Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 172, 1 (2021)	31-Jan-2021

Q(β^-)=3420 *11*; S(n)=6828 *13*; S(p)=13017 *10*; Q(α)=−5878 *12* 2017Wa10
S(2n)=11233 *12*, S(2p)=24532 *9* (2017Wa10).

Other measurements:
2009Ma47: ^{238}U(^{136}Xe,Fγ),E=954 MeV; measured prompt Eγ, and $\gamma\gamma$-coin using Clara-Prisma spectrometer at LNL-Legnaro. Detected first three γ rays of 213, 352 and 497 keV in the yrast cascade.
2009Sh42: ^{12}C(^{238}U,^{100}Zrγ),E=1.45 GeV; measured Eγ, (^{100}Zr)γ-coin using VAMOS magnetic spectrometer for fragments at GANIL. Detected first five γ rays of 212, 351, 498, 625, and 739 keV in the yrast cascade.
Mass measurements: 2007Ri01, 2006Ha03, 2006Jo14, 2005Jo22, 2004Ri12, 2004Jo18: Penning-trap method at Jyvaskyla, all the papers are from the same group.
Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 110 primary references, 104 dealing with nuclear structure calculations and six with decay modes and half-lives.
Additional information 1.

^{100}Zr Levels

Cross Reference (XREF) Flags

A	^{100}Y β^- decay (732 ms)	E	^{248}Cm,^{252}Cf SF decay	I	^{235}U(n,Fγ),^{241}Pu(n,Fγ)
B	^{100}Y β^- decay (0.94 s)	F	^{252}Cf SF decay	J	^{238}U(α,Fγ)
C	^{101}Y β^-n decay (0.432 s)	G	^{7}Li(^{98}Rb,5nγ),(^{98}Sr,T2NG)		
D	^{248}Cm SF decay	H	^{232}Th(^{7}Li,Fγ)		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[@]	0$^+$	7.1 s *4*	AB DEFGHIJ	%β^-=100 T$_{1/2}$: from growth and decay of ^{100}Nb in a chemically separated zirconium fraction (1976Ah06, earlier value of 7.1 s *2* in 1972Tr08). Others: 7.0 s *5* (1977Pf01), 6.6 s *2* (1970Ei02), 7.1 s *7* (1969WiZX). Note that in 1972Tr08, 1970Ei02 and 1969WiZX, the half-life was incorrectly assigned to ^{100}Nb decay based on γ(t) in the decay daughter ^{100}Mo, which however could account for the mixture of ^{100}Zr and ^{100}Nb decays that have comparable half-lives. Additional information 2. Evaluated rms charge radius <r^2>$^{1/2}$=4.489 fm *29* (2013An02). Evaluated δ<r^2>$^{1/2}$(^{90}Zr,^{100}Zr)=1.669 fm^2 *4* (2013An02). δ<r^2>(^{90}Zr,^{100}Zr)=1.666 fm^2 *41* (2003Th03, also 2002Ca37,2005Bi25), uncertainty is primarily systematic, statistical uncertainty is 0.004. From β-strength distributions evaluated by 2019Gu20 in their TAGS for the decay of ^{100}Zr and comparison with quasiparticle random-phase approximation (QRPA), suggest a prolate configuration for the ground state of ^{100}Zr (see plot of B(GT) versus E(level) in ^{100}Nb in Fig. 9 of 2019Gu20).
212.61[@] *4*	2$^+$	0.574 ns *15*	AB DEFGHIJ	μ=+0.56 *6* (2004Sm04) Additional information 3. J$^\pi$: 212.5γ E2 to 0$^+$. T$_{1/2}$: from weighted average of following values: 0.582 ns *13* (2017An15) from $\gamma\gamma$(t) in (n,Fγ); 0.55 ns *2* (1989Ma47), 0.54 ns *4* (1989Oh06), 0.40 ns *8* (1989Lh01) from $\gamma\gamma$(t) in β^- decay (732 ms); 0.643 ns *52* (2002Sm10), 0.71 ns *3* (1975JaYL, 1974JaZN, 1974JaYY), 0.52 ns *10* (1970Ch11, 1972Wi15), 0.62 ns *10* (1980ChZM), from recoil distance method in ^{252}Cf SF. Others

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Adopted Levels, Gammas (continued)

^{100}Zr Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
				(discrepant) results: 0.20 ns *3* (1983MaYT, RDM), 2.8 ns *9* (1972ClZN, 1974ClZX, γγ(t)), and 7 ns *2* from (fragment)γ(t) (1970Jo20), in ^{252}Cf SF. In the averaging procedure, uncertainty for value in 1975JaYL was doubled as complete details of this measurement are not available. Note that in 2016Pr01 evaluation $T_{1/2}$=0.548 ns *+18−24*, where values from 2017An15 and 2002Sm10 were not included. In our case, excluding the value from 2002Sm10 makes insignificant difference in the final value. μ: from g factor=+0.30 *3* measured by γ(θ,H,t) (integral PAC method) for 352γ-213γ and 497γ-213γ correlations in ^{252}Cf SF decay (2004Sm04), with a correction using adopted $T_{1/2}$=0.574 ns *15*. Value of μ=+0.60 *6* implied by g factor=0.30 *3* in 2004Sm04 (also in 2014StZZ) using $T_{1/2}$=0.54 ns *2* from 1997Si09 evaluation. Other: 0.44 *10* from γγ(θ,H,t) (integral PAC technique) in ^{100}Y β⁻ decay (1980Wo09) using $T_{1/2}$=0.71 ns *3* from 1975JaYL, revised to 0.52 ns *12* in 1989Wo05.
331.23& *4*	0⁺	5.53 ns *15*	AB EF	Jπ: (118.6γ)(212.5γ)(θ) in β⁻ decay decay (732 ms) and RUL give 2⁺ for 212.5 level and 0⁺ for 331.1 level. $T_{1/2}$: from β⁻ decay. E0 transition strength analyzed: 2004Vo13 (also 2005We15).
564.57@ *5*	4⁺	37.0 ps *4*	AB DEFGHIJ	Jπ: γγ(θ) in ^{248}Cm,^{256}Cf SF decay; 351.96γ, E2 to 2⁺. $T_{1/2}$: average of 37.0 ps *4* (2002Sm10, differential plunger method) in ^{252}SF decay and 37 ps *4* (1989Oh06, βγγ(t)) in β⁻ decay (732 ms). Other: 25.6 ps *28* (γγ(t) in (n,Fγ), 2017An15) seems discrepant.
829.28 *8*	0⁺		A	Jπ: spin from γγ(θ), parity from RUL (negative parity would require mult(616.7γ)=M2 and thus an isomeric $T_{1/2}$(829 level)>16 ns by RUL, which is unlikely).
878.72& *4*	2⁺		AB EF	Jπ: γγ(θ) consistent with 2 → 2→ 0 spin sequence; 547.4γ and 878.5γ to 0⁺; 314.3γ to 4⁺; band member.
1061.87@ *6*	6⁺	5.2 ps *11*	B DEFGHIJ	Jπ: γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 497.1γ, E2 to 4⁺. $T_{1/2}$: weighted average of 4.9 ps *11* from time-gated plunger method in ^{252}Cf SF decay (2002Sm10) and 8.3 ps *35* from γγ(t) in (n,Fγ) (2017An15).
1196.23 *4*	(2⁺)		AB	Jπ: 865.1γ and 1196.1γ to 0⁺ and 631.8γ to (4⁺).
1294.94 *5*	(2⁻,3)		A	Jπ: 1082.3γ to 2⁺, no γ to 0⁺ states; possible β⁻ feeding from (1)⁻ parent.
1398.23e *8*	(3⁺)		B E	Jπ: 1185.4γ to 2⁺; 833.5γ to (4⁺); member of a sequence.
1414.82& *6*	4⁺		B DEF J	Jπ: γγ(θ) in ^{248}Cm,^{252}Cf SF decay (2019Ur01); 850.2γ (M1+E2) to (4⁺); 536.05γ and 1202.2γ to 2⁺.
1441.51 *7*	(1,2⁺)		AB	Jπ: 1110.3γ and 1441.3γ to 0⁺.
1687.42@ *7*	8⁺	1.75 ps *17*	DEFGHIJ	Jπ: γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 625.5γ, ΔJ=2, E2 to (6⁺). $T_{1/2}$: average of 1.73 ps *17* from time-gated plunger method in ^{252}Cf SF decay (2002Sm10), and 1.77 ps *21* from DSAM (1996Sm04,2012Sm02) in ^{248}Cm SF decay.
1807.67 *5*	(1,2⁺)		A	Jπ: 978.4γ, 1476.5γ and 1807.9γ to 0⁺.
1856.11 *8*	4(+)		B DEF J	Jπ: J=4 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay; (M1+E2) γ to 4⁺; γ to 2⁺.
1911.23 *17*	(2⁺,3,4⁺)		F	Jπ: 1698.6γ to 2⁺, 496.5γ to (4⁺).
1938.23 *6*	(1,2⁺)		A	Jπ: 1109.1γ and 1937.9γ to 0⁺.
1961.86& *6*	(6⁺)		B EF	Jπ: J=6 or 7 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 547.0 and 1397.1γ to (4⁺); band member.
2003.2? *4*			B	
2070.49 *15*	(3,4⁺)		B	Jπ: 1857.8γ to 2⁺, 1505.5γ to (4⁺); possible direct β⁻ feeding from 4⁺ parent.
2130.53a *9*	(5⁺)		E	Jπ: J=5 or 4 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 547.0 and 1397.1γ

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Adopted Levels, Gammas (continued)

^{100}Zr Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
				to (4^+).
2183.01 *9*	$(1,2^+)$		A	Jπ: 2182.3γ to 0^+.
2208.40[e] *8*	(5^+)		E	Jπ: γγ(θ) in ^{248}Cm,^{252}Cf SF decay allows 4,5,6; 1643.8γ, D+Q to 4^+; member of a sequence.
2220.4 *3*	$(2^+,3,4^+)$		B	Jπ: 2008.0γ to 2^+ and 1655.8γ to (4^+).
2244.63[d] *10*	$4^{(+)}$		E	Jπ: J=4 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay.
2259.87[b] *15*	(6^+)#	2.5 ns *7*	D F J	Jπ: 845.2γ and 1695.2γ to (4^+), 403.7γ and 1198.2γ to (6^+). $T_{1/2}$: time-gated γγγ coincidence method (2006Hw01) in ^{252}Cf SF decay.
2316.14[c] *20*	$(5^-,6^+)$		F	Jπ: 1751.5γ to (4^+) and 1254.2γ (6^+); probable bandhead of $K^\pi=(5^-)$ or (6^+).
2349.44 *18*	$(3,4^+)$		B	Jπ: 1153.0γ and 1471.0γ to (2^+); possible direct β^- feeding from 4^+ parent.
2426.41[@] *12*	10^+	0.75 ps *9*	DEF HIJ	Jπ: γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 739.0γ, ΔJ=2, E2 to 8^+. $T_{1/2}$: Doppler-broadened line shape analysis (2012Sm02,1996Sm04).
2467.51 *21*			F	
2471.80 *12*	(6^+)		E	
2479.65[b] *24*	(7^+)#		D F J	
2496.6 *3*			F	
2526.11[a] *7*	(7^+)		EF	
2579.54[&] *8*	(8^+)		EF	Jπ: 617.6γ to (6^+); band member.
2609.57[d] *12*	(6^+)		E	Jπ: 364.9γ to 4^+; 1547.9γ to 6^+; member of a sequence.
2692.84 *9*	$(1,2^+)$		A	Jπ: 2692.6γ to 0^+.
2727.43 *22*	$(1,2^+)$		A	Jπ: 2396.2γ and 2728.0γ to 0^+.
2730.0[b] *3*	(8^+)#		D F J	
2755.05[c] *23*			F	
2770.76 *8*	$(1,2^+)$		A	Jπ: 2439.4γ and 2770.4γ to 0^+.
2776.09[e] *11*	(7^+)		E	Jπ: 567.2γ to (5^+); 1714.3γ to 6^+; member of a sequence.
2846.34 *7*	$(1,2^+)$		A	Jπ: 2017.0γ, 2515.1γ and 2846.2γ to 0^+.
2859.72 *25*			F	
2932.10 *13*	$(1,2^+)$		A	Jπ: 2600.95γ and 2932.1γ to 0^+.
3013.8[b] *3*	(9^+)#		D F J	
3019.65[a] *8*	$9^{(+)}$		EF	Jπ: J=9 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay; 1332.15γ to 8^+; 493.55γ to $7^{(+)}$; band assignment.
3022.30[c] *24*			F	
3069.82 *20*	$(1,2^+)$		A	Jπ: 2240.5γ and 2738.6γ to 0^+.
3100.27[d] *15*	(8^+)		E	Jπ: 490.7γ to (6^+); band assignment.
3268.11[@] *23*	(12^+)	0.37 ps *4*	DEF H J	Jπ: 841.7γ to 10^+; band member. $T_{1/2}$: Doppler-broadened line shape analysis (2012Sm02,1996Sm04).
3289.13[&] *23*	(10^+)		E	Jπ: 709.5γ to (8^+); band member.
3323.6[c] *3*			F	
3328.6[b] *4*	(10^+)#		D F J	Jπ: 598.6γ to (8^+), 314.8γ to (9^+); possible band assignment.
3571.8 *3*	$(1,2^+)$		A	Jπ: 3571.8γ to 0^+.
3635.46[a] *12*	(11^+)		EF	Jπ: 615.8γ and 1209.1γ to (10^+); band assignment.
3660.3[c] *4*			F	
3673.1[b] *4*	(11^+)#		F J	
3747.38[d] *25*	(10^+)		E	Jπ: 647.1γ to (8^+); band member.
3956.64 *24*	$(1,2^+)$		A	Jπ: 3956.8γ to 0^+.
4043.1[b] *4*	(12^+)#		J	Jπ: 369.9γ to (11^+) and 714.7γ to (10^+); possible band assignment.
4204.8[@] *4*	(14^+)		F J	XREF: F(?). Jπ: 936.7γ to (12^+); band member.
4288.4 *4*	$(1,2^+)$		A	Jπ: 4288.1γ to 0^+.

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Adopted Levels, Gammas (continued)

^{100}Zr Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
4377.1[a] 5	(13+)	E	Jπ: 741.6γ to (11+); band member.
4440.5[b] 4	(13+)[#]	J	Jπ: 397.5γ to (12+) and 767.4γ to (11+); possible band assignment.
5237.1[@] 5	(16+)	J	Jπ: 1032.3γ to (14+); band member.
6371.2[@] 6	(18+)	J	Jπ: 1134.1γ to (18+); band member.
7615.0?[@] 7	(20+)	J	Jπ: 1243.8γ to (14+); band member.

[†] From least-squares fit to Eγ data, keeping the energy of the first 2+ level fixed at 212.61 *4*, and assuming Δ(Eγ)=0.3 keV when not stated.

[‡] For high-spin (J>5) states, the assignments are essentially based on yrast type of population in high-spin studies (from SF decay studies) where ascending order of spins are expected as the excitation energy increases complemented by band associations.

[#] Probable band member with bandhead at 6+ (2006Hw04,1995Du10). Note that 5− bandhead was assigned in an earlier study from the same group (1995HaZT).

[@] Band(A): g.s. band. Proposed configuration=$\nu h^2_{11/2}\otimes\nu 9/2[404]^{-2}$, prolate structure (2019Ur01), same as for ^{98}Sr.

[&] Band(B): Band based on 331, 0+. Band assignment from 2006Hw04 and 2019Ur01 (also 2019Ur02). Proposed configuration=$\nu 11/2[505]^2\otimes\nu 9/2[404]^{-2}$, oblate structure (2019Ur01), same as for ^{98}Sr.

[a] Band(C): Band based on 5(+) state. Band assignment from 2019Ur02.

[b] Band(D): ΔJ=1, K^π=(6+) band. Probable configuration=$\nu 9/2[404]\otimes\nu 3/2[411]$ (2004Hu02,2006Hw04, 1995Du10). However, K^π=(5−) is assigned by 1997Ha64 (also in 2006Hw01) with configuration=$\pi 5/2[422]\otimes\pi 5/2[303]$. On the basis of agreement of calculated $(g_K-g_R)/Q_0$=0.13 with experimental value of 0.12 *1*, 2004Hu02 support 2-quasineutron configuration with $K^\pi=6^+$ rather than the 2-quasiproton configuration with $K^\pi=5^-$ which gives calculated $(g_K-g_R)/Q_0$=0.16.

[c] Band(E): Possible ΔJ=1 band. Band assignment from 2006Hw04.

[d] Band(F): Band based on 4+ state. Band assignment from 2019Ur02.

[e] Seq.(G): γ cascade based on (3+). Sequence assignment from 2019Ur02.

Adopted Levels, Gammas (continued)

γ(^{100}Zr)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.&	δ	α[a]	$I_{(\gamma+ce)}$	Comments
212.61	2+	212.61 *4*	100	0.0	0+	E2		0.0723		B(E2)(W.u.)=77 *2* E_γ: unweighted average of 212.531 *9* and 212.62 *7* in ^{100}Y β^- decay (732 ms); and 212.67 *3* in ^{248}Cm,^{252}Cf SF decay. Others: 212.5 *1* and 212.5 *3* in ^{100}Y β^- decay (0.94 s). Mult.: $\gamma\gamma(\theta)$ in ^{252}Cf SF decay and RUL.
331.23	0+	118.63 *5*	100 *6*	212.61	2+	E2		0.597		B(E2)(W.u.)=67 *6* E_γ: weighted average of 118.59 *7* in ^{100}Y β^- decay (732 ms), 118.6 *2* in β^- decay (0.94 s) and 118.65 *5* in ^{248}Cm,^{252}Cf SF decay.
		331.1		0.0	0+	E0			76 *19*	E_γ: from level-energy difference. $I_{(\gamma+ce)}$: from branching(118γ)=0.68 *6* from ^{100}Y β^- decay (732 ms) (1986Wo01). q^2_K(E0/E2)=1.7 *3*, X(E0/E2)=0.060 *11*, ρ^2(E0)=0.108 *19* (2005Ki02, evaluation). B(E0)(Wilkinson units)=0.41 *13*.
564.57	4+	351.966 *13*	100	212.61	2+	E2		0.01268		B(E2)(W.u.)=101.4 *11* E_γ: weighted average of 351.960 *12* and 352.08 *8* in ^{100}Y β^- decay (732 ms); and 351.99 *3* in ^{248}Cm,^{252}Cf SF decay. Others: 351.8 *2* and 351.9 *3* in ^{100}Y β^- decay (0.94 s). Mult.: $\gamma\gamma(\theta)$ in ^{248}Cm,^{252}Cf SF decay and RUL.
829.28	0+	616.67 *7*	100	212.61	2+					
878.72	2+	314.3 *3*	0.9 *3*	564.57	4+					I_γ: weighted average of 0.8 *3* from ^{100}Y β^- decay (732 ms) and 1.0 *5* from ^{100}Y β^- decay (0.94 s). γ not reported in ^{248}Cm,^{252}Cf SF decay.
		547.41 *7*	30 *4*	331.23	0+					E_γ: weighted average of 547.37 *7* in ^{100}Y β^- decay (732 ms); 547.4 *2* in ^{100}Y β^- decay (0.94 s); and 547.5 *1* in ^{248}Cm,^{252}Cf SF decay. I_γ: weighted average of 26 *4* in ^{100}Y β^- decay (732 ms); 37 *6* in ^{100}Y β^- decay (0.94 s); and 34 *7* in ^{248}Cm,^{252}Cf SF decay.
		666.00 *12*	100 *6*	212.61	2+	(M1+E2)	+1.0 *3*			E_γ: unweighted average of 665.98 *7* in ^{100}Y β^- decay (732 ms); 665.8 *2* in ^{100}Y β^- decay (0.94 s); and 666.23 *7* in ^{248}Cm,^{252}Cf SF decay. Mult.,δ: from (666γ)(213γ)(θ) (1986Wo01) in β^- decay (732 ms) and Δπ=no.
		878.64 *9*	52 *4*	0.0	0+					E_γ: weighted average of 878.54 *8* in ^{100}Y β^- decay (732 ms); 878.6 *2* in ^{100}Y β^- decay (0.94 s); and 878.8 *1* in ^{248}Cm,^{252}Cf SF decay. E_γ: other: 878.6 *2* from β^- decay (0.94 s). I_γ: weighted average of 52 *4* from ^{100}Y β^- decay (732 ms); 58 *8* from ^{100}Y β^- decay (0.94 s); and 48 *7* in ^{248}Cm,^{252}Cf SF decay.

From ENSDF

$^{100}_{40}Zr_{60}$-5

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ	α[a]	Comments
1061.87	6$^+$	497.36[@] *5*	100	564.57	4$^+$	E2		0.00426	B(E2)(W.u.)=130 *+35−23* Mult.: γγ(θ) in ^{248}Cm,^{252}Cf SF decay; and RUL.
1196.23	(2$^+$)	317.8 *2*	4.0 *8*	878.72	2$^+$				
		631.81 *8*	21.4 *20*	564.57	4$^+$				E_γ: weighted average of 631.84 *8* from ^{100}Y β^- decay (732 ms) and 631.6 *2* from ^{100}Y β^- decay (0.94 s). I_γ: weighted average of 22.0 *20* from ^{100}Y β^- decay (732 ms) and 19 *4* from ^{100}Y β^- decay (0.94 s).
		865.04 *8*	65 *4*	331.23	0$^+$				E_γ: weighted average of 865.05 *8* from ^{100}Y β^- decay (732 ms) and 865.0 *2* from ^{100}Y β^- decay (0.94 s). I_γ: weighted average of 64 *4* from ^{100}Y β^- decay (732 ms) and 71 *12* from ^{100}Y β^- decay (0.94 s).
		983.56 *10*	34 *4*	212.61	2$^+$				E_γ: weighted average of 983.59 *8* from ^{100}Y β^- decay (732 ms) and 983.2 *3* from ^{100}Y β^- decay (0.94 s). I_γ: weighted average of 34 *4* from ^{100}Y β^- decay (732 ms) and 35 *6* from ^{100}Y β^- decay (0.94 s).
		1196.09 *7*	100 *6*	0.0	0$^+$				E_γ: weighted average of 1196.08 *7* from ^{100}Y β^- decay (732 ms) and 1196.2 *2* from ^{100}Y β^- decay (0.94 s).
1294.94	(2$^-$,3)	416.01 *11*	10.0 *12*	878.72	2$^+$				
		1082.33 *8*	100 *9*	212.61	2$^+$				
1398.23	(3$^+$)	833.4 *2*	20 *6*	564.57	4$^+$				E_γ: weighted average of 833.5 *3* in ^{100}Y β^- decay (0.94 s); and 833.4 *2* in ^{248}Cm,^{252}Cf SF decay. I_γ: weighted average of 16 *6* in ^{100}Y β^- decay (0.94 s); and 24 *6* in ^{248}Cm,^{252}Cf SF decay.
		1185.6 *1*	100 *9*	212.61	2$^+$				E_γ: weighted average of 1185.4 *3* in ^{100}Y β^- decay (0.94 s); and 1185.6 *1* in ^{248}Cm,^{252}Cf SF decay.
1414.82	4$^+$	353.0	6.5 *22*	1061.87	6$^+$				E_γ,I_γ: from ^{100}Y β^- decay (0.94 s), γ not reported in SF decays.
		536.05[@] *5*	63[@] *6*	878.72	2$^+$				
		850.24[@] *5*	100[@] *10*	564.57	4$^+$	(M1+E2)	+0.99 *6*		δ: from γγ(θ) in ^{248}Cm,^{252}Cf SF decay (2019Ur01). Other: +1.4 *+4−2* from γγ(θ) in ^{252}Cf SF decay (2008GoZL).
		1202.2[@] *2*	12[@] *4*	212.61	2$^+$				
1441.51	(1,2$^+$)	1110.3 *3*	65 *20*	331.23	0$^+$				E_γ: weighted average of 1110.5 *3* from ^{100}Y β^- decay (732 ms) and 1110.1 *3* from ^{100}Y β^- decay (0.94 s). I_γ: weighted average of 48 *14* in ^{100}Y β^- decay (735 ms) and 88 *16* in ^{100}Y β^- decay (0.94 s).
		1228.99 *8*	100 *10*	212.61	2$^+$				E_γ: other: 1229.0 *3* from ^{100}Y β^- decay (0.94 s).
		1441.3 *2*	21 *4*	0.0	0$^+$				E_γ: weighted average of 1441.2 *3* from ^{100}Y β^- decay (732 ms) and 1441.4 *2* from ^{100}Y β^- decay (0.94 s). I_γ: from ^{100}Y β^- decay (735 ms). Other: 73 *12* from ^{100}Y β^- decay (0.94 s). Branching ratios from the decays of two ^{100}Y activities are in disagreement.

From ENSDF

$^{100}_{40}Zr_{60}$-6

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ	α[a]	Comments
1687.42	8$^+$	625.55[@] *5*	100	1061.87	6$^+$	E2		0.0022	B(E2)(W.u.)=122 *12* Mult.: γγ(θ) in ^{248}Cm,^{252}Cf SF decay and RUL.
1807.67	(1,2$^+$)	512.60 *7*	10 *3*	1294.94	(2$^-$,3)				
		611.60 *11*	28 *3*	1196.23	(2$^+$)				
		978.37 *12*	40 *4*	829.28	0$^+$				
		1476.53 *14*	73 *8*	331.23	0$^+$				
		1595.16 *17*	100 *13*	212.61	2$^+$				
		1807.9 *2*	67 *13*	0.0	0$^+$				
1856.11	4$^{(+)}$	441.0[@] *3*	17[@] *6*	1414.82	4$^+$				
		457.7[@] *2*	39[@] *11*	1398.23	(3$^+$)				
		977.4[@] *1*	50[@] *11*	878.72	2$^+$				
		1291.6[@] *1*	100[@] *11*	564.57	4$^+$	(M1+E2)	−2.8 *7*		δ: from γγ(θ) in ^{248}Cm,^{256}Cf SF decay. Mult.: large D+Q mixing ratio favors M1+E2 over E1+M2.
		1643.5[@] *3*	22[@] *11*	212.61	2$^+$				
1911.23	(2$^+$,3,4$^+$)	496.5[‡]	31[‡]	1414.82	4$^+$				
		1346.6[‡]	100[‡]	564.57	4$^+$				
		1698.6[‡]	3.4[‡]	212.61	2$^+$				
1938.23	(1,2$^+$)	496.88 *13*	13.7 *20*	1441.51	(1,2$^+$)				
		643.43 *12*	6.7 *9*	1294.94	(2$^-$,3)				
		741.99 *7*	69 *5*	1196.23	(2$^+$)				
		1059.51 *7*	100 *7*	878.72	2$^+$				
		1109.1 *3*	11 *3*	829.28	0$^+$				
		1608.0[b]	17	331.23	0$^+$				
		1725.44 *16*	10.7 *17*	212.61	2$^+$				
		1937.9 *3*	11.2 *14*	0.0	0$^+$				
1961.86	(6$^+$)	547.00[@] *5*	100[@] *11*	1414.82	4$^+$				
		900.00[@] *5*	89[@] *11*	1061.87	6$^+$	(M1+E2)	+0.74 *7*		δ: from γγ(θ) in ^{248}Cm,^{256}Cf SF decay for J=6 for 1961 level. Mult.: large D+Q mixing ratio favors M1+E2 over E1+M2.
2003.2?		1438.6[#b] *4*	100	564.57	4$^+$				
2070.49	(3,4$^+$)	672.4 *2*	32 *6*	1398.23	(3$^+$)				
		874.3 *3*	39 *8*	1196.23	(2$^+$)				
		1191.6 *3*	100 *8*	878.72	2$^+$				
		1505.5 *5*	14 *4*	564.57	4$^+$				
		1857.8 *4*	35 *9*	212.61	2$^+$				
2130.53	(5$^+$)	715.6[@] *2*	71[@] *28*	1414.82	4$^+$				
		1566.05[@] *15*	100[@] *28*	564.57	4$^+$	D+Q			δ: +0.01 *9* or +25 *18* for J(2131 level)=5 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay.
2183.01	(1,2$^+$)	244.80 *8*	100 *8*	1938.23	(1,2$^+$)				
		2182.3 *5*	57 *15*	0.0	0$^+$				

From ENSDF

$^{100}_{40}Zr_{60}$-7

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ	α[a]	Comments
2208.40	(5$^+$)	352.3[@] *3*	31[@] *16*	1856.11	4$^{(+)}$				
		793.4[@] *2*	77[@] *15*	1414.82	4$^+$				
		810.1[@] *1*	100[@] *23*	1398.23	(3$^+$)				
		1643.8[@] *1*	85[@] *15*	564.57	4$^+$	D+Q			δ: +0.24 *9* or +3 *1* for J(2208 level)=5 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay.
2220.4	(2$^+$,3,4$^+$)	1655.8[#] *3*	100[#] *17*	564.57	4$^+$				
		2008.0[#b] *8*	22[#] *14*	212.61	2$^+$				
2244.63	4$^{(+)}$	1680.0[@] *1*	100	564.57	4$^+$	(M1+E2)	−1.7 *3*		δ: from γγ(θ) in ^{248}Cm,^{252}Cf SF decay. Mult.: large D+Q mixing ratio favors M1+E2 over E1+M2.
2259.87	(6$^+$)	403.7	5.7	1856.11	4$^{(+)}$	[E2]		0.0081	B(E2)(W.u.)=0.024 *+10−7* E_γ: average of 404.0 in ^{252}Cf SF decay and 403.4 in (α,Fγ). I_γ: from ^{252}Cf SF decay. Uncertainty of 20% assumed for B(E2)(W.u.).
		845.2	100	1414.82	4$^+$	[E2]			B(E2)(W.u.)=0.010 *+6−4* E_γ: average of 845.1 in ^{252}Cf SF decay and 845.3 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		1198.2	20	1061.87	6$^+$				E_γ: average of 1197.9 in ^{252}Cf SF decay and 1798.5 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		1695.2[‡]	56[‡]	564.57	4$^+$	[E2]			B(E2)(W.u.)=0.00018 *+11−8* E_γ,I_γ: from ^{252}Cf SF decay.
2316.14	(5$^-$,6$^+$)	1254.2[‡]	100[‡]	1061.87	6$^+$				
		1751.5[‡]	85[‡]	564.57	4$^+$				
2349.44	(3,4$^+$)	907.8[#] *3*	51[#] *6*	1441.51	(1,2$^+$)				
		1153.0[#] *3*	41[#] *6*	1196.23	(2$^+$)				
		1471.0[#] *3*	100[#] *11*	878.72	2$^+$				
		2137.0[#b] *8*	16[#] *6*	212.61	2$^+$				
2426.41	10$^+$	739.0[@] *1*	100	1687.42	8$^+$	E2		0.00141	B(E2)(W.u.)=124 *+18−14* E_γ: average of 738.6 in ^{248}Cm SF decay and 739.1 in ^{252}Cf SF decay, and 739.3 in (α,Fγ).
2467.51		556.3[‡]	45[‡]	1911.23	(2$^+$,3,4$^+$)				
		1405.6[‡]	100[‡]	1061.87	6$^+$				
2471.80	(6$^+$)	615.7[@] *2*	40[@] *20*	1856.11	4$^{(+)}$				
		1409.7[@] *2*	100[@] *40*	1061.87	6$^+$				
		1907.5[@] *2*	40[@] *20*	564.57	4$^+$				
2479.65	(7$^+$)	219.9	100	2259.87	(6$^+$)				E_γ: average of 219.5 in ^{252}Cf SF decay and 220.2 in (α,Fγ).
2496.6		1434.7[‡]	100	1061.87	6$^+$				

From ENSDF

$^{100}_{40}Zr_{60}$-8

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ	Comments
2526.11	(7$^+$)	395.6[@] *1*	10[@] *5*	2130.53	(5$^+$)			
		564.2[@] *1*	45[@] *10*	1961.86	(6$^+$)			
		1464.25[@] *7*	100[@] *15*	1061.87	6$^+$	D(+Q)	+0.04 *3*	δ: +0.02 *3* or +0.05 *3* for J(2526 level)=7 from γγ(θ) in ^{248}Cm,^{252}Cf SF decay.
2579.54	(8$^+$)	617.65[@] *8*	100[@] *14*	1961.86	(6$^+$)			
		892.15[@] *5*	71[@] *21*	1687.42	8$^+$			
2609.57	(6$^+$)	364.9[@] *1*	86[@] *29*	2244.63	4$^{(+)}$			
		479.0[@] *2*	100[@] *29*	2130.53	(5$^+$)			
		1547.9[@] *2*	29[@] *15*	1061.87	6$^+$			
2692.84	(1,2$^+$)	754.54 *23*	8.3 *19*	1938.23	(1,2$^+$)			
		885.18 *11*	21.1 *19*	1807.67	(1,2$^+$)			
		1814.9 *6*	6.2 *19*	878.72	2$^+$			
		2480.17 *17*	100 *9*	212.61	2$^+$			
		2692.6 *4*	6.7 *19*	0.0	0$^+$			
2727.43	(1,2$^+$)	919.3 *4*	15 *4*	1807.67	(1,2$^+$)			
		2396.2 *3*	100 *11*	331.23	0$^+$			
		2728.0 *5*	38 *10*	0.0	0$^+$			
2730.0	(8$^+$)	250.3	100	2479.65	(7$^+$)			E_γ: average of 250.4 in ^{252}Cf SF decay and 250.2 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		470.2	4	2259.87	(6$^+$)			E_γ: average of 469.9 in ^{252}Cf SF decay and 470.4 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
2755.05		275.6[‡]	100[‡]	2479.65	(7$^+$)			
		438.8[‡]	4[‡]	2316.14	(5$^-$,6$^+$)			
2770.76	(1,2$^+$)	832.64 *10*	9.9 *8*	1938.23	(1,2$^+$)			
		1329.6 *4*	3.0 *8*	1441.51	(1,2$^+$)			
		1891.8 *2*	25 *3*	878.72	2$^+$			
		2439.39 *18*	100 *8*	331.23	0$^+$			
		2557.8 *4*	6.2 *10*	212.61	2$^+$			
		2770.4 *3*	86 *7*	0.0	0$^+$			
2776.09	(7$^+$)	304.5[@] *3*	8[@] *4*	2471.80	(6$^+$)			
		567.2[@] *2*	16[@] *8*	2208.40	(5$^+$)			
		1714.3[@] *1*	100[@] *12*	1061.87	6$^+$			
2846.34	(1,2$^+$)	908.09 *12*	7.4 *8*	1938.23	(1,2$^+$)			
		1038.68 *12*	9.9 *18*	1807.67	(1,2$^+$)			
		1551.4 *2*	13.3 *16*	1294.94	(2$^-$,3)			
		2017.0 *3*	12.4 *12*	829.28	0$^+$			
		2515.13 *14*	100 *6*	331.23	0$^+$			
		2633.7 *3*	13.1 *17*	212.61	2$^+$			
		2846.2 *2*	69 *5*	0.0	0$^+$			
2859.72		392.2[‡]	38[‡]	2467.51				

From ENSDF

$^{100}_{40}Zr_{60}$-9

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[&]	δ	Comments
2859.72		1172.3[‡]	100[‡]	1687.42	8^+			
2932.10	$(1,2^+)$	1637.0 *3*	10.5 *16*	1294.94	$(2^-,3)$			
		2600.95 *18*	100 *7*	331.23	0^+			
		2719.2 *3*	17.9 *21*	212.61	2^+			
		2932.1 *3*	61 *5*	0.0	0^+			
3013.8	(9^+)	283.8	100	2730.0	(8^+)			E_γ: average of 283.9 in ^{252}Cf SF decay and 283.7 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		534.1	24	2479.65	(7^+)			E_γ: average of 534.3 in ^{252}Cf SF decay and 533.9 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
3019.65	$9^{(+)}$	440.15[@] *7*	16[@] *4*	2579.54	(8^+)			
		493.55[@] *5*	52[@] *8*	2526.11	(7^+)			
		1332.15[@] *7*	100[@] *20*	1687.42	8^+	D(+Q)	+0.02 *5*	δ: from γγ(θ) in ^{248}Cm,^{252}Cf SF decay.
3022.30		267.3[‡]	100[‡]	2755.05				
		496.1[‡b]	[‡]	2526.11	(7^+)			
3069.82	$(1,2^+)$	2240.5 *2*	100 *9*	829.28	0^+			
		2738.6 *5*	18 *6*	331.23	0^+			
3100.27	(8^+)	490.7[@] *1*	100	2609.57	(6^+)			
3268.11	(12^+)	841.7[@] *2*	100	2426.41	10^+	[E2]		B(E2)(W.u.)=131 *+16−13*
3289.13	(10^+)	709.5[@] *3*	100[@] *29*	2579.54	(8^+)			
		862.8[@] *3*	29[@] *15*	2426.41	10^+			
3323.6		301.3[‡]	100[‡]	3022.30				
		568.6[‡]	13[‡]	2755.05				
3328.6	(10^+)	314.8	100	3013.8	(9^+)			E_γ: average of 314.7 in ^{252}Cf SF decay and 314.8 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		598.6	20	2730.0	(8^+)			E_γ: average of 598.6 in ^{252}Cf SF decay and 598.5 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
3571.8	$(1,2^+)$	2375.3 *10*	18 *10*	1196.23	(2^+)			
		3359.2 *4*	100 *12*	212.61	2^+			
		3571.8 *4*	76 *10*	0.0	0^+			
3635.46	(11^+)	615.8[@] *1*	100[@] *50*	3019.65	$9^{(+)}$			
		1209.1[@] *3*	100[@] *50*	2426.41	10^+			
3660.3		336.7[‡]	100[‡]	3323.6				
		638.0[‡]	33[‡]	3022.30				
3673.1	(11^+)	344.4	100	3328.6	(10^+)			E_γ: average of 344.0 in ^{252}Cf SF decay and 344.8 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
		659.2	40	3013.8	(9^+)			E_γ: average of 658.7 in ^{252}Cf SF decay and 659.6 in (α,Fγ). I_γ: from ^{252}Cf SF decay.
3747.38	(10^+)	647.1[@] *2*	100	3100.27	(8^+)			

From ENSDF

$^{100}_{40}Zr_{60}$-10

Adopted Levels, Gammas (continued)

γ(^{100}Zr) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Comments
3956.64	(1,2$^+$)	1185.8[b] *3*	49 *9*	2770.76	(1,2$^+$)	
		3743.9 *5*	89 *15*	212.61	2$^+$	
		3956.8 *5*	100 *14*	0.0	0$^+$	
4043.1	(12$^+$)	369.9		3673.1	(11$^+$)	E_γ: from (α,Fγ) only.
		714.7		3328.6	(10$^+$)	E_γ: from (α,Fγ) only.
4204.8	(14$^+$)	936.7	100	3268.11	(12$^+$)	E_γ: average of 936.8 in ^{252}Cf SF decay and 936.6 in (α,Fγ).
4288.4	(1,2$^+$)	4075.8 *4*	100 *17*	212.61	2$^+$	
		4288.1 *6*	44 *14*	0.0	0$^+$	
4377.1	(13$^+$)	741.6[@] *4*	100	3635.46	(11$^+$)	
4440.5	(13$^+$)	397.5		4043.1	(12$^+$)	E_γ: from (α,Fγ) only.
		767.4		3673.1	(11$^+$)	E_γ: from (α,Fγ) only.
5237.1	(16$^+$)	1032.3		4204.8	(14$^+$)	E_γ: from (α,Fγ) only.
6371.2	(18$^+$)	1134.1		5237.1	(16$^+$)	E_γ: from (α,Fγ) only.
7615.0?	(20$^+$)	1243.8		6371.2	(18$^+$)	E_γ: from (α,Fγ) only.

† From ^{100}Y β^- decay (732 ms), unless otherwise noted.
‡ From ^{252}Cf SF decay only.
# From ^{100}Y β^- decay (0.94 s) only.
@ From ^{248}Cm,^{252}Cf SF decay.
& From ce data in ^{100}Y β^- decay (732 ms), unless otherwise noted.
[a] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[b] Placement of transition in the level scheme is uncertain.

From ENSDF

$^{100}_{40}Zr_{60}$-11

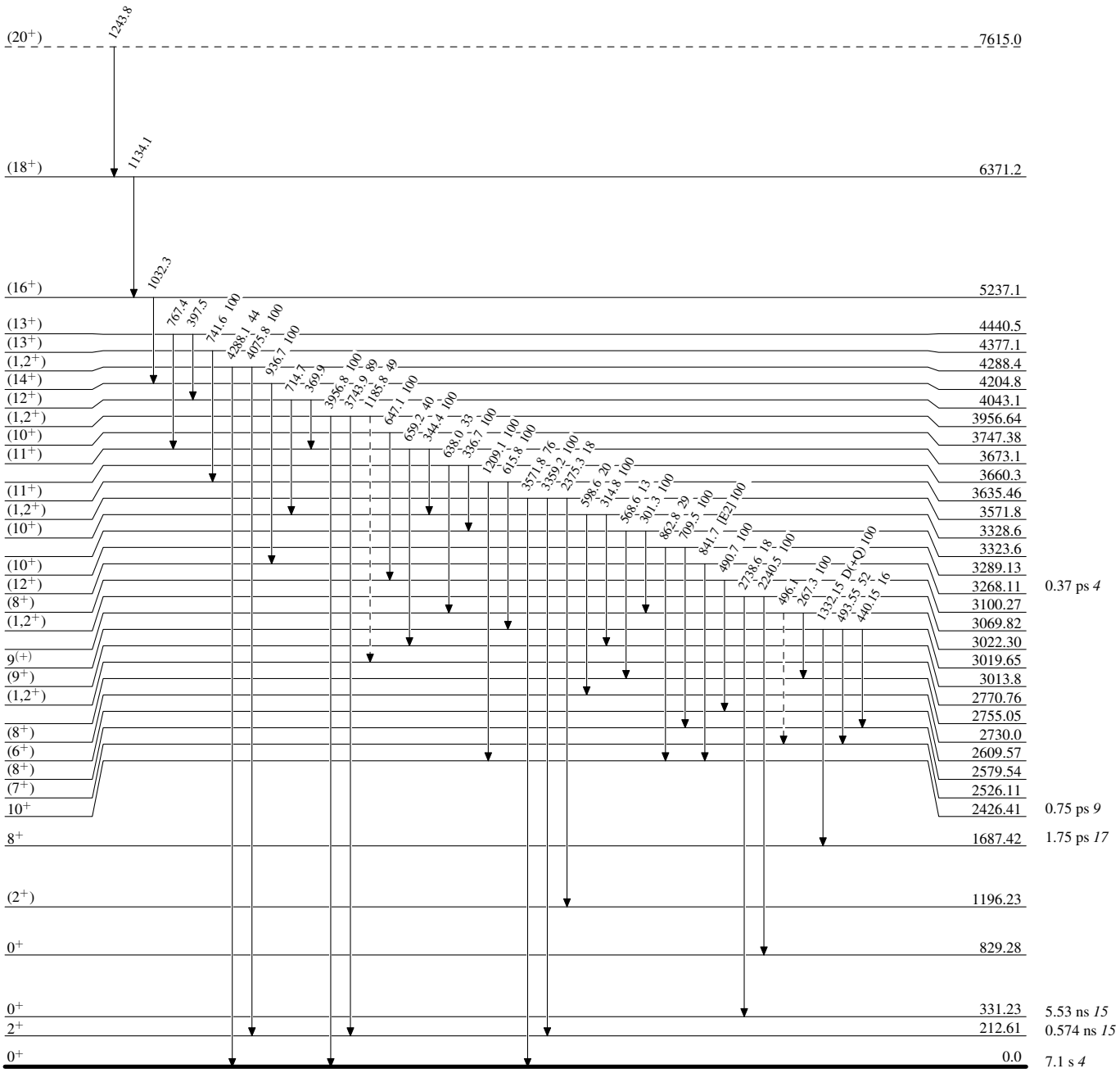
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

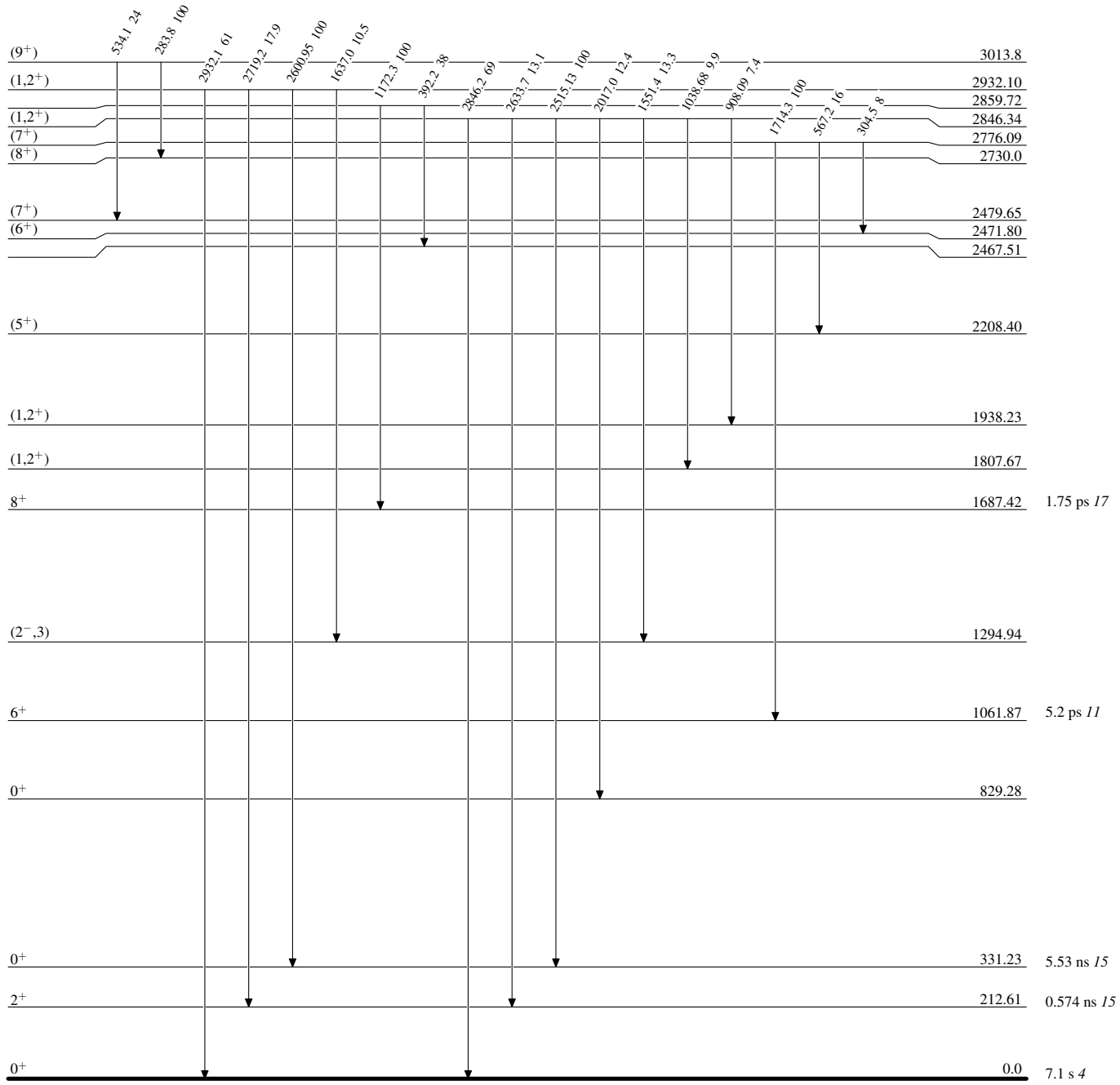


$^{100}_{40}Zr_{60}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

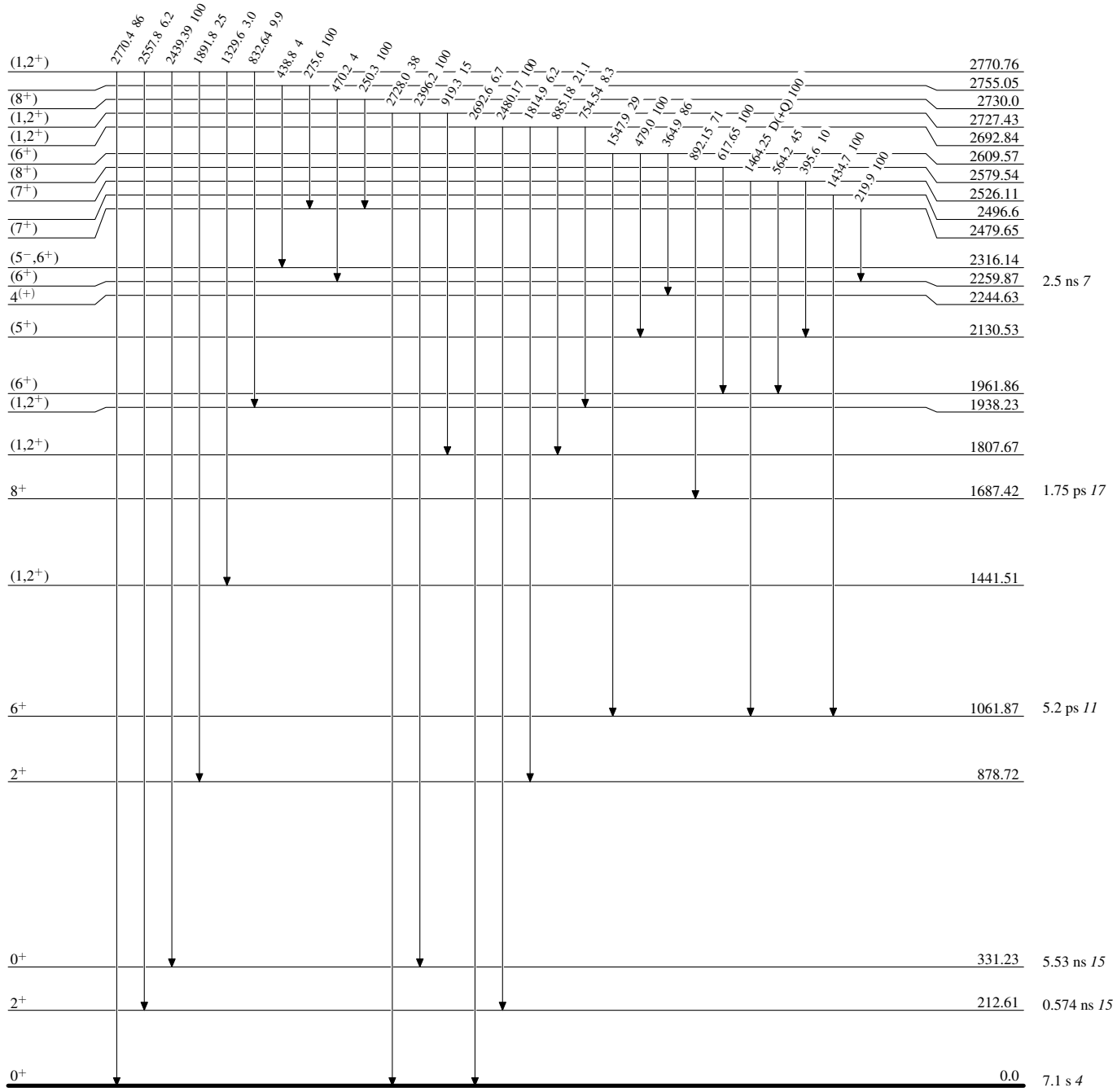


$^{100}_{40}Zr_{60}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{100}_{40}Zr_{60}$

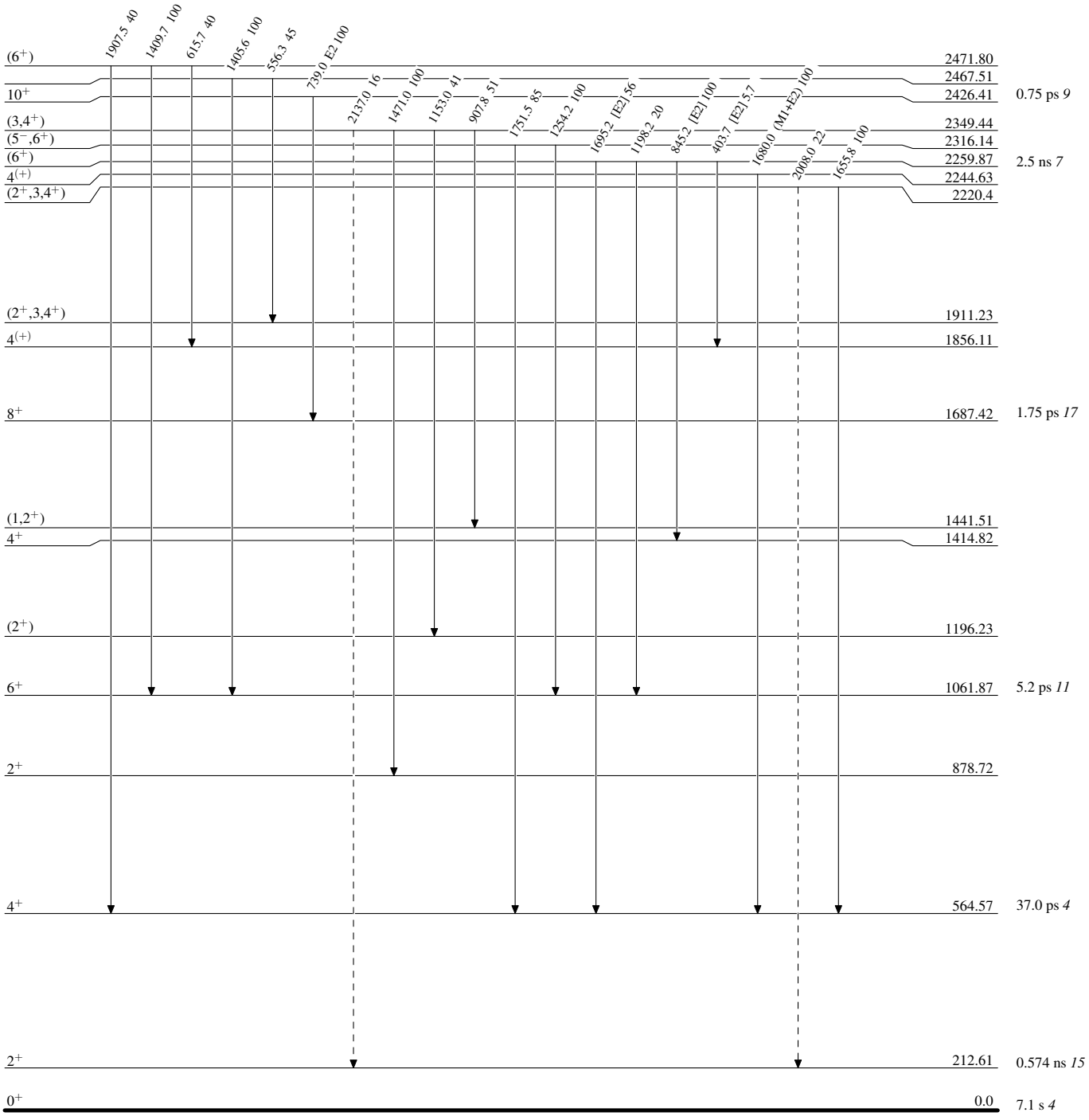
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{100}_{40}Zr_{60}$

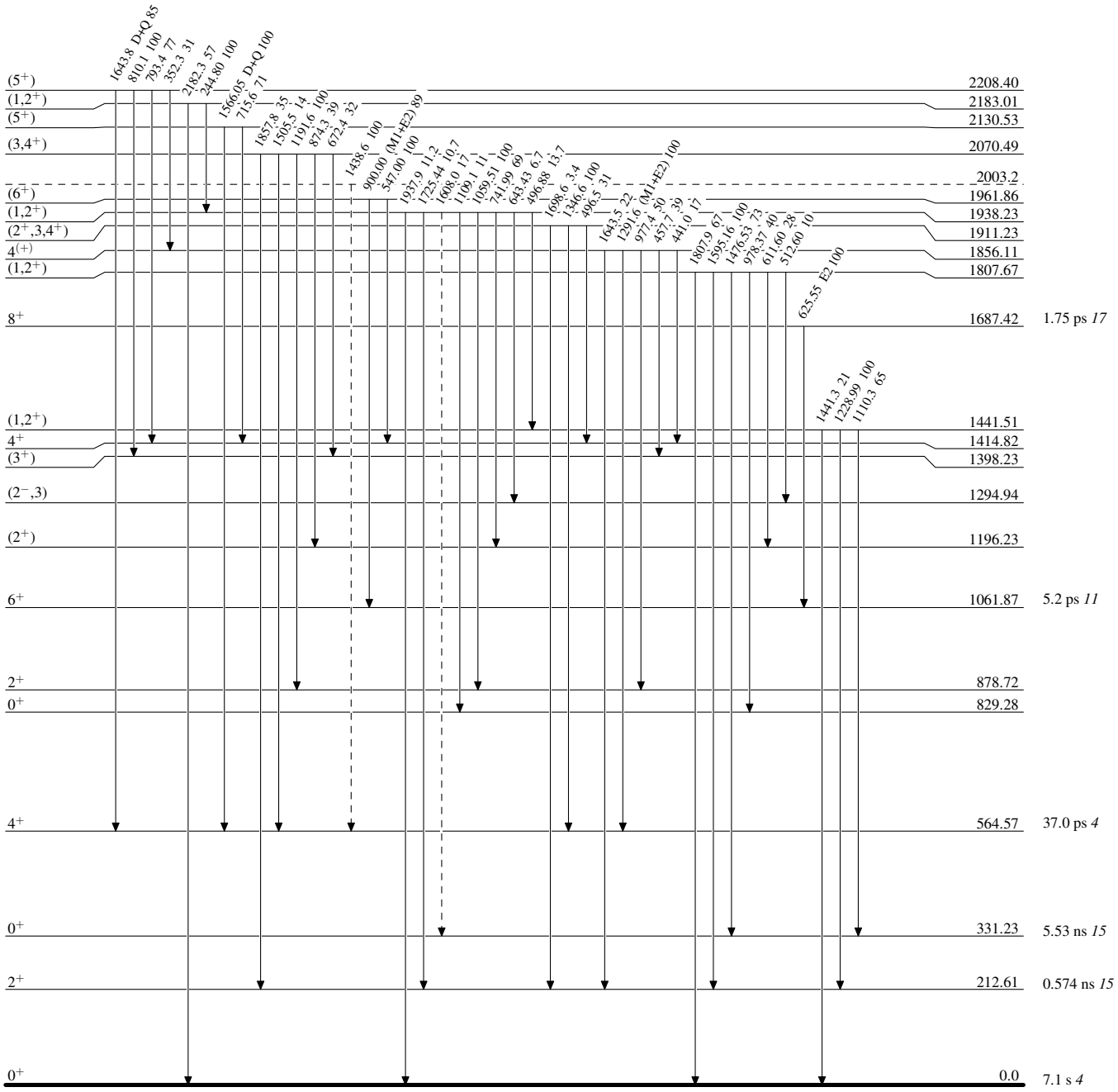
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

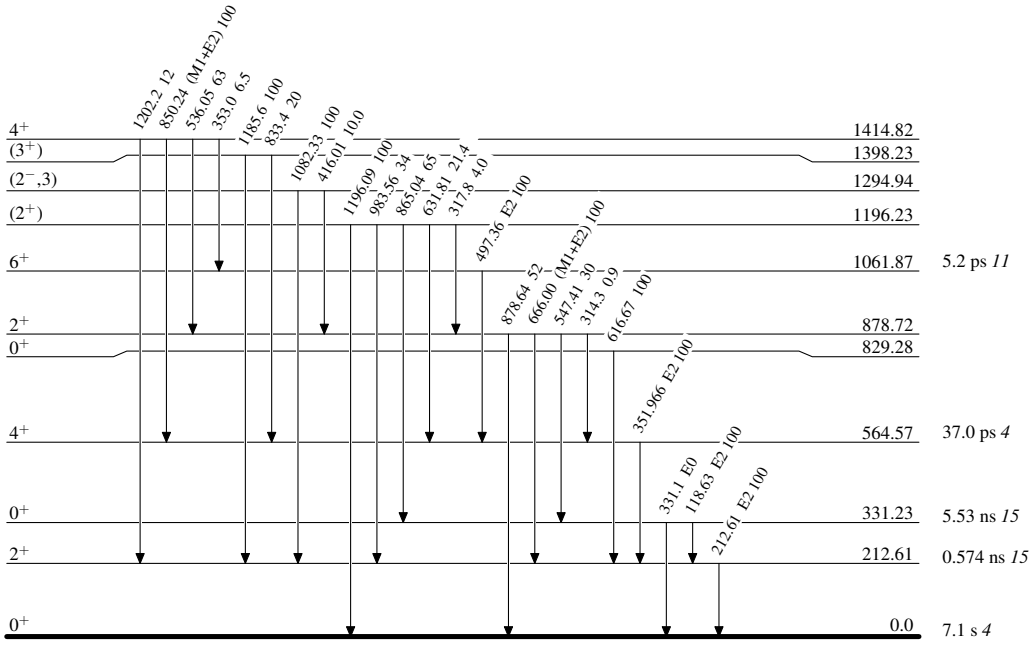


$^{100}_{40}Zr_{60}$

Adopted Levels, Gammas

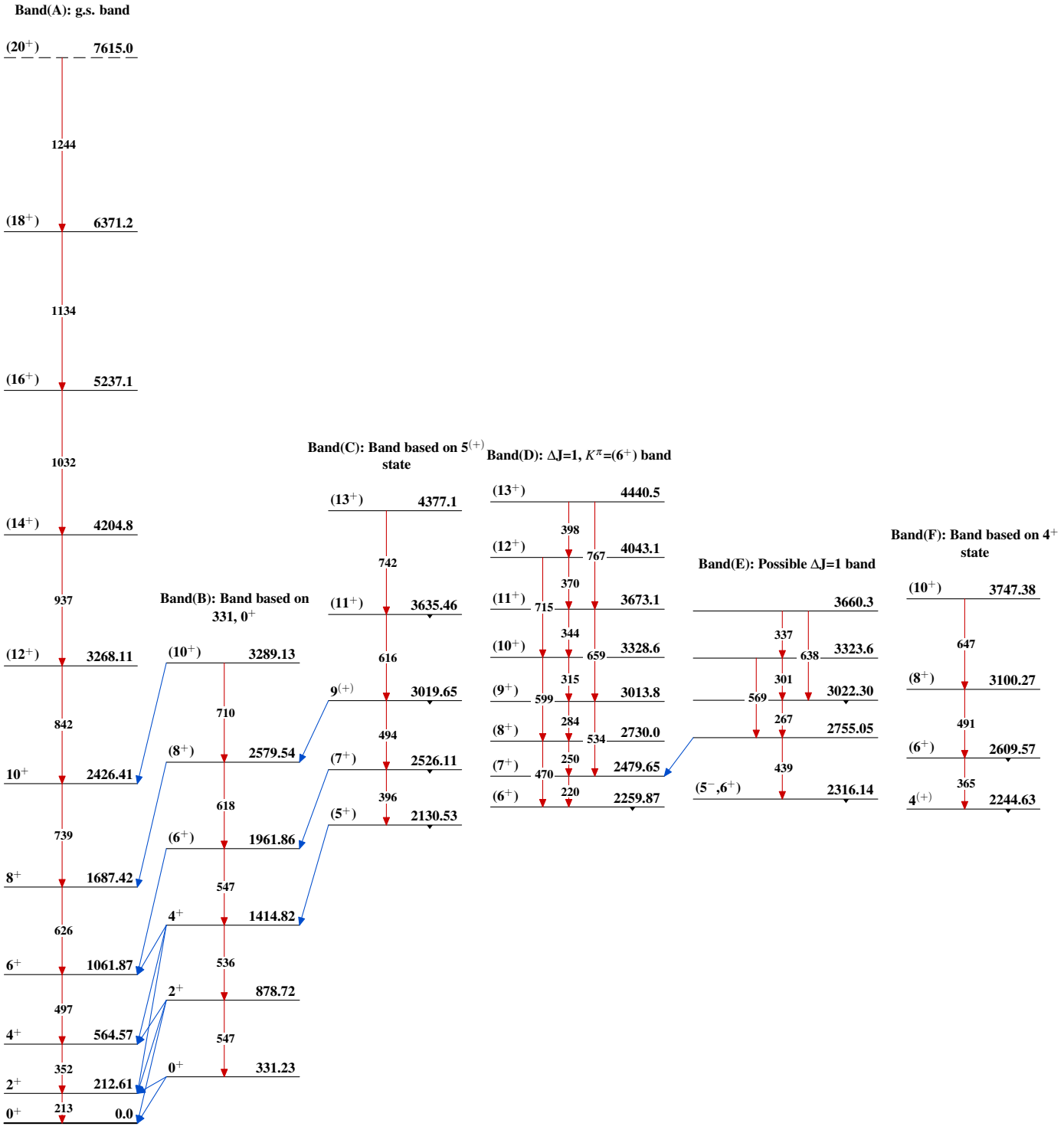
Level Scheme (continued)

Intensities: Relative photon branching from each level



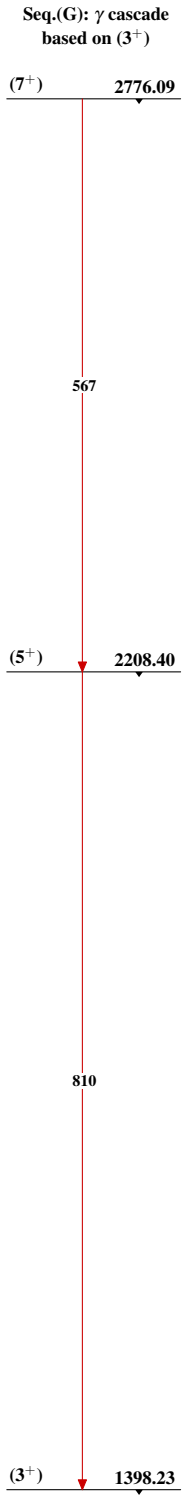
$^{100}_{40}Zr_{60}$

Adopted Levels, Gammas



$^{100}_{40}Zr_{60}$

Adopted Levels, Gammas (continued)



$^{100}_{40}Zr_{60}$