t,p)=2 from 3/2$^-$.
2804.918 *13*	(7/2)$^+$		B	Jπ: log *ft*=5.0 from 9/2$^+$; strong γ rays to 5/2$^-$.
2812 *10*	($^-$)		E g	XREF: g(2813). Jπ: L(t,p)=(4) from 3/2$^-$.
2815.792 *13*	7/2$^+$	0.19 ps *+13−6*	B g K	XREF: g(2813). Jπ: log *ft*=5.0 from 9/2$^+$; 1339.8γ to 5/2$^-$ cannot be M2 or E3 from RUL. $T_{1/2}$ or Γ: from DSAM in (n,n′γ).
2852 *30*			G	
2932 *10*	($^+$)		E G	XREF: G(2924). Jπ: L(t,p)=(3) from 3/2$^-$.

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Adopted Levels, Gammas (continued)

^{71}Ga Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$ or Γ[@]	XREF		Comments
2941.67[&] *20*	(17/2$^+$)		H	O	Jπ: 859.2γ Q, ΔJ=2 to (13/2$^+$); band assignment.
2967 *30*	(3/2$^+$,5/2$^+$)		G		Jπ: L(^{3}He,d)=(2) from 0$^+$.
2974 *10*	(−)		E		Jπ: L(t,p)=(4) from 3/2$^-$.
3016 *30*			G		
3034.6[c] *7*	(13/2$^-$)		H		Jπ: 15/2$^{(-)}$ in (^{7}Li,α2nγ); evaluators assign (13/2$^-$) from ΔJ=2, Q γ to 1941, (9/2$^-$).
3153 *30*	3/2$^+$,5/2$^+$		G		Jπ: L(^{3}He,d)=2 from 0$^+$.
3153.7[b] *3*	(15/2$^-$)		H		Jπ: 1084.0γ Q, ΔJ=2 to 11/2$^{(-)}$; 1070.4γ D, ΔJ=1 to (13/2$^+$).
3227 *30*	1/2$^-$,3/2$^-$		G		Jπ: L(^{3}He,d)=1 from 0$^+$.
3438 *30*			G		
3506 *30*			G		
3607 *30*	3/2$^+$,5/2$^+$		G		Jπ: L(^{3}He,d)=2 from 0$^+$.
3683			G		E(level): doublet.
3695.2[a] *3*	(17/2$^-$)		H	O	Jπ: 1011.5γ Q, ΔJ=2 to 13/2$^{(-)}$; 541.1γ D, ΔJ=1 to (15/2$^-$).
3749 *30*	3/2$^+$,5/2$^+$		G		Jπ: L(^{3}He,d)=2 from 0$^+$.
3813 *30*	1/2$^+$		G		Jπ: L(^{3}He,d)=0 from 0$^+$.
3839.7 *5*	(17/2$^-$)		H		Jπ: 1156.0γ (Q), ΔJ=(2) to 13/2$^{(-)}$.
3863 *30*			G		
3909.7[c] *9*	(17/2$^-$)		H		Jπ: 19/2$^{(-)}$ in (^{7}Li,α2nγ); evaluators assign (17/2$^-$) from ΔJ=(2), (Q) γ to 3034, (13/2$^-$).
3999.0 *5*				O	
4028.5[&] *3*	(21/2$^+$)		H	O	Jπ: 1086.8γ Q, ΔJ=2 to (17/2$^+$); band assignment.
4060 *30*			G		
4130 *30*	1/2$^+$		G		Jπ: L(^{3}He,d)=0 from 0$^+$.
4164.9[a] *6*	(21/2$^-$)		H	O	Jπ: 469.7γ Q, ΔJ=2 to (17/2$^-$).
4199.7[b] *6*	(19/2$^-$)		H		Jπ: 1046.0γ (Q), ΔJ=(2) to (15/2$^-$).
4211 *30*	1/2$^+$		G		Jπ: L(^{3}He,d)=0 from 0$^+$.
4278 *30*			G		
4382 *30*			G		
4487 *30*			G		
4644 *30*	1/2$^+$		G		Jπ: L(^{3}He,d)=0 from 0$^+$.
4692 *30*			G		
4813 *30*	(3/2$^+$,5/2$^+$)		G		Jπ: L(^{3}He,d)=(2) from 0$^+$.
4873.1?[c]	(21/2$^-$)		H		Additional information 1. Jπ: (23/2$^-$) in (^{7}Li,α2nγ); evaluators assign (21/2$^-$) from γ to 3909, (17/2$^-$).
5221 *30*	1/2$^+$		G		Jπ: L(^{3}He,d)=0 from 0$^+$.
5228.2[&] *6*	(25/2$^+$)		H		Jπ: 1199.7γ Q, ΔJ=2 to (21/2$^+$); band assignment.
6573.7[&] *8*	(29/2$^+$)		H		Jπ: 1345.5γ (Q), ΔJ=(2) to (25/2$^+$); band assignment.
11590 *10*	1/2$^-$[#]	20 keV *5*	F		E(level): IAR of ^{71}Zn g.s.
11671 *3*	(3/2$^+$)[#]	2.0 keV *2*	F		
11702[‡] *3*	(3/2$^+$)[#]	7.0 keV *7*	F		
11728[‡] *3*	(3/2$^+$)[#]	0.50 keV *5*	F		
11740[‡] *3*	(3/2$^+$)[#]	4.0 keV *4*	F		
11885 *10*		23 keV *5*	F		
12067 *10*		34 keV *5*	F		
12264 *10*	3/2$^-$[#]	39 keV *4*	F		E(level): IAR of 675 level in ^{71}Zn.
12453 *10*	5/2$^+$[#]	15 keV *2*	F		E(level): IAR of 853 level in ^{71}Zn.
12862	5/2$^+$[#]	19 keV *1*	F		E(level): IAR of 1261 level in ^{71}Zn.

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Adopted Levels, Gammas (continued)

^{71}Ga Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$ or Γ[@]	XREF	Comments
13012 *10*	$3/2^{-}$[#]	11 keV *1*	F	E(level): IAR of 1421 level in ^{71}Zn.
13215 *10*	$1/2^{+}$[#]	42 keV *2*	F	E(level): IAR of 1629 level in ^{71}Zn.
13267 *10*	$5/2^{+}$[#]	38 keV *1*	F	E(level): IAR of 1661 level in ^{71}Zn.
13773 *10*	$5/2^{+}$[#]	35 keV *5*	F	E(level): IAR of 2180 level in ^{71}Zn.
13918 *10*	$1/2^{+}$[#]	55 keV *15*	F	E(level): IAR of 2377 level in ^{71}Zn.

[†] From a least-squares fit to Eγ data for levels populated in γ-ray studies, excluding the energies of doubly-placed γ rays. Several Eγ values are poorly fitted and their uncertainties are increased in the fitting to lower the reduced χ^2 from 1.9 to 1.5, as noted under comments. Levels above 10 MeV are from ^{70}Zn(p,p),(p,n):res. For levels populated in particle-transfer studies only, averages are taken of available values with comparable uncertainties.

[‡] Components of the IAR of the 286 level in ^{71}Zn.

[#] From polarized proton elastic scattering differential cross section and analyzing power excitation function data or from optical model plus Breit-Wigner resonance analysis of IAR in (pol p,p),(p,n):resonance.

[@] Values for levels above 11500 keV are widths from ^{70}Zn(pol p,p),(p,n):resonance.

[&] Band(A): Band based on $9/2^{+}$. Possible configuration=$\nu g_{9/2}\otimes$(even Zn core).

[a] Seq.(B): γ cascade based on $9/2^{-}$. Possible configuration=$\pi f_{5/2}\otimes$(even Zn core).

[b] Seq.(C): γ cascade based on $3/2^{-}$ g.s.

[c] Seq.(D): γ cascade based on $5/2^{-}$.

Adopted Levels, Gammas (continued)

γ(^{71}Ga)

Transition strengths under comments are deduced by evaluators from adopted $T_{1/2}$, branching ratios and mixing ratios, unless the adopted $T_{1/2}$ is deduced from measured B(E2)↑ and/or B(M1)↑ in Coulomb excitation and/or (e,e′) for which case B(E2)(W.u.) and B(M1)(W.u.) are directly converted from measured B(E2)↑ and B(M1)↑, respectively.

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
389.983	1/2$^-$	389.979 *10*	100	0.0	3/2$^-$	(M1+E2)	0.0047 *+35−30*	2.21×10^{-3} *3*	B(E2)(W.u.)=0.19 *16* (1994Ri07); B(M1)(W.u.)=0.93 *38* (1991Ri08) B(E2)(W.u.) and B(M1)(W.u.) are from measured B(E2)↑ and B(M1)↑ in (e,e′), respectively. Other B(M1)(W.u.)=0.93 *+40−35*, B(E2)(W.u.)=0.20 *+43−17* from level $T_{1/2}$ and δ(E2/M1). E_γ: others: 390.0 *3* from ^{71}Zn β$^-$ decay (2.45 min), 389.92 *8* from (n,n′γ), and 390.2 *5* from (^{76}Ge,Xγ). Mult.: D, ΔJ=1 from γ(ADO) in (^{7}Li,α2nγ); quadrupole component observed in (e,e′); M1+E2 from level scheme. δ: deduced by the evaluators from B(E2)↑=0.00017 *14* (1994Ri07) and B(M1)↑=0.83 *34* (1991Ri08) in (e,e′). It should be mentioned that deduction of B(M1) value in (e,e′) data may be model dependent. It is also of some concern that B(M1) values were not reported in authors′ later work in 1994Ri07.
487.401	5/2$^-$	487.402 *10*	100	0.0	3/2$^-$	(M1+E2)	−0.024 *13*	1.32×10^{-3} *2*	B(M1)(W.u.)=0.0031 *+31−12*; B(E2)(W.u.)=0.011 *+22−9* E_γ: others: 487.3 *1* from ^{71}Zn β$^-$ decay (2.45 min), 487.41 *5* from (n,n′γ), and 487.5 *2* from (^{76}Ge,Xγ). Mult.: D+Q from γγ(θ) in β$^-$ decay (4.140 h); D, ΔJ=1 from γ(ADO) in (^{7}Li,α2nγ); M1+E2 from level scheme. δ: other: 0.03 *4* from γ(θ) (n,n′γ). B(E2)(W.u.)<0.12 from B(E2)↑<0.00034 in Coulomb excitation (1972An17).
511.563	3/2$^-$	121.587 *10*	8.25 *23*	389.983	1/2$^-$	(M1(+E2))	−0.01 *+13−16*	0.041 *8*	B(M1)(W.u.)=0.6 *+6−2* α(K)=0.037 *7*; α(L)=0.0039 *9*; α(M)=0.00057 *13* α(N)=3.0×10^{-5} *6* E_γ: weighted average of 121.52 *5* from ^{71}Zn β$^-$ decay (2.45 min), 121.591 *10* from ^{71}Zn β$^-$ decay (4.140 h), 121.54 *8* from (n,n′γ), and 121.1 *5* from

$^{71}_{31}Ga_{40}$-7

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
									(^{76}Ge,Xγ). I_γ: weighted average of 9.3 *9* from ^{71}Zn β^- decay (2.45 min), 8.19 *16* from ^{71}Zn β^- decay (4.140 h), 9 *5* from (^{7}Li,α2nγ), 8.0 *7* from (n,n′γ), and 12.6 *16* from (^{76}Ge,Xγ). δ: −0.01 *15* or −1.7 *6* from β^- decay (4.140 h); lower value is preferred from RUL for B(E2)(W.u.) and intensity balance in ^{71}Zn decay. B(E2)(W.u.)<3367 upper limit exceeds RUL=300.
511.563	3/2$^-$	511.556 *12*	100.0 *10*	0.0	3/2$^-$	M1+E2	−0.37 *6*	1.28×10^{-3} *4*	B(M1)(W.u.)=0.09 *+7−3*; B(E2)(W.u.)=7×10^1 *+6−3* E_γ: others: 511.6 *1* from ^{71}Zn β^- decay (2.45 min), 511.60 *9* from (n,n′γ), and 511.3 *2* from (^{76}Ge,Xγ). I_γ: others: 100 *15* from (^{7}Li,α2nγ), 100 *10* from (n,n′γ), and 100 *16* from (^{76}Ge,Xγ). δ: other: 0.09 *3* deduced from measured B(E2)=0.0080 *13* in Coulomb excitation, adopted $T_{1/2}$=1.5 ps *7* and adopted branching. B(E2)(W.u.)=4.6 *7* from B(E2)↑=0.0080 *13* (1972An17) and 5 *2* (2010Di14) in Coulomb excitation are in a good agreement but they are in disagreement with B(E2)(W.u.)=70 *40* deduced from adopted $T_{1/2}$=1.5 ps *7*, branching and δ=−0.37 *6*. Either level $T_{1/2}$ or δ(E2/M1) may be in error if B(E2) values from Coulomb excitation are considered correct.
910.164	3/2$^-$	398.63 *5*	7.9 *19*	511.563	3/2$^-$	[M1,E2]		0.0033 *12*	B(M1)(W.u.)=0.055 *+47−21* if M1. B(E2)(W.u.)=5.1×10^2 *+43−19* if E2, exceeds RUL=300. E_γ: weighted average of 398.6 *2* from ^{71}Zn β^- decay (2.45 min), 398.69 *5* from ^{71}Zn β^- decay (4.140 h), and 398.58 *5* from (n,n′γ). I_γ: unweighted average of 7.8 *8* from ^{71}Zn β^- decay (2.45 min), 11.2 *7* from ^{71}Zn β^- decay (4.140 h), and 4.8 *8* from (n,n′γ).
		423.2 *3*	0.49 *4*	487.401	5/2$^-$	[M1,E2]		0.0028 *9*	B(M1)(W.u.)=0.0028 *+23−10* if M1. B(E2)(W.u.)=23 *+19−8* if E2. E_γ,I_γ: from ^{71}Zn β^- decay (2.45 min).
		520.5 *2*	1.02 *8*	389.983	1/2$^-$	[M1,E2]		0.0015 *4*	B(M1)(W.u.)=0.0032 *+26−11* if M1. B(E2)(W.u.)=17 *+14−6* if E2. E_γ,I_γ: from ^{71}Zn β^- decay (2.45 min); uncertain γ in ^{71}Zn β^- decay (4.140 h) with Iγ<3.6.
		910.187 *21*	100.0 *11*	0.0	3/2$^-$	(M1+E2)	0.09 *5*		B(M1)(W.u.)=0.058 *+46−19*; B(E2)(W.u.)=0.8 *+16−7* B(E2)(W.u.)=1.14 *17* from B(E2)↑=0.0020 *3* in Coulomb

$^{71}_{31}Ga_{40}$-8

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
									excitation (1972An17), 0.32 *20* from B(E2)↑=0.00056 *33* in (e,e′) (1994Ri07). E_γ: weighted average of 910.3 *1* from ^{71}Zn β^- decay (2.45 min), 910.181 *21* from ^{71}Zn β^- decay (4.140 h), 910 *1* from (γ,γ'), and 910.3 *2* from (n,n′γ). I_γ: others: 100 *8* from ^{71}Zn β^- decay (2.45 min) and 100 *11* from (n,n′γ). Mult.: quadrupole component observed in Coulomb excitation; M1+E2 from level scheme. δ: from adopted B(E2)↑=0.0013 *7*, branching=91.4% *18* and $T_{1/2}$=0.46 ps *22*.
964.695	5/2$^-$	453.145 *10*	26.46 *20*	511.563	3/2$^-$	[M1,E2]		0.0023 *7*	B(M1)(W.u.)=0.037 *+8−5* if M1. B(E2)(W.u.)=2.6×10^2 *+5−4* if E2, B(E2)(W.u.) upper bound exceeds RUL=300. E_γ: others: 453.1 *2* from ^{71}Zn β^- decay (2.45 min), 453.12 *5* from (n,n′γ), and 452.5 *5* from (^{76}Ge,Xγ). I_γ: weighted average of 22.9 *25* from ^{71}Zn β^- decay (2.45 min), 26.47 *20* from ^{71}Zn β^- decay (4.140 h), and 25 *11* from (^{7}Li,α2nγ). Others: 33.2 *8* from (n,n′γ) and 100 *9* from (^{76}Ge,Xγ) are discrepant. Mult.: Q, ΔJ=2 from γ(ADO) in (Li,α2nγ) inconsistent with level scheme.
		477.316 *26*	1.25 *4*	487.401	5/2$^-$	[M1,E2]		0.0019 *6*	B(M1)(W.u.)=0.00149 *+30−22* if M1. B(E2)(W.u.)=9.6 *+20−14* if E2.
		574.684 *17*	3.01 *4*	389.983	1/2$^-$	[E2]		1.42×10^{-3} *2*	B(E2)(W.u.)=9.2 *+19−13* E_γ: others: 575.1 *5* from ^{71}Zn β^- decay (2.45 min); 574.17 *15* from (n,n′γ) is discrepant. I_γ: from β^- decay (4.140 h). Others: 3.8 *4* (β^- decay (2.45 min)); 7.0 *8* (n,n′γ).
		964.670[d] *10*	100[d] *8*	0.0	3/2$^-$	M1+E2	+1.3 *3*		B(M1)(W.u.)=0.0054 *+22−14*; B(E2)(W.u.)=14.3 *+32−35* B(E2)(W.u.)=12.2 *19* from B(E2)↑=0.032 *5* in Coulomb excitation (1972An17), 4.3 *15* from B(E2)↑=0.0112 *37* in (e,e′) (1994Ri07); 9 *5* from 2010Di14 in Coulomb excitation (2010Di14). E_γ: others: 964.8 *2* from ^{71}Zn β^- decay (2.45 min), 965 *1* from (γ,γ'), 964.62 *6* from (n,n′γ), and 963.8 *5* from (^{76}Ge,Xγ). Mult.,δ: D+Q and δ from $\gamma(\theta)$ in (n,n′γ); M2 component ruled out by RUL. Other: δ=0.76 *+35−23* from adopted $T_{1/2}$=1.3 ps *2*, B(E2)↑=0.022 *6* and branching=76.5% *15* for 964.7γ; Mult=Q, ΔJ=2 from γ(ADO) in (Li,α2nγ) inconsistent with level scheme.

$^{71}_{31}Ga_{40}$-9

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
1107.497	7/2$^-$	142.820 *10*	8.46 *23*	964.695	5/2$^-$	(M1(+E2))	−0.05 *4*	0.0274 *9*	B(M1)(W.u.)=0.81 *+21−18*; B(E2)(W.u.)=1.5×10^2 *+33−13* B(M1)(W.u.)=0.69 *18*; B(E2)(W.u.)=1.3×10^2 *+23−13* α(K)=0.0244 *8*; α(L)=0.00257 *10*; α(M)=0.000375 *14* α(N)=2.00×10^{-5} *6* Upper bound of B(E2)(W.u.) exceeds RUL=300. E_γ: others: 142.98 *5* from (n,n′γ), and 143.4 *5* from (^{76}Ge,Xγ). I_γ: weighted average of 8.43 *16* from ^{71}Zn β$^-$ decay (4.140 h), 6 *5* from (^{7}Li,α2nγ), 10.0 *7* from (n,n′γ), and 7.5 *7* from (^{76}Ge,Xγ). Mult.: D(+Q) from γγ(θ) in β$^-$ decay (4.140 h); M1+E2 from level scheme.
		595.916 *10*	52.2 *18*	511.563	3/2$^-$	E2		1.27×10^{-3} *2*	B(E2)(W.u.)=2.9×10^2 *+8−6* Upper bound of B(E2)(W.u.) exceeds RUL=300. Caution and note: through e-mail communications in September 2021, Prof. H.T. Fortune (University of Pennsylvania) pointed out that B(E2)(W.u.) value for the 595.9-keV transition was too large to be realistic in comparison to those for E2 transitions in neighboring nuclei. Evaluators have checked available spectroscopic data related to this transition as well as γ-branching ratios from the 1107.5 keV level, and cannot find any arithmetic mistake. This B(E2)(W.u.) value is entirely dependent on experimental determination of B(E2)↑ for the 1107-keV transition by 1972An17 in Coulomb excitation. No other experimental measurement exists at present for independently verification of results in 1972An17. E_γ: others: 595.9 *2* from (^{76}Ge,Xγ); 596.21 *5* from (n,n′γ) is discrepant. I_γ: unweighted average of 51.3 *5* from ^{71}Zn β$^-$ decay (4.140 h), 50 *10* from (^{7}Li,α2nγ), 50 *7* from (n,n′γ), and 57.6 *9* from (^{76}Ge,Xγ). Mult.: Q from γγ(θ) in β$^-$ decay (4.140 h); Q, ΔJ=2 from γ(ADO) in (^{76}Ge,Xγ); M2 ruled out by RUL.
		620.084 *10*	100.0 *10*	487.401	5/2$^-$	M1+E2	+0.96 *24*		B(M1)(W.u.)=0.061 *+24−18*; B(E2)(W.u.)=2.2×10^2 *8* E_γ: others: 620.18 *5* from (n,n′γ); 619.7 *2* from (^{76}Ge,Xγ) is discrepant. I_γ: others: 100 *13* from (^{7}Li,α2nγ), 100 *7* from (n,n′γ),

$^{71}_{31}Ga_{40}$-10

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
									and 100.0 *12* from (^{76}Ge,Xγ). Mult.: D+Q from γγ(θ) in β$^-$ decay (4.140 h) and γ(θ) in (n,n′γ); M2 ruled out by RUL. δ: unweighted average of +0.72 *+8−5* from γγ(θ) in β$^-$ decay (4.140 h) and 1.2 *2* from γ(θ) in (n,n′γ).
1107.497	7/2$^-$	1107.335[d] *10*	3.37[d] *15*	0.0	3/2$^-$	[E2]			B(E2)(W.u.)=0.83 *+23−19* B(E2)(W.u.)=0.83 *14* from B(E2)↑=0.0029 *5* in Coulomb excitation (1972An17). E_γ: weighted average of 1107.334 *10* from ^{71}Zn β$^-$ decay (4.140 h), 1107.6 *2* from (n,n′γ), and 1107.2 *5* from (^{76}Ge,Xγ). I_γ: others: 4.6 *5* from (^{76}Ge,Xγ); 3.6 from (n,n′γ) and Coulomb excitation.
1109.31	1/2$^-$	1109.3[‡] *2*	100	0.0	3/2$^-$	(M1+E2)	0.19 *2*		B(M1)(W.u.)=0.164 *+24−19*; B(E2)(W.u.)=7.1 *+19−15* B(E2)(W.u.)=7.2 *10* from B(E2)↑=0.0063 *9* in Coulomb excitation (1972An17). E_γ: from (n,n′γ). Others: 1109.3 *5* from ^{71}Zn β$^-$ decay (2.45 min) and 1109 *1* from (γ,γ′). Mult.: quadrupole component observed in Coulomb excitation; M1+E2 from level scheme. δ: from $T_{1/2}$=95 fs *12* and B(E2)↑=0.0063 *9*.
1395.263	7/2$^-$	430.31 *21*	16.1 *22*	964.695	5/2$^-$	[M1,E2]		0.0026 *9*	B(M1)(W.u.)=0.0259 *+40−38* if M1. B(E2)(W.u.)=206 *+32−30* if E2. E_γ: unweighted average of 430.52 *7* from ^{71}Zn β$^-$ decay (4.140 h) and 430.10 *5* from (n,n′γ). I_γ: other: 31.0 *35* from (n,n′γ) is in disagreement.
		883.74 *6*	11.2 *11*	511.563	3/2$^-$	[E2]			B(E2)(W.u.)=3.92 *+50−47* E_γ: weighted average of 883.80 *7* from ^{71}Zn β$^-$ decay (4.140 h) and 883.69 *6* from (n,n′γ). I_γ: weighted average of 10.8 *11* from ^{71}Zn β$^-$ decay (4.140 h) and 12.1 *17* from (n,n′γ).
		907.91 *5*	95.7 *22*	487.401	5/2$^-$	[M1,E2]			B(M1)(W.u.)=0.0164 *+14−12* if M1. B(E2)(W.u.)=29.3 *+25−22* if E2. E_γ: weighted average of 907.92 *3* from ^{71}Zn β$^-$ decay (4.140 h) and 907.6 *2* from (n,n′γ). I_γ: other: 35 *7* from (n,n′γ) (1984Ar09) in disagreement, although, 108 *12* in another (n,n′γ) study (1977SmZI) is in agreement with β$^-$ decay.
		1395.254 *19*	100.0 *11*	0.0	3/2$^-$	E2			B(E2)(W.u.)=3.57 *+30−26* B(E2)(W.u.)=2.7 *4* from B(E2)↑=0.0096 *14* in Coulomb excitation (1972An17).

$^{71}_{31}Ga_{40}$-11

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
									Mult.: Q, ΔJ=2 from γγ(θ) in β⁻ decay (4.140 h) and γ(θ) in (n,n′γ); M2 ruled out by RUL.
1476.004	5/2⁻	368.499 *22*	5.82 *28*	1107.497	7/2⁻	[M1,E2]		0.0042 *17*	B(M1)(W.u.)<0.022 if M1. B(E2)(W.u.)<242 if E2.
		565.852 *12*	17.53 *21*	910.164	3/2⁻	[M1,E2]		0.00121 *27*	B(M1)(W.u.)<0.018 if M1. B(E2)(W.u.)<82 if E2.
									E_γ: weighted average of 565.854 *12* from ^{71}Zn β⁻ decay (4.140 h) and 565.82 *5* from (n,n′γ).
									I_γ: other: 26.8 *25* (n,n′γ) is in disagreement.
		964.670[d] *10*	39[d] *7*	511.563	3/2⁻	[M1,E2]			B(M1)(W.u.)<0.0088 if M1. B(E2)(W.u.)<14 if E2.
									I_γ: from (n,n′γ). Other: 27 *27* in β⁻ decay (4.140 h).
		988.638 *11*	100.0 *7*	487.401	5/2⁻	(M1+E2)	+0.17 *5*		B(M1)(W.u.)<0.019; B(E2)(W.u.)<1.3
									E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=988.596.
									E_γ: weighted average of 988.640 *10* from ^{71}Zn β⁻ decay (4.140 h) and 988.57 *6* from (n,n′γ).
									I_γ: other: 100 *10* from (n,n′γ).
									Mult.: D+Q from γγ(θ) in β⁻ decay (4.140 h); M1+E2 from level scheme.
									δ: weighted average of +0.20 *3* from γγ(θ) in β⁻ decay (4.140 h) and 0.10 *5* from γ(θ) in (n,n′γ).
		1085.3[e]		389.983	1/2⁻	[E2]			E_γ: from Coulomb excitation only.
		1475.969 *14*	46.6 *7*	0.0	3/2⁻	(M1+E2)			B(M1)(W.u.)<0.0027 if M1. B(E2)(W.u.)<1.8 if E2.
									B(E2)(W.u.)<1.2 from B(E2)↑<0.0051 in Coulomb excitation (1972An17).
									E_γ: weighted average of 1475.972 *14* from ^{71}Zn β⁻ decay (4.140 h) and 1475.90 *7* from (n,n′γ).
									Mult.: quadruple component observed in Coulomb excitation; M1+E2 from level scheme.
									I_γ: other: 76 *7* (n,n′γ) is in disagreement.
1493.864	9/2⁺	98.611 *25*	0.063 *3*	1395.263	7/2⁻	[E1]		0.0670 *9*	B(E1)(W.u.)=1.66×10^{-6} *+21−17*
		386.371 *14*	100.0 *10*	1107.497	7/2⁻	(E1)		1.25×10^{-3} *2*	B(E1)(W.u.)=4.39×10^{-5} *+49−39*
									E_γ: weighted average of 386.371 *10* from ^{71}Zn β⁻ decay (4.140 h), 386.50 *16* from (n,n′γ), and 386.0 *2* from (^{76}Ge,Xγ).
									Mult.: D from γγ(θ) in β⁻ decay (4.140 h); D, ΔJ=1 from γ(ADO) in (^{76}Ge,Xγ); E1 from level scheme.
		982.292 *10*	0.012 *5*	511.563	3/2⁻	[E3]			B(E3)(W.u.)=3.5 *+16−15*
		1006.439 *10*	0.850 *10*	487.401	5/2⁻	[M2]			B(M2)(W.u.)=0.096 *+11−9*
		1493.802[d] *19*	0.070[d] *4*	0.0	3/2⁻	[E3]			B(E3)(W.u.)=1.10 *+14−12*
1498.336	9/2⁻	1010.926 *15*	100	487.401	5/2⁻	Q[a]			E_γ: others: 1010.92 *6* from (n,n′γ) and 1010.9 *2* from (^{76}Ge,Xγ).

$^{71}_{31}Ga_{40}$-12

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.&	δ&	Comments
1631.43	3/2$^-$	666.75 *6*	46 *5*	964.695	5/2$^-$	[M1,E2]		B(M1)(W.u.)=0.12 *+9−5* if M1. If E2, B(E2)(W.u.)=4.0×10^2 *+29−17* exceeds RUL=300. E_γ: weighted average of 666.8 *2* from ^{71}Zn β^- decay (2.45 min) and 666.74 *6* from (n,n′γ). I_γ: weighted average of 41 *5* from ^{71}Zn β^- decay (2.45 min) and 50 *5* from (n,n′γ).
		721.09 *11*	19 *6*	910.164	3/2$^-$	[M1,E2]		B(M1)(W.u.)=0.040 *+29−20* if M1. B(E2)(W.u.)=1.1×10^2 *+8−6* if E2. E_γ: weighted average of 721.4 *3* from ^{71}Zn β^- decay (2.45 min) and 721.05 *11* from (n,n′γ). I_γ: unweighted average of 25.0 *30* from ^{71}Zn β^- decay (2.45 min) and 13.2 *14* from (n,n′γ).
		1119.85 *16*	100 *9*	511.563	3/2$^-$	[M1,E2]		B(M1)(W.u.)=0.056 *+38−24* if M1. B(E2)(W.u.)=65 *+45−28* if E2. E_γ: unweighted average of 1120.0 *1* from ^{71}Zn β^- decay (2.45 min) and 1119.69 *6* from (n,n′γ). I_γ: from (n,n′γ). Other: 100 *10* from ^{71}Zn β^- decay (2.45 min).
		1144.2 *3*	3.7 *6*	487.401	5/2$^-$	[M1,E2]		B(M1)(W.u.)=0.0019 *+14−9* if M1. B(E2)(W.u.)=2.2 *+15−10* if E2. E_γ,I_γ: from ^{71}Zn β^- decay (2.45 min) only.
		1241.5‡ *5*	1.5‡ *2*	389.983	1/2$^-$	[M1,E2]		B(M1)(W.u.)=0.00061 *+43−27* if M1. B(E2)(W.u.)=0.58 *+41−25* if E2. E_γ,I_γ: 1240.83 *6* from (n,n′γ) not used in averaging since Iγ=54 *5* is too high by a factor of ≈30 as compared to β^- decay data.
		1631.46 *10*	18.1 *15*	0.0	3/2$^-$	(M1+E2)		B(M1)(W.u.)=0.0033 *+23−14* if M1. B(E2)(W.u.)=1.8 *+13−8* if E2. B(E2)(W.u.)=0.69 *23* from B(E2)↑=0.0012 *4* in (e,e′) (1994Ri07). E_γ: weighted average of 1631.6 *2* from ^{71}Zn β^- decay (2.45 min) and 1631.42 *10* from (n,n′γ). I_γ: weighted average of 17.7 *15* from ^{71}Zn β^- decay (2.45 min) and 23 *5* from (n,n′γ). Mult.: quadrupole component observed in (e,e′); M1+E2 from level scheme. δ: 0.8 *+∞−4* from $T_{1/2}$, B(E2)↑=0.0012 *4* in (e,e′), and branching=9.6% *+20−16*.
1699.21	1/2$^+$	1188.2‡ *2*	72‡ *11*	511.563	3/2$^-$	[E1]		B(E1)(W.u.)<4.5×10^{-4} E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=1187.63.
		1699.16‡ *8*	100‡ *11*	0.0	3/2$^-$	[E1]		B(E1)(W.u.)<2.1×10^{-4}
1719.567	5/2$^-$	1208.010 *22*	75.5 *21*	511.563	3/2$^-$	[M1,E2]		B(M1)(W.u.)=0.032 *+7−8* if M1. B(E2)(W.u.)=32 *+7−8* if E2. E_γ: weighted average of 1208.005 *22* from ^{71}Zn β^- decay (4.140 h) and 1208.06 *7* from (n,n′γ). I_γ: other: 64 *9* from (n,n′γ).
		1232.172 *28*	71.4 *21*	487.401	5/2$^-$	[M1,E2]		B(M1)(W.u.)=0.028 *+6−7* if M1. B(E2)(W.u.)=28 *+6−7* if E2. E_γ: weighted average of 1232.181 *24* from ^{71}Zn β^- decay (4.140 h) and 1232.09 *7* from (n,n′γ). I_γ: other: 100 *9* from (n,n′γ).

$^{71}_{31}Ga_{40}$-13

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	Comments
1719.567	5/2⁻	1719.562 *34*	100.0 *21*	0.0	3/2⁻	M1+E2	+1.4 *5*	B(M1)(W.u.)=0.0049 *+31−21*; B(E2)(W.u.)=4.8 *+13−22* E_γ: weighted average of 1719.574 *23* from ^{71}Zn β^- decay (4.140 h), 1719 *1* from (γ,γ′), and 1719.38 *9* from (n,n′γ). I_γ: other: 100 *9* from (n,n′γ). Mult.,δ: D+Q and δ from γ(θ) in (n,n′γ); M2 component ruled out by RUL.
1752.32	3/2⁻	788.06[‡] *6*	42[‡] *4*	964.695	5/2⁻	[M1,E2]		B(M1)(W.u.)=0.041 *+28−19* if M1. B(E2)(W.u.)=1.0×10^2 *+7−5* if E2. E_γ: uncertainty multiplied by a factor of 3 in the fitting; level-energy difference=787.62.
		1264.89[‡] *6*	100[‡] *12*	487.401	5/2⁻	[M1,E2]		B(M1)(W.u.)=0.024 *+15−11* if M1. B(E2)(W.u.)=22 *+14−10* if E2.
		1362.29[‡] *7*	35[‡] *4*	389.983	1/2⁻	M1+E2	+1.5 *5*	B(M1)(W.u.)=0.0020 *+21−11*; B(E2)(W.u.)=3.6 *+23−20* Mult.,δ: D+Q and δ from γ(θ) in (n,n′γ); M2 component ruled out by RUL.
1905.39	5/2⁻	797.82[‡] *7*	8.6[‡] *14*	1107.497	7/2⁻	[M1,E2]		B(M1)(W.u.)=0.0069 *+28−24* if M1. B(E2)(W.u.)=16 *6* if E2.
		940.70[‡] *7*	27[‡] *5*	964.695	5/2⁻	[M1,E2]		B(M1)(W.u.)=0.013 *5* if M1. B(E2)(W.u.)=22 *+9−8* if E2.
		1418.07[‡] *7*	91[‡] *9*	487.401	5/2⁻	[M1,E2]		B(M1)(W.u.)=0.0129 *+46−43* if M1. B(E2)(W.u.)=9.5 *+34−31* if E2.
		1904.83[‡] *9*	100[‡] *18*	0.0	3/2⁻	M1+E2	+0.8 *3*	B(M1)(W.u.)=0.0036 *+17−15*; B(E2)(W.u.)=0.93 *+49−54* E_γ: uncertainty multiplied by a factor of 3 in the fitting; level-energy difference=1905.36. Mult.,δ: D+Q and δ from γ(θ) in (n,n′γ); M2 component ruled out by RUL.
1941.6	(9/2⁻)	976.9[@]	100	964.695	5/2⁻	Q[a]		
1941.71	(3/2⁻)	546.57[‡] *14*	100[‡] *14*	1395.263	7/2⁻			
		976.95[c‡] *6*	<1740[c‡]	964.695	5/2⁻			
		1454.52[‡] *15*	79[‡] *14*	487.401	5/2⁻			
2064.16	1/2⁻,3/2⁻	1552.4 *3*	57 *7*	511.563	3/2⁻	[M1,E2]		B(M1)(W.u.)=0.026 *+22−9* if M1. B(E2)(W.u.)=16 *+14−6* if E2. E_γ: weighted average of 1553.0 *5* from ^{71}Zn β^- decay (2.45 min) and 1552.3 *2* from (n,n′γ). I_γ: from β^- decay (2.45 min). Other: 20 in (n,n′γ).
		2064.3 *3*	100 *14*	0.0	3/2⁻	[M1,E2]		B(M1)(W.u.)=0.019 *+16−7* if M1. B(E2)(W.u.)=7 *+6−2* if E2. E_γ: weighted average of 2064.6 *2* from ^{71}Zn β^- decay (2.45 min), 2064 *1* from (γ,γ′), and 2063.9 *2* from (n,n′γ). I_γ: from β^- decay (2.45 min). Other: 100 *20* from (n,n′γ).
2069.6	11/2[(−)]	570.7[#] *5*	41[#] *8*	1498.336	9/2⁻	D[a]		
		961.9[#] *5*	100[#] *8*	1107.497	7/2⁻	Q[a]		
2082.461	(13/2⁺)	588.602 *17*	100	1493.864	9/2⁺	Q[a]		E_γ: other: 588.3 *2* from (^{76}Ge,Xγ).
2134.12	5/2⁻,7/2⁻	635.7[‡] *1*	18[‡]	1498.336	9/2⁻			
		1026.69[‡] *6*	100[‡] *9*	1107.497	7/2⁻			

$^{71}_{31}Ga_{40}$-14

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ[&]	Comments
2134.12	5/2$^-$,7/2$^-$	1169.34[‡] *7*	91[‡] *9*	964.695	5/2$^-$			
		1646.69[‡] *8*	82[‡] *9*	487.401	5/2$^-$			
		2134.19[‡] *13*	55[‡] *9*	0.0	3/2$^-$			
2247.269	7/2$^+$	527.71 *4*	1.40 *8*	1719.567	5/2$^-$	[E1]		B(E1)(W.u.)=0.00096 *+31−21*
		753.395 *10*	100.0 *11*	1493.864	9/2$^+$	M1+E2	−0.085 *15*	B(M1)(W.u.)=1.31 *+41−29*; B(E2)(W.u.)=25 *+13−9* E_γ: other: 753.72 *5* from (n,n′γ) is discrepant. Mult.: D+Q and δ from γγ(θ) in β$^-$ decay (4.140 h); M2 component ruled out by RUL.
		771.265 *10*	65.8 *6*	1476.004	5/2$^-$	[E1]		B(E1)(W.u.)=0.0145 *+45−32* exceeds RUL=0.01. E_γ,I_γ: other: 771.18 *6* with Iγ=45 *6* from (n,n′γ).
		852.02 *5*	0.59 *9*	1395.263	7/2$^-$	[E1]		B(E1)(W.u.)=9.7×10^{-5} *+34−25*
		1139.752 *12*	7.00 *8*	1107.497	7/2$^-$	[E1]		B(E1)(W.u.)=0.00048 *+15−11* E_γ,I_γ: other: 1139.95 *8* from (n,n′γ) with Iγ=32 *5* from (n,n′γ), which is too high. In the opinion of the evaluators, either the intensity of this γ ray in 1984Ar09 is incorrect or there is an alternate placement of 1139.95γ.
		1282.562 *15*	7.96 *9*	964.695	5/2$^-$	[E1]		B(E1)(W.u.)=0.00038 *+12−8*
		1759.865 *18*	2.91 *6*	487.401	5/2$^-$	[E1]		B(E1)(W.u.)=5.4×10^{-5} *+17−12*
2294.41	1/2$^-$	1383.8 *5*	20.8 *19*	910.164	3/2$^-$			E_γ,I_γ: from β$^-$ decay (2.45 m). Other: 1380.64 *7* in (n,n′γ) is discrepant.
		1904.4 *3*	100 *10*	389.983	1/2$^-$			E_γ,I_γ: from β$^-$ decay (2.45 min) only.
		2294.8 *5*	15.1 *19*	0.0	3/2$^-$			E_γ,I_γ: from β$^-$ decay (2.45 min) only.
2450.661	7/2$^+$	952.352 *29*	8.8 *5*	1498.336	9/2$^-$			
		956.785 *15*	63.8 *7*	1493.864	9/2$^+$			
		974.659 *12*	100.0 *9*	1476.004	5/2$^-$			E_γ: other: 976.95 *6* from (n,n′γ) for a doublet.
		1343.129 *21*	10.9 *5*	1107.497	7/2$^-$			
		1485.874 *19*	12.90 *23*	964.695	5/2$^-$			E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=1485.949. E_γ: Other: 1485.86 *14* from (n,n′γ).
		1963.41 *7*	1.81 *23*	487.401	5/2$^-$			E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=1963.231.
2488.244	(7/2)$^+$	994.395 *19*	19.2 *8*	1493.864	9/2$^+$			
		1012.231 *22*	71.6 *21*	1476.004	5/2$^-$			
		1093.02 *6*	2.81 *26*	1395.263	7/2$^-$			
		1380.713 *15*	100.0 *10*	1107.497	7/2$^-$			
		2000.75 *10*	1.53 *26*	487.401	5/2$^-$			
		2488.37 *9*	2.05 *26*	0.0	3/2$^-$	[M2,E3]		
2600.883	(9/2)$^+$	518.430 *18*	14.55 *22*	2082.461	(13/2$^+$)			
		1102.46 *5*	3.01 *22*	1498.336	9/2$^-$			
		1107.334[d] *10*	100[d] *10*	1493.864	9/2$^+$	(E2+M1)	+3 *+10−1*	δ: +3 *+10−1* for J(2601)=9/2 (1978Kr06) in ^{71}Zn decay (4.14 h). Mult.: large mixing ratio and ΔJ^π suggest (E2+M1).

$^{71}_{31}Ga_{40}$-15

Adopted Levels, Gammas (continued)

γ(^{71}Ga) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	Comments
2600.883	$(9/2)^+$	1493.802[d] *19*	0.65[d] *43*	1107.497	$7/2^-$		
2683.72	$13/2^{(-)}$	613.6[@]	≈13[@]	2069.6	$11/2^{(-)}$	D[a]	I_γ: 13 *17* from (^{7}Li,α2nγ).
		1185.6[#] *2*	100 *8*	1498.336	$9/2^-$	Q[a]	I_γ: from (^{7}Li,α2nγ).
2720.019	$7/2^+$	472.754 *22*	100.0 *44*	2247.269	$7/2^+$		
		1226.152 *30*	38.2 *15*	1493.864	$9/2^+$		
		1243.989 *17*	97.1 *30*	1476.004	$5/2^-$		
		1612.55 *4*	22.1 *15*	1107.497	$7/2^-$		
2804.918	$(7/2)^+$	1085.381 *25*	33.3 *16*	1719.567	$5/2^-$		
		1306.565 *21*	100.0 *16*	1498.336	$9/2^-$		
		1311.016 *22*	98.4 *16*	1493.864	$9/2^+$		
		1697.35 *6*	6.4 *8*	1107.497	$7/2^-$		
		1840.183 *22*	39.7 *8*	964.695	$5/2^-$		
		2317.54 *4*	54.0 *16*	487.401	$5/2^-$		
2815.792	$7/2^+$	1321.891 *14*	100.0 *16*	1493.864	$9/2^+$		E_γ: other: 1322.30 *9* from (n,n′γ).
		1339.80 *6*	4.8 *4*	1476.004	$5/2^-$	[E1]	B(E1)(W.u.)=2.9×10^{-5} *+14−11*
		1708.311 *19*	37.0 *4*	1107.497	$7/2^-$	[E1]	B(E1)(W.u.)=1.07×10^{-4} *+50−40*
		1905.65 *8*	2.4 *4*	910.164	$3/2^-$	[M2+E3]	If M2, B(M2)(W.u.)=6.3 *+32−26* exceeds RUL=1. If E3, B(E3)(W.u.)=3.9×10^3 *+20−16* exceeds RUL=100. E_γ: 1905.65γ to $3/2^-$ seems too strong for pure M2 or pure E3, as B(M2)(W.u.) and B(E3)(W.u.) exceed respective RUL=1 and 100. It is possible that the main intensity of this γ is due to coincidence summing.
2941.67	$(17/2^+)$	859.2[#] *2*	100	2082.461	$(13/2^+)$	Q[a]	
3034.6	$(13/2^-)$	1093.0[@]	100	1941.6	$(9/2^-)$	Q[a]	
3153.7	$(15/2^-)$	470.4[@]	≈25[@]	2683.72	$13/2^{(-)}$	(D)	I_γ: 25 *86* from (^{7}Li,α2nγ).
		1070.4[@]	≈25[@]	2082.461	$(13/2^+)$	D[a]	I_γ: 25 *25* from (^{7}Li,α2nγ).
		1084.0[@]	≈100[@]	2069.6	$11/2^{(-)}$	Q[a]	I_γ: 100 *134* from (^{7}Li,α2nγ).
3695.2	$(17/2^-)$	541.1[@]	16[@] *16*	3153.7	$(15/2^-)$	D[a]	γ reported in (^{7}Li,α2nγ) only.
		1011.5[@] *2*	100[@]	2683.72	$13/2^{(-)}$	Q[a]	
3839.7	$(17/2^-)$	1156.0[@]	100	2683.72	$13/2^{(-)}$	(Q)[a]	
3909.7	$(17/2^-)$	875.1	100	3034.6	$(13/2^-)$	(Q)[a]	
3999.0		1057.3[#] *5*	100	2941.67	$(17/2^+)$		
4028.5	$(21/2^+)$	1086.8[#] *2*	100	2941.67	$(17/2^+)$	Q[a]	
4164.9	$(21/2^-)$	469.7[#] *5*	100	3695.2	$(17/2^-)$	Q[a]	
4199.7	$(19/2^-)$	1046.0[@]	100	3153.7	$(15/2^-)$	(Q)[a]	
4873.1?	$(21/2^-)$	964.0[@e]		3909.7	$(17/2^-)$		
5228.2	$(25/2^+)$	1199.7[@]	100	4028.5	$(21/2^+)$	Q[a]	
6573.7	$(29/2^+)$	1345.5	100	5228.2	$(25/2^+)$	(Q)[a]	

$^{71}_{31}Ga_{40}$-16

Adopted Levels, Gammas (continued)

$\gamma(^{71}Ga)$ (continued)

† From ^{71}Zn β^- decays (4.140 h), unless otherwise noted.
‡ From (n,n′γ).
# From (^{76}Ge,Xγ).
@ From (^{7}Li,α2nγ).
& From $\gamma\gamma(\theta)$ in ^{71}Zn β^- decays (4.140 h) with the firm assignments of magnetic/electric natures determined based on measured $T_{1/2}$ and RUL where available and those inside parentheses determined from level scheme, unless otherwise noted.
[a] From γ(ADO) in (^{7}Li,α2nγ) with $\Delta J=2$ for Q an $\Delta J=1$ for D.
[b] 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.
[c] Multiply placed with undivided intensity.
[d] Multiply placed with intensity suitably divided.
[e] Placement of transition in the level scheme is uncertain.

$^{71}_{31}Ga_{40}$-17

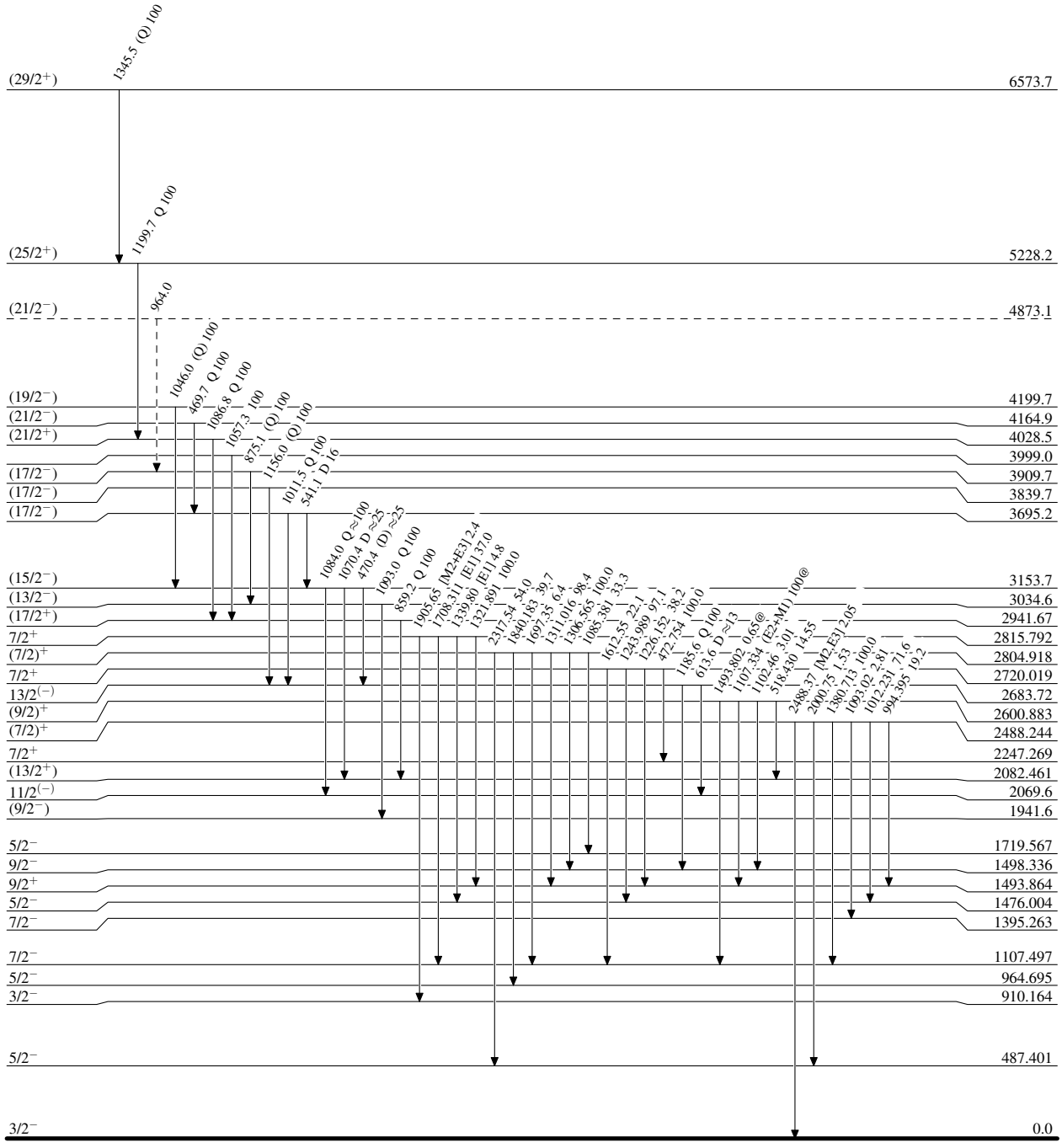
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

γ Decay (Uncertain)

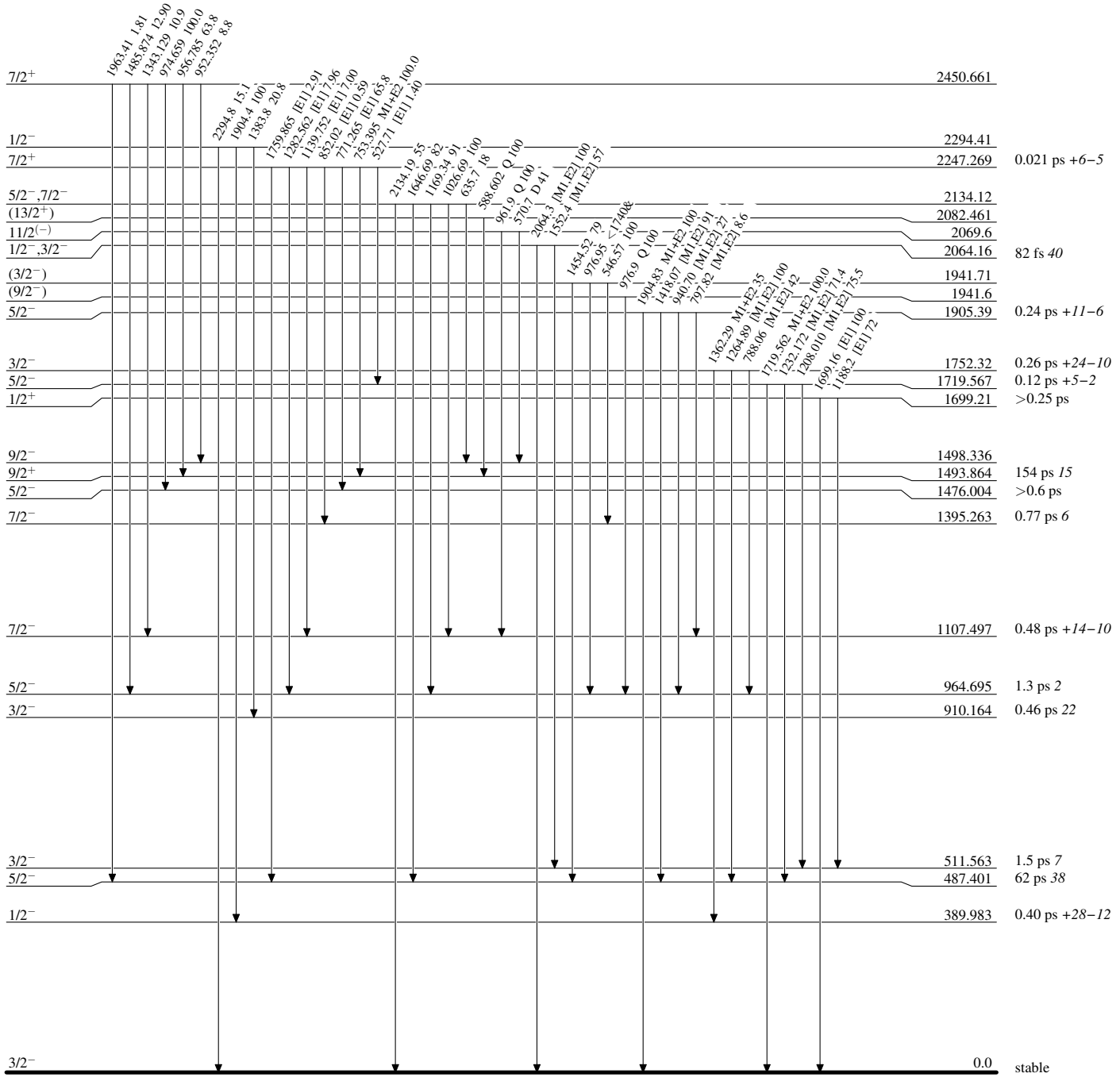


$^{71}_{31}Ga_{40}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



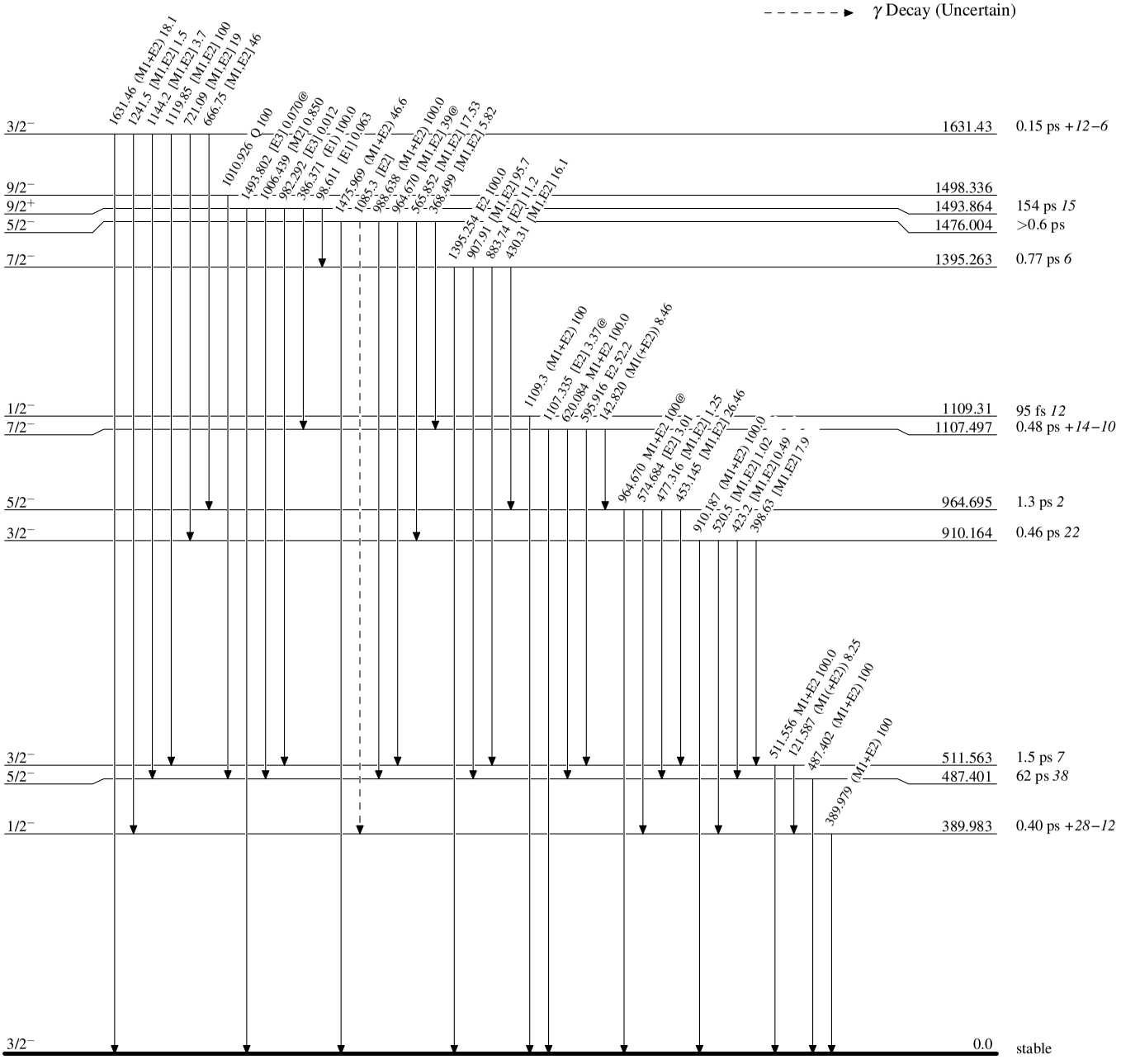
$^{71}_{31}Ga_{40}$

Adopted Levels, Gammas

Level Scheme (continued)

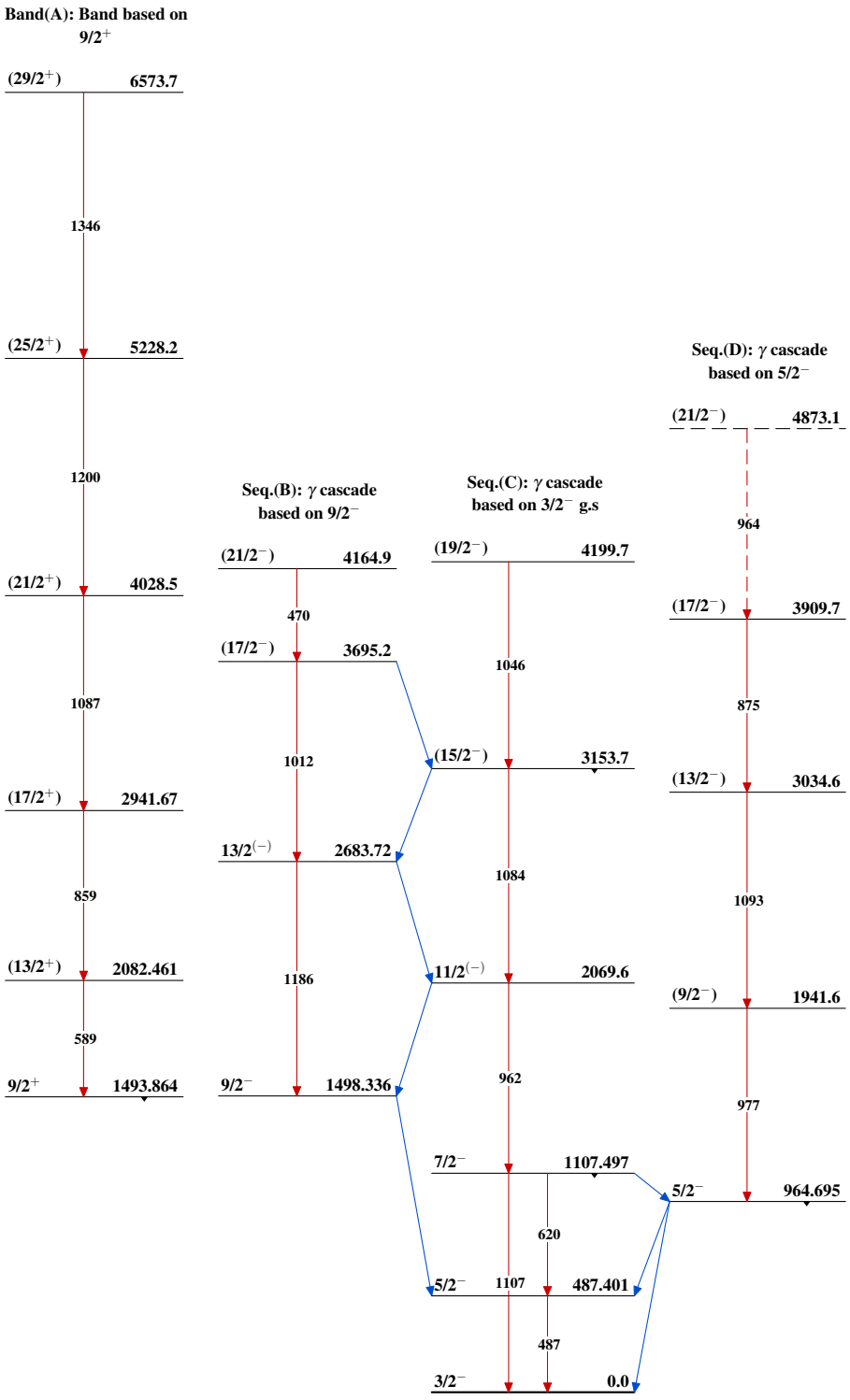
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend: ------► γ Decay (Uncertain)



$^{71}_{31}Ga_{40}$

Adopted Levels, Gammas



$^{71}_{31}Ga_{40}$