

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	A. A. Sonzogni	NDS 93,599 (2001)	1-Dec-2000

$Q(\beta^-)=3083$ 15; $S(n)=5901$ 10; $S(p)=11382$ 23; $Q(\alpha)=-1206$ 8 [2012Wa38](#)

Note: Current evaluation has used the following Q record 3119 565907 1811378 25 -1210 62 [1995Au04](#).

Isotope shift, $\Delta\langle r^2 \rangle$: [1988We07](#), [1985Ne09](#), [1983Mu12](#), [1997Co26](#).

Theory, calculations, systematics: [1998Ga15](#), [1997Sa61](#), [1997Ga27](#), [1995Jo11](#), [1995Hi10](#), [1995Go14](#), [1995De13](#), [1995Ba45](#),
[1994Za01](#), [1994Se15](#), [1994Li43](#), [1993Li32](#), [1992Wo11](#), [1992Na07](#), [1992Eg01](#), [1992De46](#), [1991Sk01](#), [1991Eg01](#), [1990Eg01](#),
[1989Ku17](#), [1989De11](#), [1988So08](#), [1988Sh40](#).

Fission yields: [1987GuZX](#), [1986Ha18](#), [1985Ch40](#), [1984Ch39](#), [1982Go17](#), [1981Di02](#), [1981Di01](#).

 ^{144}Ba LevelsCross Reference (XREF) Flags

A ^{144}Cs β^- decay
B ^{252}Cf SF decay
C ^{248}Cm SF decay

E(level) [†]	J ^π	T _{1/2}	XREF	Comments
0.0 [‡]	0 ⁺	11.5 s 2	ABC	$\% \beta^- = 100$ T _{1/2} : from 1982Ch22 . Others: 12.0 s 4 (1979En02), 12.3 s 4 (1978Wo09), 11.9 s 6 (1976AmZW), 11.1 s 5 (1974Gr29), 12.1 s 10 (1973Ta13), 12.3 s 2 (1969WiZX), 11.9 s 3 (1969Ru14), 11.4 s 25 (1967Am01).
199.326 [‡] 6	2 ⁺	0.71 ns 2	ABC	$\mu=0.68$ 10 (1983Wo05) J ^π : 199γ is E2. T _{1/2} : weighted average of 0.70 ns 3 (1974JaZN) and 0.71 ns 3 (1990Ma25). Others: 0.67 ns 11 (1983MaYT), 0.85 ns 15 (1976MoZB), 1.0 ns 2 (1970Wa05), 0.70 ns 7 (1980ChZM).
530.19 [‡] 7	4 ⁺	34 ps 5	ABC	T _{1/2} : from 1990Ma25 . J ^π : stretched E2 to 2 ⁺ , g.s. band member.
758.94 [#] 4	1 ⁽⁻⁾	<24 ps	AB	T _{1/2} : from 1990Ma25 . J ^π : 559γ-199γ(θ) gives J=1,3 but J=3 ruled out by strong 759γ to 0 ⁺ . Member of π=- band.
838.37 [#] 5	3 ⁽⁻⁾	<10 ps	ABC	T _{1/2} : from 1990Ma25 . J ^π : γγ(θ) consistent only with J=3. Member of π=- band.
961.53 [‡] 11	6 ⁺		BC	J ^π : stretched E2 to 4 ⁺ , g.s. band member.
1020.03 7	0 ⁺		A	J ^π : (820γ)(199γ)(θ) consistent only with 0(Q)2(Q)0.
1038.83 [#] 11	5 ⁽⁻⁾		BC	J ^π : stretched D to 4 ⁺ . Member π=- band.
1315.64 8	(2)		A	J ^π : 1116γ-199γ(θ) is closest to that for J=2 in β ⁻ decay.
1355.24 [#] 13	7 ⁽⁻⁾		BC	J ^π : stretched E2 to 5 ⁻ , π=- band member.
1470.84 [‡] 14	8 ⁺		BC	J ^π : stretched E2 to 6 ⁺ , g.s. band member.
1772.95 [#] 14	9 ⁽⁻⁾		BC	J ^π : stretched E2 to 7 ⁺ , π=- band member.
1837.58 21			A	
1848.16 9	2 ⁽⁺⁾		A	J ^π : γ' s to 1 ⁻ and 3 ⁻ . D+Q to 2 ⁺ . γγ(θ) consistent with J=2 with large δ(1649γ).
1864.25 8	2 ⁺		A	J ^π : level decays to 0 ⁺ , 4 ⁺ levels. γγ(θ) confirms 2.
1880.98 ^{&} 24	(5 ⁺)		C	
1991.46 [@] 18	(6 ⁻)		BC	
2044.32 [‡] 16	10 ⁺		BC	J ^π : stretched E2 to 8 ⁺ , g.s. band member.
2159.26 ^{&} 18	(7 ⁺)		BC	
2212.42 8	(2 ⁺)		A	J ^π : 348γ to 2 ⁺ is M1,E2. Decays to 1 ⁻ and 4 ⁺ levels. J=3 unlikely from

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{144}Ba Levels (continued)

E(level) [†]	J ^π	XREF	Comments
			1374γ-239γ-199γ(θ).
2279.07 [#] 16	11 ⁽⁻⁾	BC	J ^π : stretched E2 to 9 ⁻ , g.s. band member.
2362.94 [@] 21	(8 ⁻)	BC	
2375.39 25	(1 ⁺ , 2 ⁺)	A	J ^π : 2176γ-199γ(θ) is consistent with 1 and possibly 2. 2176γ is D+23% Q for J=1. γ to 0 ⁺ makes J ^π =2 ⁻ unlikely.
2664.0 ^{&} 3		BC	
2667.07 [‡] 19	12 ⁺	BC	J ^π : stretched E2 to 10 ⁺ , g.s. band member.
2863.68 [#] 18	13 ⁽⁻⁾	BC	J ^π : stretched E2 to 11 ⁻ , π=- band member.
2903.66 [@] 23		C	
3320.72 [‡] 22	(14 ⁺)	BC	J ^π : member of g.s. rotational band.
3519.00 [#] 24	(15 ⁻)	BC	J ^π : stretched E2 to 13 ⁻ , π=- band member.
3991.5 [‡] 3	(16 ⁺)	BC	J ^π : member of g.s. rotational band.
4242.1 [#] 4	(17 ⁻)	BC	
5027.6 [#] 11	(19 ⁻)	B	

[†] From a least-squares fit to Eγ data.[‡] Band(A): g.s. band.

Band(B): octupole band.

@ Band(C): rotational band 1.

& Band(D): rotational band 2.

Adopted Levels, Gammas (continued)

$\gamma(^{144}\text{Ba})$

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\#$	$\alpha^@$	Comments
199.326	2 ⁺	199.326 6	100	0.0	0 ⁺	E2		0.175	B(E2)(W.u.)=48.1 14 $\alpha(\text{K})=0.136$ 4; $\alpha(\text{L})=0.0311$ 10; $\alpha(\text{M})=0.00660$ 20; $\alpha(\text{N}+..)=0.00172$ 6
530.19	4 ⁺	330.88 9	100	199.326	2 ⁺	E2		0.0333	B(E2)(W.u.)=91 14 $\alpha(\text{K})=0.0273$ 9; $\alpha(\text{L})=0.00475$ 15; $\alpha(\text{M})=0.00099$ 3; $\alpha(\text{N}+..)=0.00026$ 1
758.94	1 ⁽⁻⁾	559.57 5	98.1 25	199.326	2 ⁺	D(+Q)	-0.005 10		
		758.96 5	100 3	0.0	0 ⁺				
838.37	3 ⁽⁻⁾	308.23 9	14.6 7	530.19	4 ⁺	D(+Q)	+0.06 5		Seen only in β -decay studies.
		638.99 5	100.0 19	199.326	2 ⁺	D(+Q)	-0.09 2		
961.53	6 ⁺	431.3 1	100	530.19	4 ⁺	E2		0.0150	$\alpha(\text{K})=0.0125$ 4; $\alpha(\text{L})=0.00197$ 6; $\alpha(\text{M})=0.00041$ 1; $\alpha(\text{N}+..)=0.00011$
1020.03	0 ⁺	261.0 3	13.2 25	758.94	1 ⁽⁻⁾				
		820.71 7	100 11	199.326	2 ⁺	Q			
1038.83	5 ⁽⁻⁾	199.1		838.37	3 ⁽⁻⁾				Not seen by 1997Ur01.
		508.7 1	100	530.19	4 ⁺				
1315.64	(2)	477.21 11	31 4	838.37	3 ⁽⁻⁾	D+Q	+0.23 15		
		556.4 3	29 6	758.94	1 ⁽⁻⁾				
		785.1 5	11 3	530.19	4 ⁺				
		1116.42 10	100 12	199.326	2 ⁺	D+Q	+7 +19-3		
1355.24	7 ⁽⁻⁾	316.5 2	22 3	1038.83	5 ⁽⁻⁾	E2		0.0383	$\alpha(\text{K})=0.0313$ 10; $\alpha(\text{L})=0.00555$ 17; $\alpha(\text{M})=0.00116$ 4; $\alpha(\text{N}+..)=0.00031$ 1
		393.7 1	100 8	961.53	6 ⁺	E1		0.00575	$\alpha(\text{K})=0.00496$ 15; $\alpha(\text{L})=0.00063$ 2; $\alpha(\text{M})=0.00013$
1470.84	8 ⁺	115.6 2	6.0 7	1355.24	7 ⁽⁻⁾	E1		0.153	$\alpha(\text{K})=0.131$ 4; $\alpha(\text{L})=0.0175$ 6; $\alpha(\text{M})=0.00356$ 11; $\alpha(\text{N}+..)=0.00093$ 3
		509.3 1	100 11	961.53	6 ⁺	E2		0.0095	$\alpha(\text{K})=0.00789$ 24; $\alpha(\text{L})=0.00118$ 4
1772.95	9 ⁽⁻⁾	302.1 1	100 9	1470.84	8 ⁺	E1		0.0112	$\alpha(\text{K})=0.0097$ 3; $\alpha(\text{L})=0.00123$ 4; $\alpha(\text{M})=0.00025$ 1
		417.7 1	61 4	1355.24	7 ⁽⁻⁾	E2		0.0164	$\alpha(\text{K})=0.0137$ 5; $\alpha(\text{L})=0.00218$ 7; $\alpha(\text{M})=0.00045$ 1; $\alpha(\text{N}+..)=0.00012$
1837.58		1078.63 20	100	758.94	1 ⁽⁻⁾				
1848.16	2 ⁽⁺⁾	1009.73 13	62 7	838.37	3 ⁽⁻⁾				
		1089.08 15	100 12	758.94	1 ⁽⁻⁾				
		1649.07 17	65 9	199.326	2 ⁺	Q+D	-3.2 +18-69		
1864.25	2 ⁺	1025.73 11	100 11	838.37	3 ⁽⁻⁾				
		1105.3 4	50 11	758.94	1 ⁽⁻⁾				
		1333.9 6	7.1 21	530.19	4 ⁺				
		1664.98 16	100 11	199.326	2 ⁺	Q+D	-2.8 +11-31		
		1864.24 24	43 4	0.0	0 ⁺				
1880.98	(5 ⁺)	1350.8 2	100	530.19	4 ⁺				
1991.46	(6 ⁻)	952.8 3	100 25	1038.83	5 ⁽⁻⁾				

Adopted Levels, Gammas (continued)

$\gamma(^{144}\text{Ba})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\#$	$\alpha^@$	Comments
1991.46	(6 ⁻)	1029.8 3	100 25	961.53	6 ⁺				
2044.32	10 ⁺	271.4 2	35 4	1772.95	9 ⁽⁻⁾	E1		0.0149	$\alpha(\text{K})=0.0128$ 4; $\alpha(\text{L})=0.00163$ 5; $\alpha(\text{M})=0.00033$ 1
		573.5 1	100 8	1470.84	8 ⁺	E2		0.00688	$\alpha(\text{K})=0.00577$ 18; $\alpha(\text{L})=0.00084$ 3
2159.26	(7 ⁺)	167.8 2	69 19	1991.46	(6 ⁻)				Seen by 1997Ur01 only.
		278.3 3	56 13	1880.98	(5 ⁺)				
		1197.7 2	100 19	961.53	6 ⁺				
2212.42	(2 ⁺)	348.06 11	100 8	1864.25	2 ⁺	M1,E2		0.031 3	$\alpha(\text{K})=0.026$ 3; $\alpha(\text{L})=0.00386$ 14; $\alpha(\text{M})=0.00080$ 4; $\alpha(\text{N}+..)=0.00021$ 1
		897.1 4	15 3	1315.64	(2)				
		1374.12 12	83 10	838.37	3 ⁽⁻⁾	D+Q	+1.03 8		
		1453.46 24	60 10	758.94	1 ⁽⁻⁾				
		1682.10 22	38 5	530.19	4 ⁺				
		2013.34 22	98 4	199.326	2 ⁺	D(+Q)	+0.04 13		
2279.07	11 ⁽⁻⁾	234.8 2	37 5	2044.32	10 ⁺	E1		0.0218	$\alpha(\text{K})=0.0188$ 6; $\alpha(\text{L})=0.00241$ 8; $\alpha(\text{M})=0.00049$ 2; $\alpha(\text{N}+..)=0.00013$
		506.1 1	100 11	1772.95	9 ⁽⁻⁾	E2		0.0096	$\alpha(\text{K})=0.00802$ 24; $\alpha(\text{L})=0.00120$ 4
2362.94	(8 ⁻)	203.3& 3	≤33	2159.26	(7 ⁺)				Seen by 1997Ur01 only.
		371.5 3	67 22	1991.46	(6 ⁻)				
		892.0 3	100 22	1470.84	8 ⁺				
		1007.8 3	44 22	1355.24	7 ⁽⁻⁾				
2375.39	(1 ⁺ ,2 ⁺)	1355.3 6	5.1 15	1020.03	0 ⁺				
		1616.7 6	15 6	758.94	1 ⁽⁻⁾				
		2176.0 3	100 13	199.326	2 ⁺	D+Q			δ : -0.72 +17-33 if J(2375)=1.
2664.0		301.1 3	86 29	2362.94	(8 ⁻)				
		504.7 3	100 43	2159.26	(7 ⁺)				
2667.07	12 ⁺	388.0 2	70 13	2279.07	11 ⁽⁻⁾	E1		0.00596	$\alpha(\text{K})=0.00514$ 16; $\alpha(\text{L})=0.00065$ 2; $\alpha(\text{M})=0.00013$
		622.8 2	100 17	2044.32	10 ⁺	E2		0.00556	$\alpha(\text{K})=0.00467$ 14; $\alpha(\text{L})=0.00067$ 2
2863.68	13 ⁽⁻⁾	196.6 2	16 4	2667.07	12 ⁺	E1		0.0352	$\alpha(\text{K})=0.0303$ 9; $\alpha(\text{L})=0.00393$ 12; $\alpha(\text{M})=0.00080$ 2; $\alpha(\text{N}+..)=0.00021$ 1
		584.6 1	100 10	2279.07	11 ⁽⁻⁾	E2		0.00654	$\alpha(\text{K})=0.00549$ 17; $\alpha(\text{L})=0.00079$ 2
2903.66		541.0& 3	≤8	2362.94	(8 ⁻)				
		624.6 2	100 17	2279.07	11 ⁽⁻⁾				
		859.3 3	21 8	2044.32	10 ⁺				
3320.72	(14 ⁺)	457.0 2	57 14	2863.68	13 ⁽⁻⁾				
		653.7 2	100 19	2667.07	12 ⁺				
3519.00	(15 ⁻)	198.3 3	10 3	3320.72	(14 ⁺)				
		655.3 2	100 16	2863.68	13 ⁽⁻⁾			0.00488	$\alpha(\text{K})=0.00411$ 13; $\alpha(\text{L})=0.00058$ 2
3991.5	(16 ⁺)	472.5 3	67 22	3519.00	(15 ⁻)				
		670.8 3	100 22	3320.72	(14 ⁺)				
4242.1	(17 ⁻)	250.4& 3	≤25	3991.5	(16 ⁺)				Seen only by 1997Ur01 .

Adopted Levels, Gammas (continued)

$\gamma(^{144}\text{Ba})$ (continued)

<u>E_i(level)</u>	<u>J^{π}_i</u>	<u>E_{γ}[†]</u>	<u>I_{γ}[†]</u>	<u>E_f</u>	<u>J^{π}_f</u>
4242.1	(17 ⁻)	723.1 2	100 25	3519.00	(15 ⁻)
5027.6	(19 ⁻)	785.5	100	4242.1	(17 ⁻)

† From weighted average of ²⁴⁸Cm SF decay (1997Ur01) and ¹⁴⁴Cs β^- decay (1980Sc16) values.
‡ From SF decay or $\gamma\gamma(\theta)$ and $\alpha(\text{K})\text{exp}$ in β^- decay.
From $\gamma\gamma(\theta)$ in β^- decay.
@ 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.

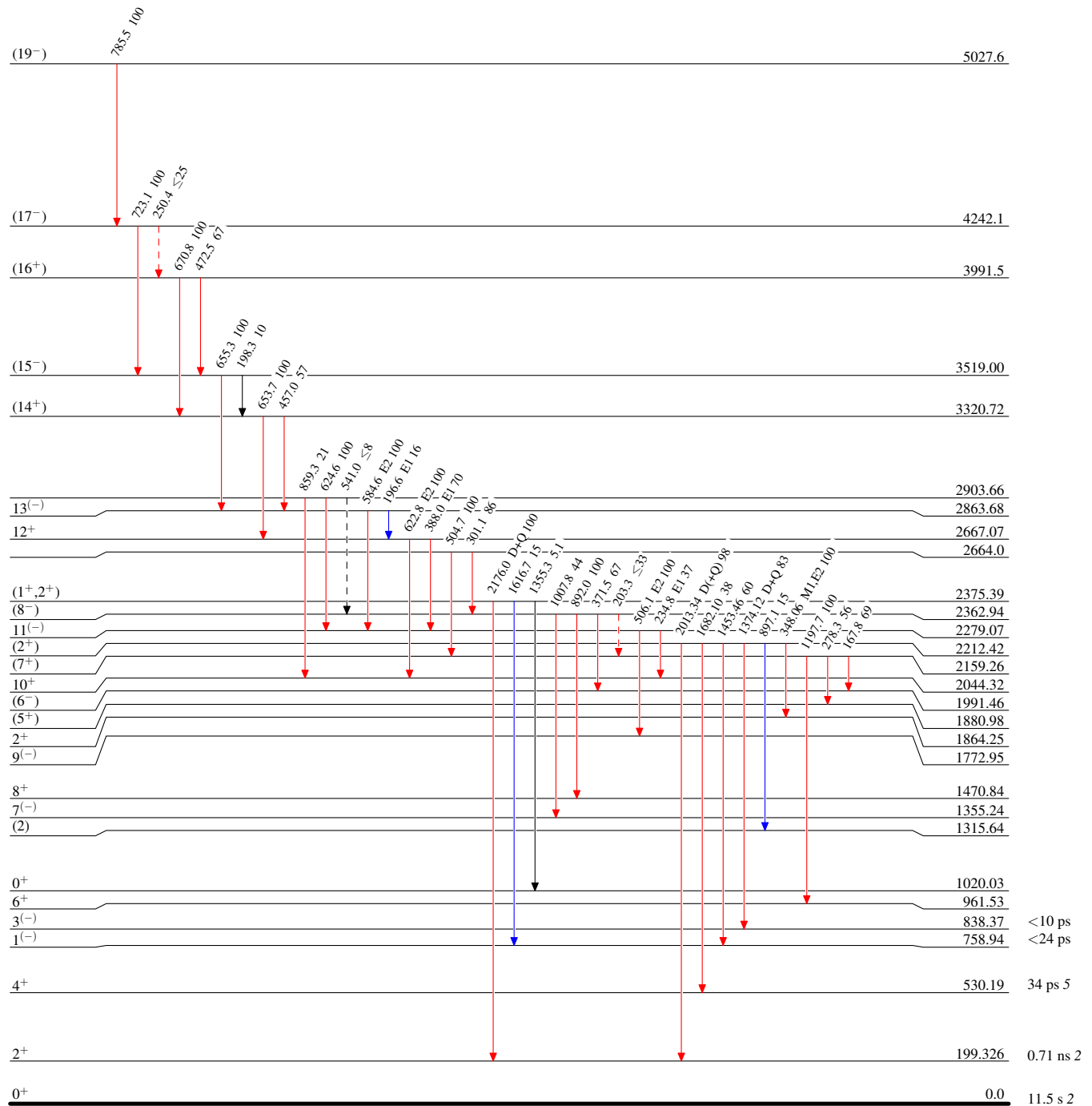
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Type not specified

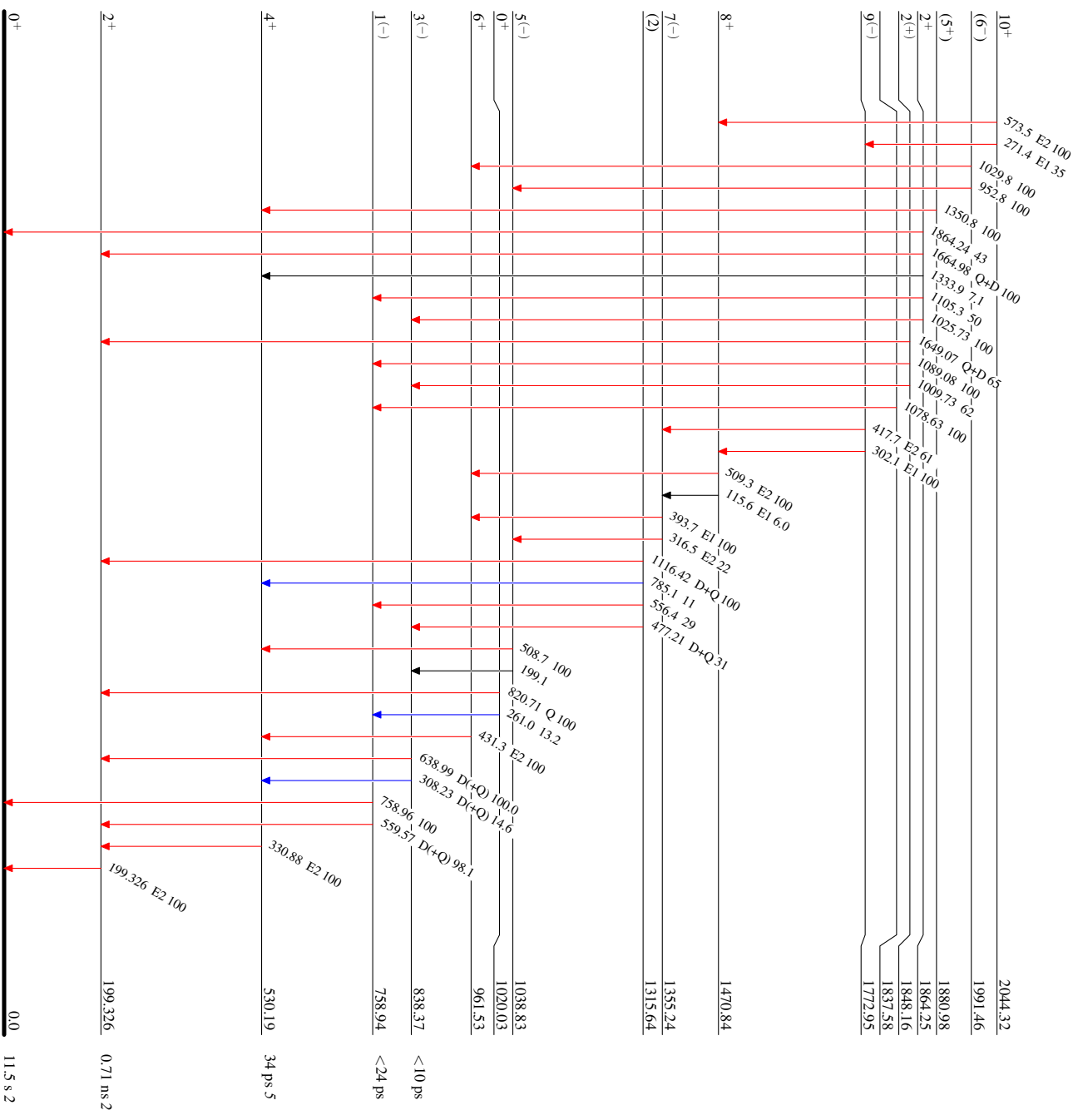
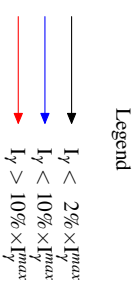
- $I_\gamma < 2\% \times I_\gamma^{\max}$
 —→ $I_\gamma < 10\% \times I_\gamma^{\max}$
 —→ $I_\gamma > 10\% \times I_\gamma^{\max}$
 - - - - -→ γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Type not specified



Adopted Levels, Gammas