Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

Q(β^-)=2238 *10*; S(n)=6415 *8*; S(p)=12454 *11*; Q(α)=−4866 *9* 2017Wa10
S(2n)=11990 *8*, S(2p)=22940 *12* (2017Wa10).
Mass measurements: 2006Ha03 (also 2006Jo14), 2004Ri12 (also 2005Jo22,2004Jo18).
Additional information 1.
Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 79 primary references, 75 dealing with nuclear structure calculations and 4 with decay modes and half-lives.

^{98}Zr Levels

Cross Reference (XREF) Flags

A	^{98}Y β^- decay (0.548 s)	E	^{248}Cm SF decay	I	^{100}Mo(^{14}C,^{16}O),(^{6}Li,^{8}B)
B	^{98}Y β^- decay (2.32 s)	F	^{252}Cf SF decay	J	^{235}U(n,Fγ),^{241}Pu(n,Fγ)
C	^{98}Zr IT decay (1.9 μs)	G	^{9}Be(^{238}U,Fγ)	K	^{238}U(α,Fγ)
D	^{99}Y β^-n decay (1.478 s)	H	^{96}Zr(t,p),(t,pγ)	L	Coulomb excitation

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
0.0#	0^+	30.7 s *4*	ABCDEFGHIJKL	%β^-=100 Evaluated rms charge radius=4.401 fm *16* (2013An02). Evaluated δ<r^2>(^{90}Zr,^{98}Zr)=+1.002 fm^2 *5* (2013An02). $T_{1/2}$: from 1976He10. Others: 1968DeZZ, 1967Hu08, 1960Or02. <r^2>$^{1/2}$(^{90}Zr,^{98}Zr)=+0.981 fm^2 *5* (2003Th03,2002Ca37); systematic uncertainty=0.043 fm^2. Also 2005Bi25 from the same group.
854.06@ *6*	0^+	64 ns *7*	ABC EFGHIJKL	Jπ: E0 transition to 0^+. $T_{1/2}$: weighted average of 64 ns *7* from ^{98}Y β^- decay (0.548 s) and 65 ns *10* from (n,Fγ).
1222.91# *5*	2^+	2.63 ps *55*	ABC EFGHIJKL	Jπ: E2 368.8γ to 0^+. $T_{1/2}$: from RDDS in ^{9}Be(^{238}U,Fγ) (2018Si26). Others: ≥0.68 ps from B(E2)(W.u.)=8.9 *20* or <11 (2018Wi09) deduced from γ-ray yields in Coulomb excitation; <4 ps from fast-timing $\gamma\gamma$-coin in ^{235}U(n,Fγ), ^{241}Pu(n,Fγ), and analysis by generalized centroid difference method (2017An15); <11 ps (2010Be30), <21 ps (1989Ma38), <0.2 ns (1982Ka03), all from $\beta\gamma$(t) in ^{98}Y decay (0.548 s); <0.20 ns (2001AhZY, $\gamma\gamma$(t) in ^{252}Cf SF decay). μ: >+0.38 *17* (integral PAC method, preliminary result from 2001AhZY).
1436.17& *7*	0^+	0.72 ns *8*	A EFGH J	Jπ: E0 to 0^+. $T_{1/2}$: from $\beta\gamma\gamma$(t) or $\beta\gamma$(t) in ^{98}Y β^- decay (0.548 s). Unweighted average of 0.611 ns *33* (2010Be30), 0.865 ns *42* (1989Ma38), 0.69 ns *10* (1982Ka03). Weighted average is 0.71 ns *9*, but reduced χ^2=11 is too high.
1590.78@ *6*	2^+		AB EFGH JK	Jπ: L(t,p)=2.
1744.61& *6*	2^+		A EF H J	Jπ: L(t,p)=2.
1806.18a *6*	3^-		ABC EFGH JK	Jπ: L(t,p)=3.
1843.41@ *6*	4^+	5.2 ps *10*	BC EFGH JK	Jπ: 620.5γ E2 to 2^+; 204.3γ from 4^+;probable band assignment (1995HaZT). However, $\gamma\gamma(\theta)$ in ^{98}Y β^- decay (2.32 s) suggests J=3. $T_{1/2}$: from RDDS in ^{9}Be(^{238}U,Fγ) (2018Si26). Others: 20 ps *6* from $\beta\gamma$(t) in ^{98}Y β^- decay (2.32 s) (2010Be30); ≤10 ps (2017An15, $\gamma\gamma$(t) fast-timing technique, ≤14 ps in ^{241}Pu(n,Fγ), and ≤10 ps in ^{235}U(n,Fγ)); 28 ps *12* (from ^{98}Y decay (2.32 s), quoted by 1994St31 from thesis by M.

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Adopted Levels, Gammas (continued)

^{98}Zr Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
				Liang, University of Koln (1992)). Note that in 2017An15, lifetime of this state could not be determined precisely due to imprecise lifetime of the first 2^+ state.
1859.37 *7*	0^+	0.290 ns *13*	A H J	Jπ: 636.5γ E2 to 2^+; E0 to 0^+. $T_{1/2}$: from βγ(t) in ^{98}Y β^- decay (0.548 s). Weighted average of 0.318 ns *27* (2010Be30), 0.283 ns *15* (1989Ma38), and 0.24 ns *10* (1982Ka03).
2047.71# *8*	4^+		BC EFGH JK	Jπ: L(t,p)=4.
2104 *1*			H	Jπ: 1986Me11 quote 2^+ from decay characteristics; however, no details of γ rays from this level are available.
2225.15 *8*	(2^+)		A	Jπ: 2225.2γ and 789.0γ to 0^+; no β feeding from 0^- parent.
2276.93& *8*	(4^+)		B EFG JK	Jπ: γγ(θ) in ^{235}U(n,Fγ) (2017Ur03); 686.2γ and 1053.9γ to 2^+; possible band member.
2487 *1*			H	Jπ: 1986Me11 quote 3^+ from decay characteristics; however, no details of γ transitions from this level are available.
2490.98@ *6*	6^+	1.80 ps *62*	BC EFGH JK	Jπ: 647.6γ ΔJ=2, E2 to 4^+; band member. $T_{1/2}$: from RDDS in ^{9}Be(^{238}U,Fγ) (2018Si26). Other: <10 ps from βγ(t) in ^{98}Y β^- decay (2.32 s) (2010Be30).
2568 *1*			H	Jπ: 1986Me11 quote 4^+ from decay characteristics; however, no details of γ transitions from this level are available.
2613 *1*			H	Jπ: 1986Me11 quote 2^+ from decay characteristics; however, no details of γ transitions from this level are available.
2778.71 *7*	(2^+)		A	Jπ: 2779γ to 0^+, 972.2γ to 3^-, no β feeding from 0^- parent.
2800.22[a] *9*	5^-		BC EF H K	Jπ: L(t,p)=5.
3035 *8*			H	
3064.37[b] *13*	$5^{(-)}$		BC EFGh J	Jπ: ΔJ=2, Q 1258.2γ to 3^-, 1221.0γ and 1016.7γ to 4^+.
3065.61 *15*	(1)		A h	Jπ: 3065.5γ to 0^+; possible β feeding from 0^- parent.
3117.10& *11*	(6^+)		B EFG K	Jπ: 1273.7γ ΔJ=2, Q to 4^+; member of a sequence.
3160 *8*			H	
3216.35@ *12*	8^+	1.95 ps *47*	BC EFGH JK	XREF: H(3205). Jπ: 725.4γ ΔJ=2, E2 to 6^+; spin=8 from γγ(θ) in ^{252}Cf SF decay; band member. $T_{1/2}$: from DSAM in ^{248}Cm SF decay (2012Sm02).
3249.02 *22*	$(5,6,7^-)$		B E	Jπ: 448.8γ to 5^-; possible β feeding from $(7^+,6^+)$ parent.
3271 *8*	4^+		H	Jπ: L(t,p)=4.
3336.4 *5*			EF	
3354 *8*	5^-		H	Jπ: L(t,p)=5.
3435 *8*	2^+		H	Jπ: L(t,p)=2.
3506 *8*			H	
3539 *8*			H	
3576.26[b] *12*	(7^-)		C EF	Jπ: 776γ to $5^{(-)}$; member of a sequence built on $5^{(-)}$.
3592.2[a] *5*	(7^-)		EF	Jπ: 792γ to 5^-; member of a sequence.
3739 *8*			H	
3763 *8*			H	
3812.1& *4*	(8^+)		EFG K	Jπ: 1321.6γ to 6^+; member of a sequence.
3825 *8*			H	
3855 *8*			H	
3894.1 *4*	(7^-)		EFGH K	XREF: H(3886). Jπ: L(t,p)=(7).
3984.73@ *14*	(10^+)	1.42 ps *34*	C EFG JK	Jπ: 768.4γ to 8^+; possible band member. $T_{1/2}$: from DSAM in ^{248}Cm SF decay (2012Sm02).
4005 *8*	$(5^-,6^+)$		H	Jπ: L(t,p)=(5,6).
4061 *8*	(6^+)		H	Jπ: L(t,p)=(6).

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Adopted Levels, Gammas (continued)

^{98}Zr Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
4097 *8*	$(5^-,6^+)$		H	Jπ: L(t,p)=(5,6).
4108.67 *13*	(1)		A	Jπ: 2672.7γ, 3254.4γ and 4108.5γ to 0^+; possible β feeding from 0^- parent.
4165.18 *6*	1^-		A F J	Jπ: log *ft*=4.3 (allowed transition) from 0^-; 2728.9γ to 0^+; spin=1 from γγ(θ) in ^{252}Cf SF decay.
4198.88[b] *14*	(9^-)		C EF	Jπ: 622.6γ to (7^-); member of a sequence built on $5^{(-)}$.
4225 *8*	6^+		H	Jπ: L(t,p)=6.
4271.11 *6*	1^-		A J	Jπ: log *ft*=5.2 (allowed transition) from 0^-; 2411.9γ to 0^+; also supported by γγ(θ) in (n,Fγ).
4278.79 *12*			B	Jπ: $(5,6,7,8^+)$ from 1787.8γ to 6^+; log *ft*=6.0 from $(7^+,6^+)$.
4292.41 *10*	6^+		B EF J	Jπ: log *ft*=4.9 from $(7^+,6^+)$; spin=6 from γγ(θ) in (n,Fγ) and ^{98}Y β^- decay (2.32 s).
4365 *8*			H	
4387 *8*			H	
4399.07 *12*	1^-		A	Jπ: log *ft*=5.3 (allowed transition) from 0^-; 2174.4γ to 0^+.
4450 *8*	(7^-)		H	Jπ: L(t,p)=(7).
4452.59 *9*	1^-		A J	Jπ: log *ft*=4.5 from 0^-; 2593γ to 0^+; spin=1 from γγ(θ) in (n,Fγ).
4492.35 *15*	1^-		A	Jπ: log *ft*=5.3 from 0^-; 4492γ, 3638.6γ to 0^+.
4545.81 *14*	(7^+)		B EF	Jπ: 253.4γ to 6^+; possible (weak) β feeding (log *ft*=6.3) from $(7^+,6^+)$ parent.
4608 *8*			H	
4754.71[@] *16*	(12^+)		C EF K	Jπ: 770γ to (10^+); band member.
4916.61[b] *16*	(11^-)		C F	Jπ: 717.7γ to (9^-), member of a sequence.
5589.29[@] *17*	(14^+)		C F K	Jπ: 834.6γ to (12^+); band member.
5720.94[b] *17*	(13^-)		C F	Jπ: 804.3γ to (11^-); member of a sequence.
6538.9[@] *11*	(16^+)		K	E(level): see comment for 6541 level for the two levels being separate. Jπ: γ to (14^+), band member.
6541.37[b] *17*	(15^-)		C F	E(level): 2006Si36 suggest that 6541 level is most likely different from a (16^+) level at 6539 decaying by a 949.6γ proposed by 2004Wu08, as no 820γ was reported in 2004Wu08. Jπ: γs to (14^+) and (13^-); member of a sequence.
6601.9 *11*	(17^-)	1.9 μs *2*	C	%IT=100 Jπ: proposed configuration=$\pi g^2_{9/2}\otimes\nu(g_{7/2}h_{11/2})$. $T_{1/2}$: from sum of time spectra gated on 952γ+835γ+820γ+804γ+770γ+768γ+725γ+718γ (2006Si36). Other: 1.4 μs *5* (2013RuZX, from 1223γ(t)).
7595.9[@] *15*	(18^+)		K	Jπ: 1057γ to (16^+); band member.
8725.4[@] *18*	(20^+)		K	Jπ: 1229.5γ to (18^+); band member.

[†] From least-squares fit to Eγ data, assuming 0.5 keV uncertainty when not stated.
[‡] Ascending spins are assumed for levels populated in SF decays due to yrast pattern of excitation of levels in such studies.
[#] Seq.(B): γ cascade based on g.s.
[@] Band(A): Band based on 854, 0^+. The 2^+ member of this band is either at 1590.8 keV as in 2001Ur01 or at 1222.9 keV as in 2006Si36. Q(intrinsic)=2.00 *10* (2001Ur01) from lifetime data for 12^+, 10^+ and 8^+ states.
[&] Seq.(C): γ cascade based on 1436, 0^+.
[a] Seq.(D): γ cascade based on 3^-. Possible octupole structure.
[b] Seq.(E): γ cascade based on (5^-), 3064.

Adopted Levels, Gammas (continued)

γ(^{98}Zr)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	δ	α[#]	$I_{(\gamma+ce)}$	Comments
854.06	0^+	854.06 *6*		0.0	0^+	E0			100	Monopole strength ρ^2(E0)=0.0112 *12* (2005Ki02 evaluation), based on data in 1994Lh01. Energy of E0 transition from level energy difference. Mult.: from ce data in (t,pγ) and ^{98}Y β^- decay (0.548 s).
1222.91	2^+	368.8 *1*	2.5 *2*	854.06	0^+	[E2]		0.0109		B(E2)(W.u.)=29 *+8−6* E_γ: other: 370.0 *10* in (α,Fγ). I_γ: from ^{98}Y β^- decay (0.548 s). Others: 2.1 *2* in (α,Fγ), 0.9 *3* in ^{248}Cm SF decay.
		1222.9 *1*	100.0 *2*	0.0	0^+	E2		0.00044		B(E2)(W.u.)=2.9 *+8−5* E_γ: others: 1222.7 *2* in ^{98}Zr IT decay, 1222.7 *10* in (α,Fγ). I_γ: deduced from ^{98}Y β^- decay (0.548 s). Uncertainty of 0.2 is from deduced absolute γ-branching ratios to the 854 level and the ground state. Mult.: γγ(θ) in β^- decay (0.548 s) and ^{235}U(n,Fγ), and RUL.
1436.17	0^+	213.2 *1*	100 *4*	1222.91	2^+	E2		0.0716		B(E2)(W.u.)=58 *8* Mult.: γγ(θ) in β^- decay (0.548 s) and ^{235}U(n,Fγ), and RUL.
		582.0[‡] *2*		854.06	0^+	E0[‡]			6.6 *6*	Mult.: ce data in (t,pγ) and ^{98}Y β^- decay (0.548 s). Evaluated q^2_K(E0/E2)=1.05 *7*, X(E0/E2)=0.054 *3*, ρ^2=0.076 *6* (2005Ki02), based on data in 1994Lh01 and 1982Ka03. Monopole strength ρ=0.274 *15* (1994Lh01), 0.29 *8* (1982Ka03). I(E0)/I(E2)=0.065 *4* (1994Lh01).
1590.78	2^+	154.5	1.9	1436.17	0^+	[E2]		0.228		
		367.8 *1*	11.7 *8*	1222.91	2^+	[M1+E2]		0.0088 *22*		
		736.8 *1*	14.6 *8*	854.06	0^+	[E2]				
		1590.9 *1*	100 *3*	0.0	0^+	E2				Mult.: from γγ(θ) in ^{98}Zr β^- decay (0.548 s), and (n,Fγ), and ΔJ^π, where J^π of each level is known independently.
1744.61	2^+	152.7[@]	3	1590.78	2^+	[M1+E2]		0.15 *9*		
		521.6 *1*	79 *3*	1222.91	2^+	M1+E2	+0.44 *4*	0.00302		Mult.,δ: γγ(θ) in ^{235}U(n,Fγ), D+Q from γγ(θ), M1+E2 from ΔJ^π, where each J^π is determined uniquely in different experiments. Other δ: +0.2 *1* from γγ(θ) in ^{98}Y β^- decay (0.548 s).
		890.6 *1*	43 *3*	854.06	0^+					
		1744.5 *1*	100 *4*	0.0	0^+					
1806.18	3^-	215.5 *2*	6.7 *17*	1590.78	2^+	[E1]		0.0122		
		583.258 *30*	100 *3*	1222.91	2^+	E1				Mult.: γ(θ) and γ(pol) in ^{248}Cm SF decay.
1843.41	4^+	252.7 *2*	1.7 *4*	1590.78	2^+	[E2]		0.0392		B(E2)(W.u.)=54 *+18−16*

$^{98}_{40}Zr_{58}$-4

Adopted Levels, Gammas (continued)

γ(^{98}Zr) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.	α #	$I_{(\gamma+ce)}$	Comments
									I_γ: others: 1.4 *2* in (α,Fγ), 5.2 *17* in ^{248}Cm SF decay, 4.8 in ^{252}Cf SF decay. Values in SF decay seem too high by a factor of ≈3.
1843.41	4+	620.505 *19*	100 *3*	1222.91	2+	E2	0.00225		B(E2)(W.u.)=42 *+10−7* I_γ: other: 100 in (α,Fγ), 100 *5* in ^{248}Cm SF decay. Mult.: γ(θ) and γ(pol) in ^{248}Cm SF decay.
1859.37	0+	268.7 *1*	100 *3*	1590.78	2+	E2	0.0316		B(E2)(W.u.)=42 *3* Mult.: γγ(θ) and RUL.
		423.0‡ *2*		1436.17	0+	E0‡		1.5 *2*	Mult.: ce data in (t,pγ) and ^{98}Y β^- decay (0.548 s). Evaluated q^2_K(E0/E2)=5.4 *14*, X(E0/E2)=26 *7*, ρ^2=0.061 *8* (2005Ki02), based on data in 1994Lh01 and 1982Ka03. Monopole strength ρ=0.237 *25* (1994Lh01), 0.29 *15* (1982Ka03). I(E0)/I(E2(269γ))=0.0130 *16* (1994Lh01).
		636.5 *1*	18.1 *9*	1222.91	2+	E2	0.00209		B(E2)(W.u.)=0.103 *8* Mult.: Q from γγ(θ) in ^{98}Y β^- decay (0.548 s); M2 ruled out by RUL.
2047.71	4+	204.3 *1*	14 *3*	1843.41	4+	[M1+E2]	0.06 *3*		I_γ: other: 21 *7* in ^{248}Cm SF decay. Iγ=67 in ^{252}Cf SF decay is discrepant.
		241.5 *1*	100 *8*	1806.18	3−	[E1]	0.00885		E_γ: other: 240.1 *1* from ^{98}Zr IT decay. I_γ: others: 100 *14* in ^{248}Cm SF decay, 100 in ^{252}Cf SF decay.
		456.8 *2*	11 *3*	1590.78	2+	[E2]			I_γ: other: 21 *7* in ^{248}Cm SF decay. Iγ=67 in ^{252}CF SF decay is discrepant.
		824.8 *2*	28 *3*	1222.91	2+	E2			I_γ: other: 36 *7* in ^{248}Cm SF decay. Iγ=133 in ^{252}Cf SF decay is discrepant. Mult.: γ(θ) in ^{248}Cm SF decay, and ΔJ^π.
2225.15	(2+)	789.0 *2*	45 *9*	1436.17	0+				
		1002.3 *1*	100 *18*	1222.91	2+				
		2225.2 *2*	45 *18*	0.0	0+				
2276.93	(4+)	433.5 *1*	36 *7*	1843.41	4+				I_γ: from ^{98}Y β^- decay (2.32 s).
		686.2 *1*	100 *7*	1590.78	2+				I_γ: 24 in ^{252}Cf SF decay is discrepant.
		1053.9 *1*	100 *7*	1222.91	2+				I_γ: from ^{98}Y β^- decay (2.32 s), 414 from ^{252}Cf SF decay.
2490.98	6+	647.580 *30*	100	1843.41	4+	E2	0.0020		B(E2)(W.u.)=106 *+56−27* Mult.: γ(θ) and γ(pol) in ^{248}Cm SF decay, also supported by γγ(θ) in ^{98}Y β^- decay (2.32 s).
2778.71	(2+)	972.2 *2*	25 *4*	1806.18	3−				
		1033.9 *3*	18 *4*	1744.61	2+				
		1187.8 *2*	14 *4*	1590.78	2+				
		1555.7 *1*	100 *11*	1222.91	2+				
		2779.0 *2*	14 *4*	0.0	0+				
2800.22	5−	752.5 *1*	100 *8*	2047.71	4+				I_γ: others: 100 *19* in ^{98}Zr IT decay, 100 *17* in ^{248}Cm SF decay, 100 in ^{252}Cf SF decay.
		956.6 *2*	13 *4*	1843.41	4+				I_γ: others: 50 *17* in ^{248}Cm SF decay, 12.5 in ^{252}Cf SF decay.
		994.0 *1*	38 *8*	1806.18	3−				I_γ: others: 50 *19* in ^{98}Zr IT decay, 50 *17* in ^{248}Cm SF decay, 63 in ^{252}Cf SF decay.

$^{98}_{40}Zr_{58}$-5

Adopted Levels, Gammas (continued)

γ(^{98}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	α[#]	Comments
3064.37	5$^{(-)}$	1016.7	50 *25*	2047.71	4$^+$			E_γ,I_γ: from ^{248}Cm SF.
		1221.0 *5*	75 *25*	1843.41	4$^+$			Eγ from IT decay. Iγ from ^{248}Cm SF.
		1258.6 *4*	100 *25*	1806.18	3$^-$	Q		E_γ: unweighted average of 1258.9 *1* from ^{98}Y β^- decay (2.32 s) and 1258.2 *2* from ^{98}Zr IT decay (1.9 μs). I_γ: from ^{248}Cm SF. Mult.: γγ(θ) in IT decay.
3065.61	(1)	3065.5 *2*	100	0.0	0$^+$			
3117.10	(6$^+$)	840.1 *1*	100 *11*	2276.93	(4$^+$)			
		1273.7 *2*	28 *11*	1843.41	4$^+$	Q		Mult.: γ(DCO) in ^{248}Cm SF decay.
3216.35	8$^+$	725.4 *1*	100	2490.98	6$^+$	E2	0.00148	B(E2)(W.u.)=54 *13* E_γ: from IT decay. Other: 725.3 *2* in ^{98}Y β^- decay (2.32 s). Mult.: γγ(θ) and γ(pol) in ^{248}Cm SF decay ,also supported by γγ(θ) in ^{252}Cf SF decay and RUL.
3249.02	(5,6,7$^-$)	448.8 *2*	100	2800.22	5$^-$			
3336.4		846[@]	20×10^1 *10*	2490.98	6$^+$			E_γ,I_γ: from ^{248}Cm SF.
		1493.0	100 *50*	1843.41	4$^+$			E_γ,I_γ: from ^{248}Cm SF.
3576.26	(7$^-$)	511.9 *1*	70 *25*	3064.37	5$^{(-)}$			E_γ: from IT decay. I_γ: unweighted average of 111 *25* in IT decay, 50 *25* in ^{248}Cm SF decay and 47 in ^{252}Cf SF decay.
		776.0 *1*	100 *21*	2800.22	5$^-$			E_γ,I_γ: from IT decay. Others: Iγ=100 *50* in ^{248}Cm SF and 100 in ^{252}Cf SF.
3592.2	(7$^-$)	792.0	100	2800.22	5$^-$			
3812.1	(8$^+$)	694.6 *10*	25	3117.10	(6$^+$)			E_γ: from (α,Fγ). Others: 694.3 from ^{248}Cm SF, 694.8 from ^{252}Cf SF. I_γ: from ^{252}Cf SF.
		1321.6	100	2490.98	6$^+$			E_γ: average of 1321.0 from ^{248}Cm SF and 1322.2 from ^{252}Cf SF.
3894.1	(7$^-$)	677.7 *3*	100	3216.35	8$^+$			
3984.73	(10$^+$)	768.4 *1*	100	3216.35	8$^+$	[E2]	0.00127	B(E2)(W.u.)=55 *14* E_γ: from IT decay. Other: 770.0 *10* from (α,Fγ).
4108.67	(1)	2672.7 *2*	60 *10*	1436.17	0$^+$			
		3254.4 *2*	100 *20*	854.06	0$^+$			
		4108.5 *2*	40 *10*	0.0	0$^+$			
4165.18	1$^-$	1099.5 *2*	2.8 *4*	3065.61	(1)			
		1386.3 *1*	11.1 *7*	2778.71	(2$^+$)			
		2305.9 *1*	16.7 *7*	1859.37	0$^+$			
		2420.6 *1*	26.4 *7*	1744.61	2$^+$			
		2574.4 *1*	22.9 *7*	1590.78	2$^+$	(E1)		Mult.: γγ(θ) in ^{235}U(n,Fγ).
		2728.9 *1*	7.6 *4*	1436.17	0$^+$			
		2942.3 *1*	100 *3*	1222.91	2$^+$	(E1)		Mult.: γγ(θ) in ^{98}Y β^- (0.548 s), ^{252}Cf SF, and ^{235}U(n,Fγ).
		3311.1 *1*	52.4 *17*	854.06	0$^+$			
		4164.9 *2*	3.8 *4*	0.0	0$^+$			
4198.88	(9$^-$)	622.6 *1*	100	3576.26	(7$^-$)			E_γ: from IT decay.
4271.11	1$^-$	1492.4 *1*	94 *6*	2778.71	(2$^+$)			
		2045.9 *2*	19 *6*	2225.15	(2$^+$)			

Adopted Levels, Gammas (continued)

γ(^{98}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	δ	α[#]	Comments
4271.11	1⁻	2411.9 *2*	25 *6*	1859.37	0⁺				
		2526.3 *1*	69 *6*	1744.61	2⁺				
		2680.3 *1*	100 *6*	1590.78	2⁺	(E1)			Mult.: γγ(θ) in ^{235}U(n,Fγ).
		2834.4 *3*	25 *6*	1436.17	0⁺				
		3048.3 *1*	56 *6*	1222.91	2⁺				
		3416.9 *1*	63 *6*	854.06	0⁺				
		4271.3 *2*	31 *6*	0.0	0⁺				
4278.79		1787.8 *1*	100	2490.98	6⁺				
4292.41	6⁺	698.6[@]	4.4	3592.2	(7⁻)				E_γ: from ^{252}Cf SF decay only.
		1174.9 *3*	9.2 *15*	3117.10	(6⁺)				
		1492.0 *2*	11.5 *15*	2800.22	5⁻				
		1801.6 *1*	100 *3*	2490.98	6⁺	M1+E2	+0.17 *8*		Mult.: γγ(θ) in ^{98}Y β^- (2.32 s), ^{252}Cf SF, and ^{235}U(n,Fγ). δ: from γγ(θ) in ^{98}Y β^- (2.32 s). Other: −0.77 *12* from γγ(θ) in (n,Fγ).
		2015.4 *2*	5.4 *8*	2276.93	(4⁺)				
		2244.0 *4*	1.5 *8*	2047.71	4⁺				
		2448.8 *2*	3.1 *8*	1843.41	4⁺				
4399.07	1⁻	2174.4 *2*	54 *18*	2225.15	(2⁺)				
		2539.5 *2*	25 *4*	1859.37	0⁺				
		2962.1 *5*	7 *4*	1436.17	0⁺				
		3176.0 *3*	11 *4*	1222.91	2⁺				
		4398.8 *2*	100 *4*	0.0	0⁺				
4452.59	1⁻	2227.3 *2*	5.9 *12*	2225.15	(2⁺)				
		2593.0 *3*	2.9 *6*	1859.37	0⁺				
		2707.8 *3*	3.5 *12*	1744.61	2⁺				
		2861.7 *3*	2.9 *6*	1590.78	2⁺				
		3016.6 *2*	4.7 *6*	1436.17	0⁺				
		3229.8 *2*	35.9 *12*	1222.91	2⁺	E1			Mult.: γγ(θ) in ^{235}U(n,Fγ).
		3598.4 *2*	4.7 *6*	854.06	0⁺				
		4452.4 *2*	100 *4*	0.0	0⁺				
4492.35	1⁻	3056.3 *3*	11 *3*	1436.17	0⁺				
		3638.6 *3*	11 *2*	854.06	0⁺				
		4492.0 *2*	100 *3*	0.0	0⁺				
4545.81	(7⁺)	253.4 *1*	100	4292.41	6⁺	[M1+E2]		0.028 *11*	
4754.71	(12⁺)	770.0 *1*	100	3984.73	(10⁺)				E_γ: from IT decay.
4916.61	(11⁻)	717.7 *1*	100	4198.88	(9⁻)				E_γ: from IT decay.
5589.29	(14⁺)	834.6 *1*	100	4754.71	(12⁺)				E_γ: from IT decay.
5720.94	(13⁻)	804.3 *1*	100	4916.61	(11⁻)				E_γ: from IT decay.
6538.9	(16⁺)	949.6 *10*		5589.29	(14⁺)				E_γ: from (α,Fγ).
6541.37	(15⁻)	820.4 *1*	100 *19*	5720.94	(13⁻)				E_γ,I_γ: from IT decay.
		952.1 *1*	59 *12*	5589.29	(14⁺)				E_γ,I_γ: from IT decay.
6601.9	(17⁻)	63.0 *1*	100	6541.37	(15⁻)	(E2)		5.91 *9*	α(K)=4.52 *7*; α(L)=1.157 *19*; α(M)=0.204 *4*; α(N)=0.0260 *4*; α(O)=0.000682 *11*

$^{98}_{40}Zr_{58}$-7

Adopted Levels, Gammas (continued)

γ(^{98}Zr) (continued)

E_i(level)	J_i^π	E_γ †	E_f	J_f^π	Comments
					α(exp)=5.5 *16* (2006Si36) B(E2)(W.u.)=1.62 *18* E_γ: from IT decay. Mult.: from α(expt)=5.5 *16* (2006Si36), deduced from intensity balance. Value is consistent with E2(+M1), δ>1.25 or E2(+M3), δ<0.09. E_γ: 2006Si36 discussed another scenario for the placement of 63.0γ: two closely-spaced 63.0-keV gamma rays, an E1 to 6540, (16^+) level (from 2004Wu08) and E2 to 6541, (15^-) level, however, based on intensity-balance arguments, this scenario was considered unlikely.
7595.9	(18^+)	1057.0 *10*	6538.9	(16^+)	E_γ: from (α,Fγ).
8725.4	(20^+)	1129.5 *10*	7595.9	(18^+)	E_γ: from (α,Fγ).

† Most γ-ray data for low-spin (J≤2) levels are from ^{98}Y β^- decay (0.548 s), and for high-spin (J>2) are from ^{98}Y β^- decay (2.32 s), based on detailed studies by 2017Ur03, when a level is populated in these decays. Exceptions are noted.

‡ E0 transitions are from ce data in (t,pγ) (1986Me11) and from ^{98}Y β^- decay (0.548 s) (1994Lh01,1982Ka03).

Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

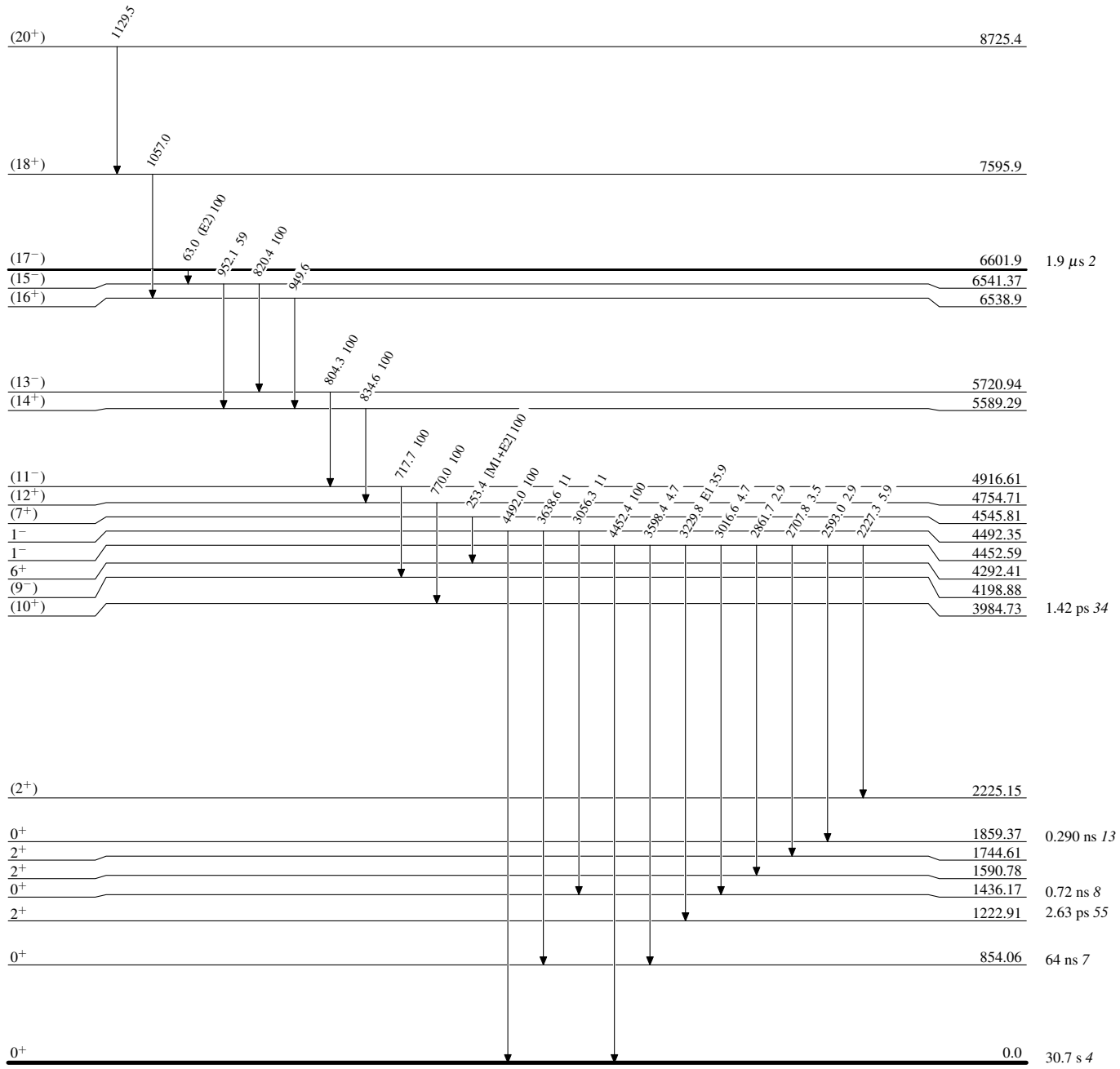
@ Placement of transition in the level scheme is uncertain.

$^{98}_{40}Zr_{58}$-8

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



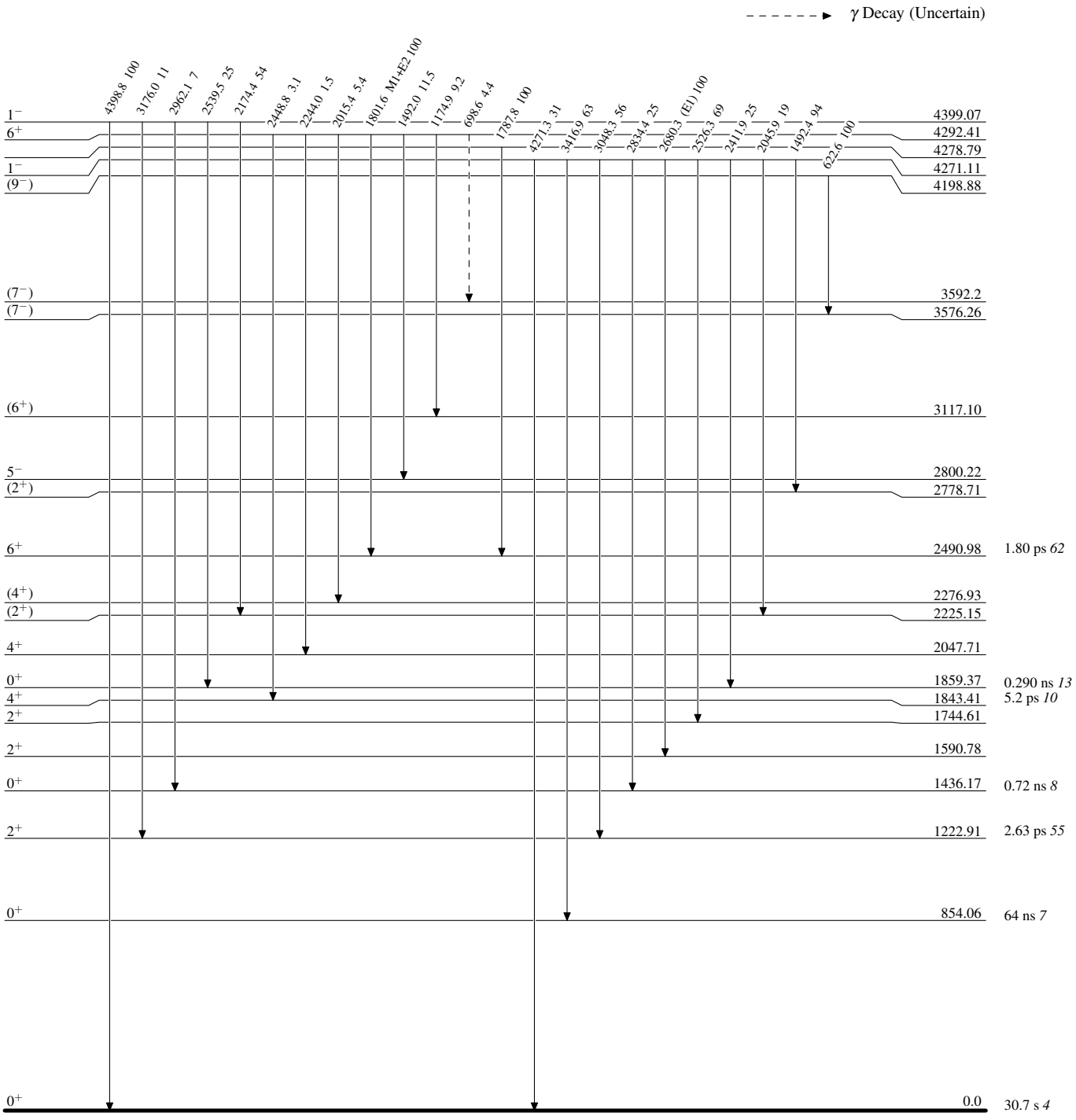
$^{98}_{40}Zr_{58}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{98}_{40}Zr_{58}$

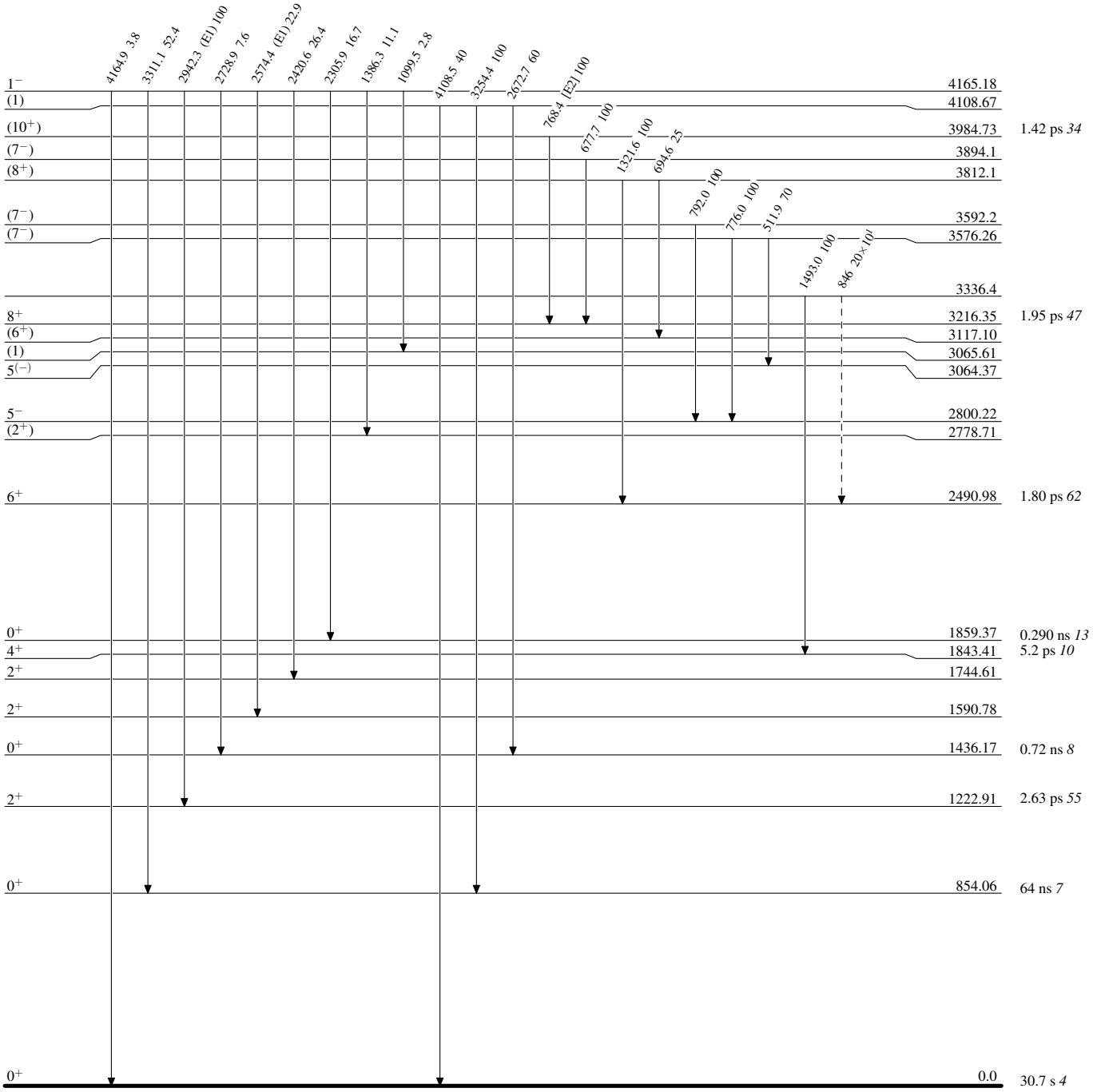
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

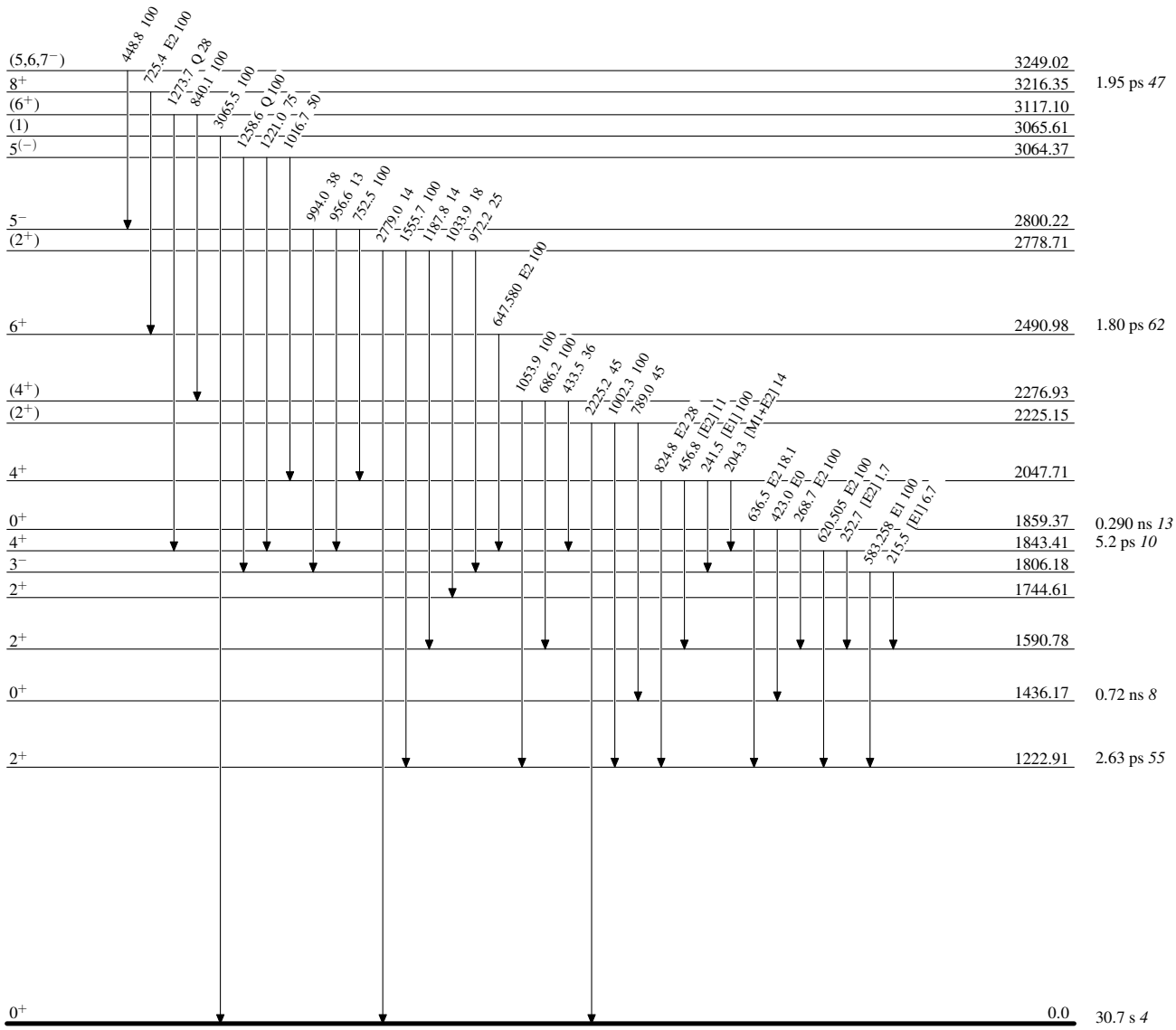


$^{98}_{40}Zr_{58}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{98}_{40}Zr_{58}$

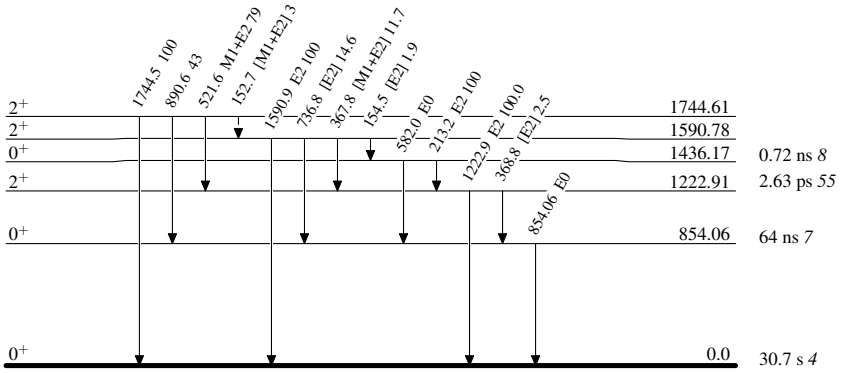
Adopted Levels, Gammas

Legend

Level Scheme (continued)

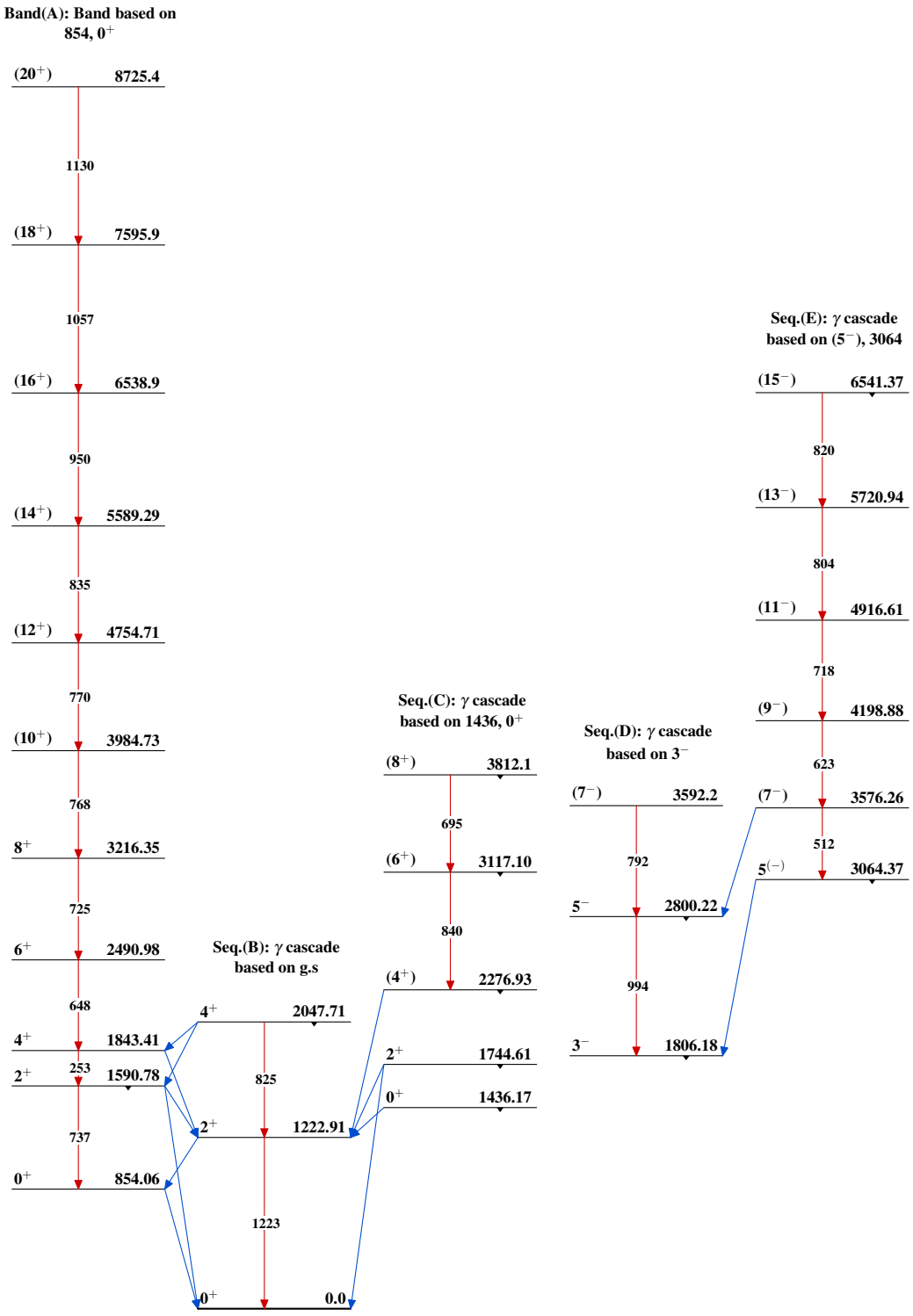
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{98}_{40}Zr_{58}$

Adopted Levels, Gammas



$^{98}_{40}Zr_{58}$