Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

Q(β^-)=5375 *9*; S(n)=4413 *9*; S(p)=7793 *9*; Q(α)=−1268 *10* 2017Wa10
S(2n)=12691 *9*, S(2p)=17920 *17*, Q(2β^+)=3632 *10* (2017Wa10).
Additional information 1.
First identification of ^{138}Xe nuclide by 1943Se02 (see 2012Ma48).
Other reactions:
^{137}Cs(n,γ): 2000NaZY, 2000Wa38, 1998Ma97, 1993Se11, 1990Ha24.
^{138}Ba(n,p): 2012La07, 2000ZhZV, 1997FiZZ, 1989Fa13.

^{138}Cs Levels

Cross Reference (XREF) Flags

A	^{138}Xe β^- decay (14.14 min)	D	^{252}Cf SF decay
B	^{138}Cs IT decay (2.91 min)	E	^{138}Ba(μ^-,γ)
C	^{248}Cm SF decay		

E(level)†	J$^\pi$	$T_{1/2}$	XREF	Comments
0.0	3$^-$	32.5 min *2*	ABCDE	%β^-=100 μ=+0.700 *4* (1981Th06,2014StZZ) Q=+0.112 *17* (1981Th06,2016St14) J$^\pi$: spin from atomic beam (1967St22, 1978Sc27,1979Bo01); parity from no-allowed β feedings to 0$^+$, 2$^+$ and 4$^+$ levels in ^{138}Ba, no γ transitions from 1$^+$ levels above 2 MeV and also shell-model prediction. $T_{1/2}$: unweighted average of 33.1 min *6* (1990Ha24), 33.41 min *18* (1972Eh02), 32.2 min *1* (1956Ba66), 32.1 min *2* (1956Bu01), 32.33 min *12* (1966Ar08), 32.2 min *2* (1969Ca03), 32.1 min *25* (1971Be35). μ: from 1981Th06 using atomic beam laser spectroscopy. Others: +0.701 *7* (1979Ek02, atomic-beam magnetic resonance), +0.701 *14* (1979Bo01, Collinear Fast Beam Laser Spectroscopy), +0.705 *15* (1978Sc27, atomic beam laser spectroscopy), 0.48 *10* (1967St22, atomic-beam magnetic resonance). Q: re-evaluated value in 2013StZZ based on +0.12 *2* measured in 1981Th06 using atomic beam laser spectroscopy. Others: +0.125 *18* (1979Bo01, Collinear Fast Beam Laser Spectroscopy), +0.12 2 (1978Sc27, atomic beam laser spectroscopy). Evaluated nuclear charge radius <r^2>$^{1/2}$=4.826 fm *5* (2013An02). Configuration=$\pi g_{7/2}^{-3}\otimes\nu f_{7/2}$ (1979Ek02).
10.86 *3*	2$^-$		A	J$^\pi$: 10.85γ M1 to 3$^-$, strong 2015.82γ, 2252.26γ, 2326.9γ from 1$^+$.
15.749 *21*	(1)$^-$		A	J$^\pi$: 4.85γ M1 to 2$^-$, strong 2321.90γ, 2475.26γ from 1$^+$; spin=1 is expected from shell-model predictions and systematics of neighboring nuclei.
79.9 *3*	6$^-$	2.91 min *10*	BCD	%β^-=19 *3*; %IT=81 *3* μ=+1.713 *9* (1981Th06,2014StZZ) Q=−0.37 *5* (1981Th06,2016St14) J$^\pi$: spin from atomic beam (1981Th06), 79.9γ to 3$^-$ requires Mult=M3. $T_{1/2}$: weighted average of 2.92 min *11* (1978Au08) and 2.90 min *10* (1971Ca21). μ: from 1981Th06 using atomic beam laser spectroscopy. Q: re-evaluated value in 2013StZZ based on −0.40 *3* measured in 1981Th06 using atomic beam laser spectroscopy. %IT is the weighted average of 81.5 *+25−30* (at 68.3% confidence level) from 1978Au08 and 75 *8* from 1971Ca21, deduced from growth curves of 463γ, 1436γ, and 1010γ. Other: %IT=81.5 *+50−140* from 1978Au08 at 99.7% confidence level. The 1010γ is not fed in β^- decay of 2.9-min ^{138}Cs, but follows the β^- decay of the ^{138}Cs ground state (1978Au08,1971Ca21).

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Adopted Levels, Gammas (continued)

^{138}Cs Levels (continued)

E(level)[†]	Jπ	XREF	Comments
			Configuration=$\pi g^5_{7/2}\otimes\nu f_{7/2}$ predicted in 2007Li21, but $\pi g^4_{7/2}\otimes\pi d_{5/2}\otimes\nu f_{7/2}$ in 2007Rz03.
254.4[‡] *5*	(7⁻)	CD	Jπ: 174.5γ (M1) to 6⁻.
258.405 *19*	1⁻,2⁻	A E	Jπ: 258.411γ E2 to 3⁻, 242.56γ M1,E2 to (1)⁻, strong 1768.26γ, 2004.75γ, 2079,17γ from 1⁺.
335.38 *8*		A	
403.68 *15*		A	
412.262 *19*	1⁻	A	Jπ: 401.36γ M1 to 2⁻, 412.8γ to 3⁻; log *ft*=6.9 from 0⁺ in ^{138}Xe β⁻ decay.
450.32 *5*	0⁻,1⁻	A	Jπ: log *ft*=6.7 from 0⁺ parent in ^{138}Xe β⁻ decay, 434.56γ M1,E2 to (1)⁻.
540.99 *4*		A	
555.98? *9*	1⁻,2⁻	A	Jπ: log *ft*=9.2 from 0⁺ parent in ^{138}Xe β⁻ decay, 555.95γ to 3⁻.
691.16 *11*	1⁻,2⁻	A	Jπ: log *ft*=9.0 from 0⁺ parent, 691.5γ to 3⁻.
912.48 *4*	(1⁻,2)	A	Jπ: 912.51γ to 3⁻, 500.22γ to 1⁻, 1114.29γ from 1⁺.
952.09 *6*	(0⁻,1)	A	Jπ: log *ft*=8.1 from 0⁺ parent, 941.25γ to 2⁻.
1109.59 *5*	(0⁻,1)	A	Jπ: log *ft*=8.6 from 0⁺ parent, 1098.77γ to 2⁻, 1153.6γ from 1⁺.
1121.8 *5*	(8⁻)	C	Jπ: proposed in ^{248}Cm SF decay.
1157.39 *6*		A	
1160.93 *7*	(1⁻,2)	A	Jπ: 1160.96γ to 3⁻, 1145.44γ to (1)⁻, 1102.24γ from 1⁺.
1205.23 *10*	(1⁻,2⁻)	A	Jπ: log *ft*=8.0 from 0⁺ parent, 1204.5γ to 3⁻.
1206.2 *5*	(8⁻)	C	Jπ: proposed in ^{248}Cm SF decay.
1312.4 *5*	(8⁻)	C	Jπ: proposed in ^{248}Cm SF decay.
1372.14? *18*		A	
1411.3[‡] *6*	(9⁻)	CD	Jπ: 1156.9γ (E2) to (7⁻).
1488.88 *11*		A	
1537.92 *21*		A	
1559.57 *13*		A	
1596.8[‡] *5*	(10⁻)	CD	Jπ: 185.6γ M1+E2 to (9⁻).
1794.05 *12*	(0⁻,1)	A	Jπ: log *ft*=7.3 from 0⁺ parent, 1783.4γ to 2⁻.
1832.8[‡] *6*	(11⁻)	CD	Jπ: 421.5γ to (9⁻), 236.0γ to (10⁻).
1917.5[‡] *7*	(12⁻)	CD	Jπ: 84.7γ M1 to (11⁻).
2022.22 *16*	(0⁻,1)	A	Jπ: log *ft*=6.8 from 0⁺ parent.
2026.73 *5*	1⁺	A	Jπ: log *ft*=4.7 from 0⁺ parent.
2263.12 *7*	1⁺	A	Jπ: log *ft*=4.8 from 0⁺ parent.
2337.65 *7*	1⁺	A	Jπ: log *ft*=5.1 from 0⁺ parent.
2491.01 *14*	1⁺	A	Jπ: log *ft*=5.5 from 0⁺ parent.
2508.43? *14*	1⁺	A	Jπ: log *ft*=5.7 from 0⁺ parent.
2731.9 *8*		CD	Jπ: proposed in ^{248}Cm SF decay.
2813.0[#] *8*	(11⁺)	CD	Jπ: proposed in ^{252}Cm SF decay. (14⁻) from ^{248}Cm SF decay.
3158.3 *10*		C	
3260.5[#] *10*	(12⁺)	CD	Jπ: proposed in ^{252}Cm SF decay. (15⁻) from ^{248}Cm SF decay.
3348.8[#] *10*	(13⁺)	C	
4164.5[#] *11*	(14⁺)	CD	Jπ: proposed in ^{252}Cm SF decay. (16⁻) from ^{248}Cm SF decay.
4258.6 *11*		C	
4626.1[#] *12*	(16⁺)	C	

[†] From a least-squares fit to γ-ray energies, assuming ΔEγ=0.5 keV if not given.
[‡] Seq.(A): γ sequence based on 6⁻.
[#] Seq.(B): γ sequence based on (11⁺).

Adopted Levels, Gammas (continued)

γ(^{138}Cs)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[†]	Comments
10.86	2⁻	10.85 *5*	100	0.0	3⁻	M1	89.7 *18*	α(L)=71.5 *14*; α(M)=14.7 *3* α(N)=3.10 *7*; α(O)=0.428 *9*; α(P)=0.0207 *4*
15.749	(1)⁻	4.85 *5*	100	10.86	2⁻	M1	202 *7*	α(M)=163 *6* α(N)=34.3 *12*; α(O)=4.74 *17*; α(P)=0.229 *8*
79.9	6⁻	79.9 *3*	100	0.0	3⁻	M3	213 *5*	α(K)=119.4 *25*; α(L)=72.7 *18*; α(M)=16.9 *5* α(N)=3.55 *9*; α(O)=0.444 *11*; α(P)=0.0127 *3* B(M3)(W.u.)=0.097 *+9−8* E_γ: from ^{138}Cs IT decay. Mult.: $T_{1/2}$=2.91 min requires Mult=M3 or E3; M3 (α(K)=119, calculated using the BrIcc program) would account for observed K x-ray intensity in ^{138}Cs IT decay (1971Ca21) whereas E3 (α(K)=12.5) would not.
254.4	(7⁻)	174.5	100	79.9	6⁻	(M1)[@]	0.190	α(K)=0.1628 *23*; α(L)=0.0214 *3*; α(M)=0.00439 *7* α(N)=0.000928 *13*; α(O)=0.0001292 *18*; α(P)=6.38×10^{-6} *9* E_γ: from ^{252}Cf SF decay. Other: 175.5 from ^{242}Cm SF decay.
258.405	1⁻,2⁻	242.56 *5*	11.1 *2*	15.749	(1)⁻	M1,E2	0.082 *5*	α(K)=0.0684 *18*; α(L)=0.0112 *25*; α(M)=0.0023 *6* α(N)=0.00048 *11*; α(O)=6.4×10^{-5} *12*; α(P)=2.46×10^{-6} *17*
		258.411 *20*	100 *2*	0.0	3⁻	E2	0.0706	α(K)=0.0570 *8*; α(L)=0.01077 *15*; α(M)=0.00226 *4* α(N)=0.000467 *7*; α(O)=5.99×10^{-5} *9*; α(P)=1.89×10^{-6} *3* Additional information 2.
335.38		325.3 *3*	22 *8*	10.86	2⁻			
		335.28 *9*	100 *9*	0.0	3⁻			
403.68		68.3 *2*		335.38				
		403		0.0	3⁻			
412.262	1⁻	153.858 *3*	94.5 *20*	258.405	1⁻,2⁻	M1,E2	0.34 *8*	α(K)=0.27 *4*; α(L)=0.06 *3*; α(M)=0.012 *6* α(N)=0.0025 *12*; α(O)=0.00031 *13*; α(P)=9.16×10^{-6} *18*
		396.513 *10*	100.0 *20*	15.749	(1)⁻	M1,E2	0.0200 *17*	α(K)=0.0170 *17*; α(L)=0.00241 *4*; α(M)=0.000496 *10* α(N)=0.0001042 *16*; α(O)=1.42×10^{-5} *4*; α(P)=6.3×10^{-7} *10*
		401.36 *5*	34.5 *15*	10.86	2⁻	M1	0.0210	α(K)=0.0181 *3*; α(L)=0.00232 *4*; α(M)=0.000474 *7* α(N)=0.0001004 *14*; α(O)=1.403×10^{-5} *20*; α(P)=7.02×10^{-7} *10*
		412.8 *7*	1.0 *5*	0.0	3⁻			
450.32	0⁻,1⁻	434.56 *4*	100	15.749	(1)⁻	M1,E2	0.0156 *16*	α(K)=0.0133 *16*; α(L)=0.00185 *6*; α(M)=0.000381 *9* α(N)=8.00×10^{-5} *23*; α(O)=1.09×10^{-5} *6*; α(P)=5.0×10^{-7} *8*
540.99		137.20 *20*	16 *8*	403.68				
		282.51 *6*	100 *3*	258.405	1⁻,2⁻			
		530.07 *7*	59 *3*	10.86	2⁻			

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Adopted Levels, Gammas (continued)

γ(^{138}Cs) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[†]	Comments
540.99		540.8 *6*	5 *3*	0.0	3⁻			
555.98?	1⁻,2⁻	555.95 *9*	100	0.0	3⁻			
691.16	1⁻,2⁻	675.37 *15*	100 *18*	15.749	(1)⁻			
		680.24 *19*	74 *18*	10.86	2⁻			
		691.5 *4*	43 *18*	0.0	3⁻			
912.48	(1⁻,2)	371.44 *5*	100 *5*	540.99				
		500.22 *6*	72.3 *25*	412.262	1⁻			
		654.08 *8*	28.9 *25*	258.405	1⁻,2⁻			
		896.87 *12*	26.4 *25*	15.749	(1)⁻			
		912.51 *7*	65 *4*	0.0	3⁻			
952.09	(0⁻,1)	693.53 *16*	38 *6*	258.405	1⁻,2⁻			
		936.36 *11*	59 *6*	15.749	(1)⁻			
		941.25 *8*	100 *7*	10.86	2⁻			
1109.59	(0⁻,1)	197		912.48	(1⁻,2)			
		568.53 *6*	75 *4*	540.99				
		697.6 *4*	5.4 *23*	412.262	1⁻			
		774.21 *15*	16.2 *23*	335.38				
		851.30 *17*	17 *3*	258.405	1⁻,2⁻			
		1093.87 *9*	100 *6*	15.749	(1)⁻			
		1098.77 *11*	52 *4*	10.86	2⁻			
1121.8	(8⁻)	1041.9	100	79.9	6⁻			E_γ: from ^{248}Cm SF decay.
1157.39		746		412.262	1⁻			
		1141.64 *9*	100	15.749	(1)⁻			
1160.93	(1⁻,2)	619.7 *5*	17 *10*	540.99				
		902.3 *3*	33 *10*	258.405	1⁻,2⁻			
		1145.44 *18*	100 *14*	15.749	(1)⁻			
		1160.96 *18*	74 *10*	0.0	3⁻			
1205.23	(1⁻,2⁻)	755.0 *6*	29 *14*	450.32	0⁻,1⁻			
		792.9 *5*	25 *11*	412.262	1⁻			
		869		335.38				
		946.63 *20*	71 *4*	258.405	1⁻,2⁻			
		1189.54 *21*	93 *14*	15.749	(1)⁻			
		1194.94 *20*	100 *14*	10.86	2⁻			
		1204.5 *4*	39 *14*	0.0	3⁻			
1206.2	(8⁻)	1126.3	100	79.9	6⁻			E_γ: from ^{248}Cm SF decay.
1312.4	(8⁻)	190.5	100 *20*	1121.8	(8⁻)			
		1058.1	27 *7*	254.4	(7⁻)			
		1232.5	33 *7*	79.9	6⁻			
1372.14?		816.06 *18*	100 *18*	555.98?	1⁻,2⁻			
		1356.6 *4*	70 *22*	15.749	(1)⁻			
		1361.9 *6*	48 *22*	10.86	2⁻			
1411.3	(9⁻)	1156.9	100	254.4	(7⁻)	(E2)[@]	1.26×10^{-3}	α(K)=0.001084 *16*; α(L)=0.0001382 *20*; α(M)=2.82×10^{-5} *4* α(N)=5.94×10^{-6} *9*; α(O)=8.25×10^{-7} *12*; α(P)=4.02×10^{-8} *6*; α(IPF)=2.48×10^{-6} *4* E_γ: from ^{252}Cf SF decay. Other: 1157.0 from ^{248}Cm SF decay.
1488.88		1076.38 *22*	100 *18*	412.262	1⁻			
		1473.2 *3*	79 *14*	15.749	(1)⁻			
1537.92		586.0 *4*	30 *11*	952.09	(0⁻,1)			
		996.8 *3*	100 *25*	540.99				
1559.57		647.2 *5*	21 *13*	912.48	(1⁻,2)			
		1548.9 *4*	100 *25*	10.86	2⁻			

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Adopted Levels, Gammas (continued)

γ(^{138}Cs) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[†]	Comments
1596.8	(10$^-$)	185.6	100 *10*	1411.3	(9$^-$)	M1+E2[@]	0.19 *3*	α(K)=0.152 *15*; α(L)=0.028 *11*; α(M)=0.0059 *23* α(N)=0.0012 *5*; α(O)=0.00016 *5*; α(P)=5.30×10^{-6} *12* E_γ,I_γ: from ^{248}Cm SF decay. Other: Eγ=185.5 from ^{252}Cf SF decay.
		284.5	19 *4*	1312.4	(8$^-$)			E_γ,I_γ: from ^{248}Cm SF decay.
		390.6	21 *4*	1206.2	(8$^-$)			E_γ,I_γ: from ^{248}Cm SF decay.
1794.05	(0$^-$,1)	588.84 *8*	100 *8*	1205.23	(1$^-$,2$^-$)			
		1381.4 *3*	56 *13*	412.262	1$^-$			
		1783.4 *6*	31 *13*	10.86	2$^-$			
1832.8	(11$^-$)	236.0	100 *11*	1596.8	(10$^-$)			E_γ,I_γ: from ^{248}Cm SF decay.
		421.5	13 *4*	1411.3	(9$^-$)			E_γ,I_γ: from ^{248}Cm SF decay.
1917.5	(12$^-$)	84.7	100 *12*	1832.8	(11$^-$)	M1[@]	1.448	α(K)=1.240 *18*; α(L)=0.1656 *24*; α(M)=0.0339 *5* α(N)=0.00717 *10*; α(O)=0.000996 *14*; α(P)=4.88×10^{-5} *7* E_γ,I_γ: from ^{248}Cm SF decay. Other: Eγ=84.5 from ^{252}Cf SF decay.
		320.7	4.8 *24*	1596.8	(10$^-$)			E_γ: from ^{252}Cf SF decay. Other: 321 from ^{248}Cm SF decay. I_γ: from ^{248}Cm SF decay.
2022.22	(0$^-$,1)	534.0 *6*	5.6 *23*	1488.88				
		1571.84 *16*	100 *10*	450.32	0$^-$,1$^-$			
2026.73	1$^+$	537.76 *13*	0.70 *10*	1488.88				
		865.82 *7*	1.77 *11*	1160.93	(1$^-$,2)			
		869.35 *6*	3.71 *21*	1157.39				
		917.13 *6*	5.50 *23*	1109.59	(0$^-$,1)			
		1114.29 *10*	8.8 *4*	912.48	(1$^-$,2)			
		1614.57 *18*	1.41 *15*	412.262	1$^-$			
		1768.26 *13*	100.0 *21*	258.405	1$^-$,2$^-$			
		2015.82 *14*	73.3 *15*	10.86	2$^-$			
2263.12	1$^+$	703.58 *17*	1.06 *18*	1559.57				
		1102.24 *17*	2.00 *24*	1160.93	(1$^-$,2)			
		1153.6 *5*	0.6 *3*	1109.59	(0$^-$,1)			
		1311.07 *24*	1.6 *3*	952.09	(0$^-$,1)			
		1812.54 *18*	3.4 *4*	450.32	0$^-$,1$^-$			
		1850.86 *13*	26.6 *9*	412.262	1$^-$			
		2004.75 *14*	100.0 *24*	258.405	1$^-$,2$^-$			
		2252.26 *14*	42.7 *13*	10.86	2$^-$			
2337.65	1$^+$	778.10 *19*	3.1 *7*	1559.57				
		799.6 *6*	1.1 *7*	1537.92				
		848.7 *3*	3.1 *9*	1488.88				
		1228.3 *4*	4.4 *15*	1109.59	(0$^-$,1)			
		1385.5 *3*	5.2 *11*	952.09	(0$^-$,1)			
		1646.5 *3*	4.6 *9*	691.16	1$^-$,2$^-$			
		1887.3 *3*	4.8 *9*	450.32	0$^-$,1$^-$			
		1925.36 *14*	39 *2*	412.262	1$^-$			
		2079.17 *14*	100 *3*	258.405	1$^-$,2$^-$			
		2321.90 *16*	43 *2*	15.749	(1)$^-$			
		2326.9 *3*	3.9 *7*	10.86	2$^-$			
2491.01	1$^+$	953.1 *5*	9 *4*	1537.92				
		1578.1 *5*	16 *6*	912.48	(1$^-$,2)			
		1799.4 *6*	11 *4*	691.16	1$^-$,2$^-$			
		2041.2 *5*	10 *3*	450.32	0$^-$,1$^-$			

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Adopted Levels, Gammas (continued)

$\gamma(^{138}Cs)$ (continued)

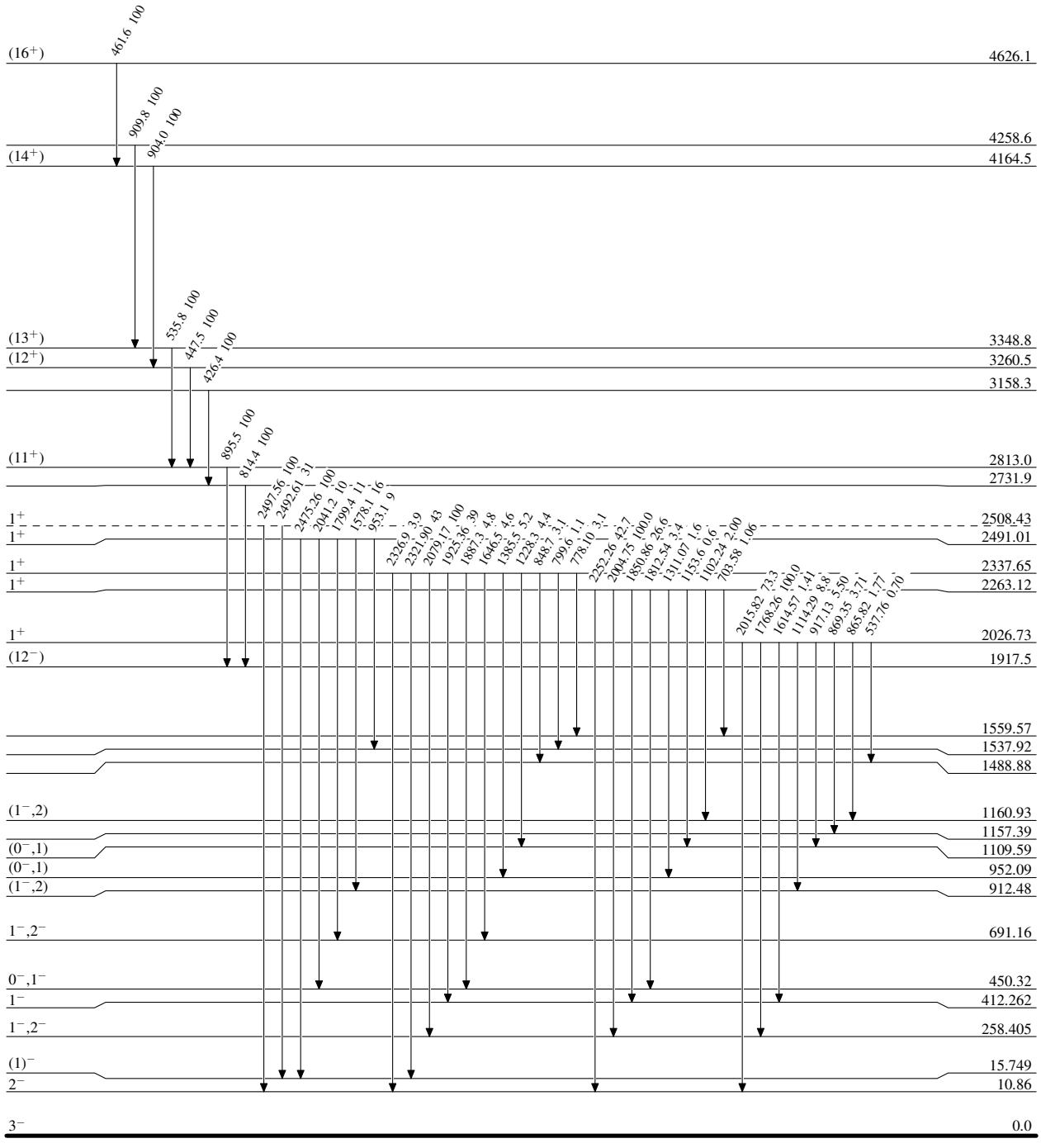
E_i(level)	J_i^π	E_γ[‡]	I_γ[‡]	E_f	J_f^π	Comments
2491.01	1^+	2475.26 *16*	100 *5*	15.749	$(1)^-$	
2508.43?	1^+	2492.61 *24*	31 *4*	15.749	$(1)^-$	
		2497.56 *17*	100 *7*	10.86	2^-	
2731.9		814.4	100	1917.5	(12^-)	E_γ: from ^{248}Cm SF decay and ^{252}Cf SF decay.
2813.0	(11^+)	895.5	100	1917.5	(12^-)	E_γ: from ^{252}Cf SF decay. Other: 895.4 from ^{248}Cm SF decay.
3158.3		426.4	100	2731.9		E_γ: from ^{252}Cf SF decay.
3260.5	(12^+)	447.5	100	2813.0	(11^+)	E_γ: from ^{252}Cf SF decay. Other: 447.2 from ^{248}Cm SF decay.
3348.8	(13^+)	535.8	100	2813.0	(11^+)	E_γ: from ^{252}Cf SF decay.
4164.5	(14^+)	904.0	100	3260.5	(12^+)	E_γ: from ^{252}Cf SF decay. Other: 903.8 from ^{248}Cm SF decay.
4258.6		909.8	100	3348.8	(13^+)	E_γ: from ^{252}Cf SF decay.
4626.1	(16^+)	461.6	100	4164.5	(14^+)	E_γ: from ^{252}Cf SF decay.

† Additional information 3.
‡ From ^{138}Xe β^- decay, unless otherwise noted.
# From ce data in ^{138}Xe β^- decay, unless otherwise noted.
@ From $\gamma\gamma(\theta)$ and ce data in ^{252}Cf SF decay.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

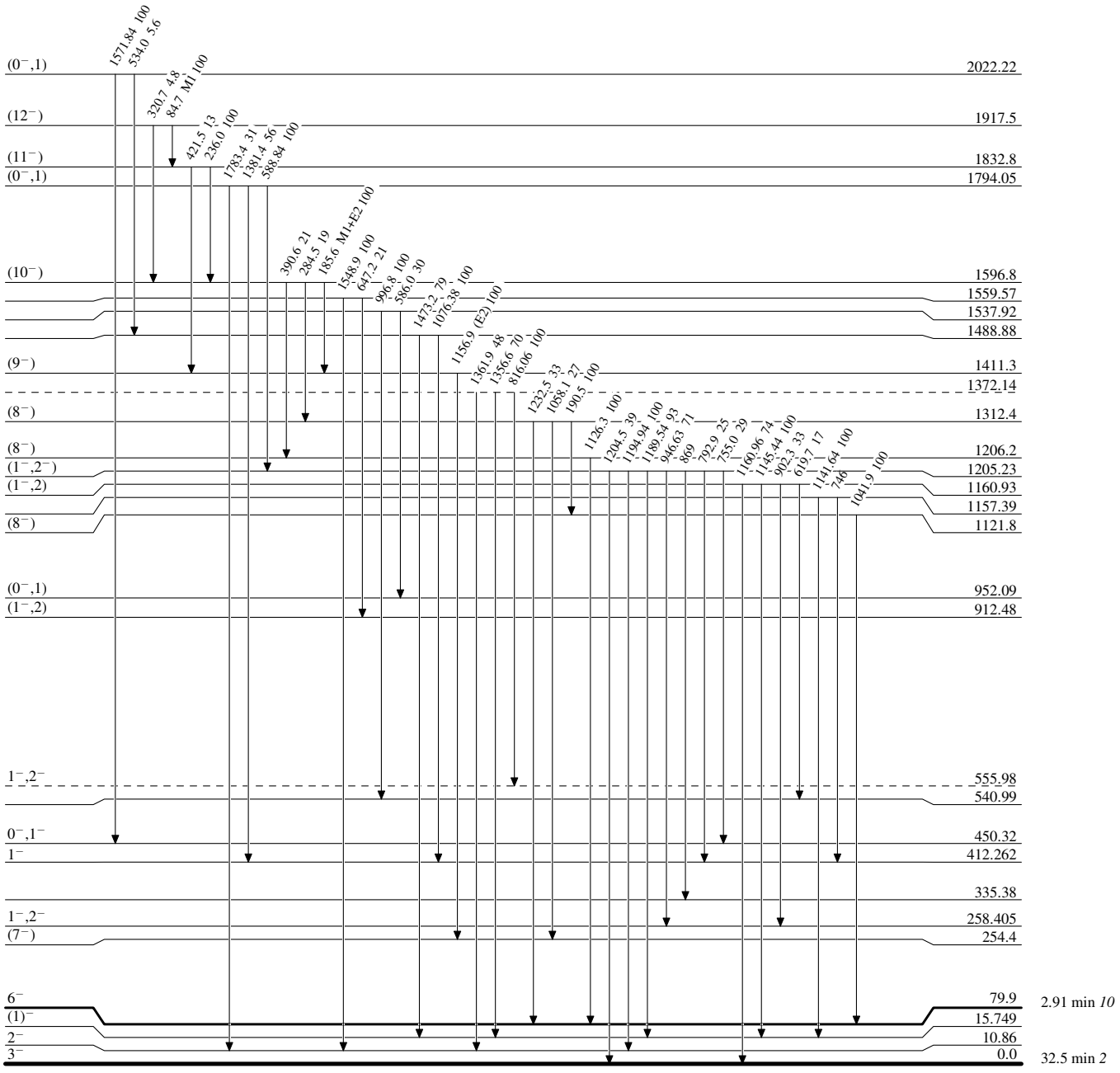


$^{138}_{55}Cs_{83}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

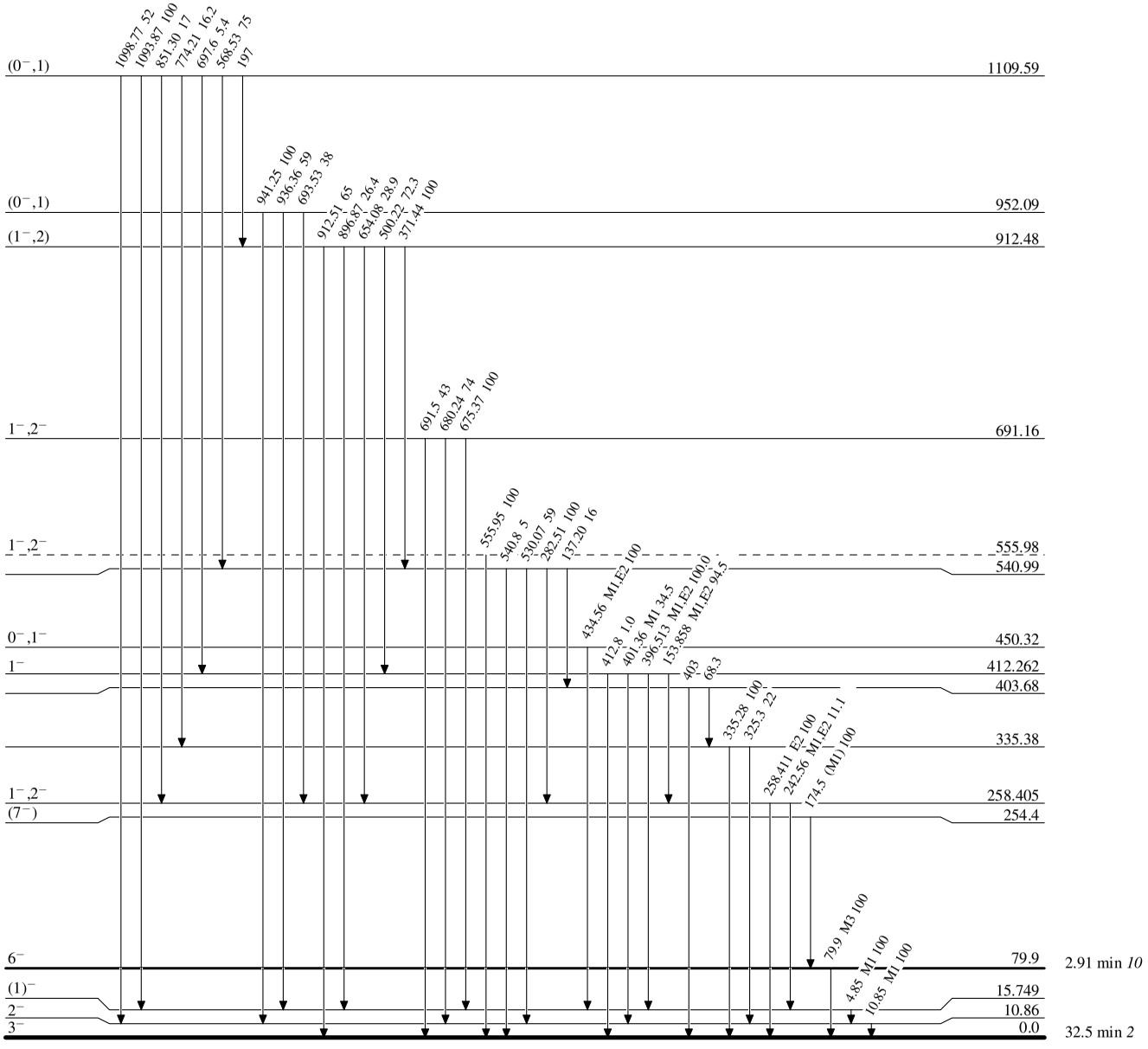


$^{138}_{55}Cs_{83}$

Adopted Levels, Gammas

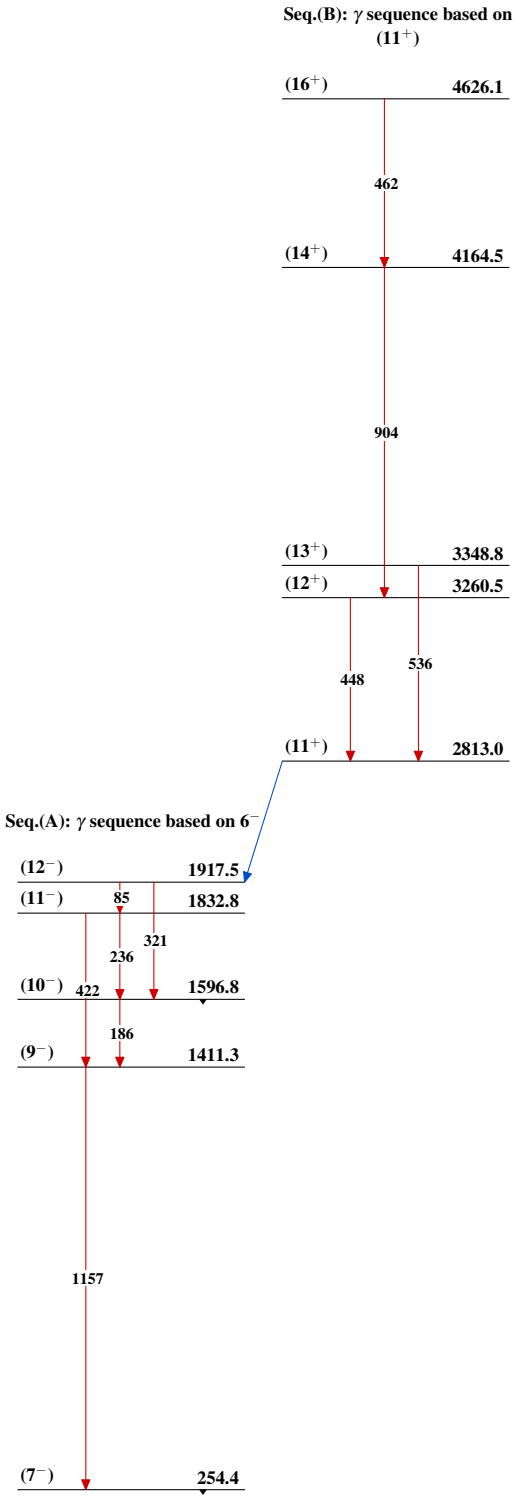
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{138}_{55}Cs_{83}$

Adopted Levels, Gammas



$^{138}_{55}Cs_{83}$