

**Adopted Levels, Gammas**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jean Blachot	NDS 111,1471 (2010)	1-May-2009

Q( $\beta^-$ )=4824 10; S(n)=7.11×10<sup>3</sup> 5; S(p)=10428 12; Q( $\alpha$ )=-6912 12 [2012Wa38](#)  
 Note: Current evaluation has used the following Q record 5010 407000 7010490 90-6.57e+311 [2003Au03,2009AuZZ](#).  
 Production and identification: <sup>238</sup>U(p,F) E=20 MeV, on-line isotopic separator IGISOL.  
<sup>252</sup>Cf SF decay. Mass from kinetic energy of fragment ([1970Jo20](#)). (K x-ray) $\gamma$  coin ([1972Ho08](#)).  
 $\alpha$ : [Additional information 1](#).

<sup>113</sup>Rh Levels

Cross Reference (XREF) Flags

- A <sup>113</sup>Ru  $\beta^-$  decay (0.80 s)    D <sup>208</sup>Pb(<sup>18</sup>O,F $\gamma$ )
- B <sup>113</sup>Ru  $\beta^-$  decay (0.51 s)    E <sup>248</sup>Cm SF decay
- C <sup>252</sup>Cf SF decay

E(level) <sup>†</sup>	J $\pi$ <sup>‡</sup>	T <sub>1/2</sub>	XREF	Comments
0.0 <sup>#</sup>	(7/2 <sup>+</sup> )	2.80 s 12	ABCDE	% $\beta^-$ =100 T <sub>1/2</sub> : From <a href="#">1993Pe11</a> .
211.72 <sup>@</sup> 6	(9/2 <sup>+</sup> )	0.21 ns 13	ABCDE	T <sub>1/2</sub> : From centroid-shift in $\beta\gamma$ (t)( <a href="#">2002Ku18</a> ).
263.21 <sup>c</sup> 6	(3/2 <sup>+</sup> )	0.38 ns 12	ABC E	T <sub>1/2</sub> : From centroid-shift in $\beta\gamma$ (t)( <a href="#">2002Ku18</a> ).
351.35 <sup>c</sup> 6	(5/2 <sup>+</sup> )		ABC E	
444.01 <sup>#</sup> 7	(11/2 <sup>+</sup> )		BCD	
570.96 <sup>&amp;</sup> 7	(11/2 <sup>+</sup> )		CD	
578.98 <sup>c</sup> 7	(7/2 <sup>+</sup> )		ABC E	
600.72 <sup>d</sup> 7	(3/2 <sup>+</sup> )	0.66 ns 14	ABCDE	T <sub>1/2</sub> : From centroid-shift in $\beta\gamma$ (t)( <a href="#">2002Ku18</a> ).
666.2 10	(1/2 <sup>-</sup> )		E	
684.67 <sup>@</sup> 8	(13/2 <sup>+</sup> )		CD	
784.8 <sup>c</sup> 6	(9/2 <sup>+</sup> )		E	
785.13 <sup>f</sup> 9	(7/2 <sup>-</sup> )		ABC	
786.55 <sup>d</sup> 12	(7/2 <sup>+</sup> )		ABC E	
823.4 4			A	
834.36 <sup>e</sup> 8	(5/2 <sup>+</sup> )		ABC E	
883.2 14			E	
911.92 9	(9/2 <sup>+</sup> )		C E	
936.33 <sup>a</sup> 8	(13/2 <sup>+</sup> )		CD	
967.9 3			A	
978.0 3			A	
1008.9 3			A	
1034.0 4			A	
1060.9 3			A	
1071.0 <sup>c</sup> 8	(11/2 <sup>+</sup> )		E	
1075.73 <sup>#</sup> 8	(15/2 <sup>+</sup> )		CD	
1138.5 10	(11/2 <sup>+</sup> )		E	
1206.4 5			B	
1258.62 <sup>e</sup> 13	(9/2 <sup>+</sup> )		C E	
1259.9 10			E	
1284.26 <sup>&amp;</sup> 7	(15/2 <sup>+</sup> )		CD	
1320.22 <sup>@</sup> 10	(17/2 <sup>+</sup> )		CD	
1412.0 <sup>&amp;</sup> 7	(17/2 <sup>+</sup> )		D	

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**Adopted Levels, Gammas (continued)**

<sup>113</sup>Rh Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	XREF	E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	XREF	E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	XREF
1463.9 7		A	2058.4 6	(9/2 <sup>-</sup> )	B	2470.33 <sup>#</sup> 12	(23/2 <sup>+</sup> )	C
1485.2 6		A	2122.0 4		A	2525.7 4		A
1529.8 6		B	2133.19 12	(21/2 <sup>+</sup> )	C	2623.6 9		A
1673.62 <sup>a</sup> 9	(17/2 <sup>+</sup> )	C	2191.3 3		A	2675.4 13		A
1775.49 <sup>#</sup> 11	(19/2 <sup>+</sup> )	CD	2221.4 4		A	2723.25 <sup>@</sup> 13	(25/2 <sup>+</sup> )	C
1843.4 6		B	2287.5 5		A	2776.90 15	(25/2 <sup>+</sup> )	C
1908.6 5		A	2297.4 7		A	3090.77 <sup>#</sup> 14	(27/2 <sup>+</sup> )	C
1945.8 <sup>#</sup> 4		A	2367.9 4	(9/2 <sup>-</sup> )	B	3133.07 <sup>b</sup> 18	(27/2 <sup>+</sup> )	C
1965.8 5		A	2398.49 <sup>a</sup> 11	(21/2 <sup>+</sup> )	C	3334.76 <sup>@</sup> 15	(29/2 <sup>+</sup> )	C
2025.31 <sup>&amp;</sup> 9	(19/2 <sup>+</sup> )	C	2417.5 5	(9/2 <sup>-</sup> )	B	3770.05 <sup>#</sup> 15	(31/2 <sup>+</sup> )	C
2037.98 <sup>@</sup> 12	(21/2 <sup>+</sup> )	CD	2446.50 <sup>b</sup> 15	(23/2 <sup>+</sup> )	C	4006.04 <sup>@</sup> 16	(33/2 <sup>+</sup> )	C

<sup>†</sup> From least-squares fit to adopted gamma energies.

<sup>‡</sup> Based on bands assignments and systematics.

<sup>#</sup> Band(A): g.s. band,  $\alpha=-1/2$ .

<sup>@</sup> Band(a): g.s. band,  $\alpha=+1/2$ .

<sup>&</sup> Band(B): 11/2<sup>+</sup> band,  $\alpha=-1/2$ .

<sup>a</sup> Band(b): 13/2<sup>+</sup> band,  $\alpha=+1/2$ .

<sup>b</sup> Band(C): 23/2<sup>+</sup> band,  $\alpha=-1/2$ .

<sup>c</sup> Band(D): 3/2<sup>+</sup> band.

<sup>d</sup> Band(E):  $\pi 1/2[431]$  band,  $\alpha=-1/2$ .

<sup>e</sup> Band(e):  $\pi 1/2[431]$  band,  $\alpha=+1/2$ .

<sup>f</sup> Band(F):  $\pi 1/2[301]$  band.

$\gamma(^{113}\text{Rh})$

E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>γ</sub> <sup>†</sup>	I <sub>γ</sub> <sup>†</sup>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>	Mult.	α	Comments
211.72	(9/2 <sup>+</sup> )	211.70 10	100	0.0	(7/2 <sup>+</sup> )	M1	0.0444	$\alpha(K)=0.0388$ 6; $\alpha(L)=0.00464$ 7; $\alpha(M)=0.000862$ 13; $\alpha(N)=0.0001431$ 21; $\alpha(O)=7.22 \times 10^{-6}$ 11 $\alpha(N+..)=0.0001503$ 22
263.21	(3/2 <sup>+</sup> )	263.17 10	100	0.0	(7/2 <sup>+</sup> )			
351.35	(5/2 <sup>+</sup> )	88.17 10	78 16	263.21	(3/2 <sup>+</sup> )			
		351.44 10	100 20	0.0	(7/2 <sup>+</sup> )	M1	0.01209	$\alpha(K)=0.01057$ 15; $\alpha(L)=0.001244$ 18; $\alpha(M)=0.000231$ 4; $\alpha(N)=3.84 \times 10^{-5}$ 6; $\alpha(O)=1.96 \times 10^{-6}$ 3 $\alpha(N+..)=4.03 \times 10^{-5}$ 6
444.01	(11/2 <sup>+</sup> )	232.28 10	100 13	211.72	(9/2 <sup>+</sup> )			
		443.95 10	91 13	0.0	(7/2 <sup>+</sup> )			
570.96	(11/2 <sup>+</sup> )	359.26 10	100 20	211.72	(9/2 <sup>+</sup> )			
		571.0 1	15 3	0.0	(7/2 <sup>+</sup> )			
578.98	(7/2 <sup>+</sup> )	227.68 10	100 20	351.35	(5/2 <sup>+</sup> )			
		315.73 10		263.21	(3/2 <sup>+</sup> )			
		367.25 10	29 6	211.72	(9/2 <sup>+</sup> )			
600.72	(3/2 <sup>+</sup> )	337.58 10	100 20	263.21	(3/2 <sup>+</sup> )			
		600.7 1	14 3	0.0	(7/2 <sup>+</sup> )			
666.2	(1/2 <sup>-</sup> )	403 <sup>‡</sup>	100	263.21	(3/2 <sup>+</sup> )			
684.67	(13/2 <sup>+</sup> )	240.65 10	82 11	444.01	(11/2 <sup>+</sup> )			
		472.93 10	100 12	211.72	(9/2 <sup>+</sup> )			
784.8	(9/2 <sup>+</sup> )	206.0		578.98	(7/2 <sup>+</sup> )			

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Adopted Levels, Gammas (continued) $\gamma(^{113}\text{Rh})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$
784.8	(9/2 <sup>+</sup> )	433.5		351.35	(5/2 <sup>+</sup> )
785.13	(7/2 <sup>-</sup> )	206.10 10	100	578.98	(7/2 <sup>+</sup> )
		433.82 10		351.35	(5/2 <sup>+</sup> )
		785		0.0	(7/2 <sup>+</sup> )
786.55	(7/2 <sup>+</sup> )	185.82 10	100	600.72	(3/2 <sup>+</sup> )
823.4		560.1 4	100	263.21	(3/2 <sup>+</sup> )
834.36	(5/2 <sup>+</sup> )	233.69 10	100 20	600.72	(3/2 <sup>+</sup> )
		483.04 10	27 6	351.35	(5/2 <sup>+</sup> )
		571.07 10	82 16	263.21	(3/2 <sup>+</sup> )
883.2		217.7 <sup>‡</sup>	100	666.2	(1/2 <sup>-</sup> )
911.92	(9/2 <sup>+</sup> )	332.97 10	100	578.98	(7/2 <sup>+</sup> )
		560.54 10		351.35	(5/2 <sup>+</sup> )
936.33	(13/2 <sup>+</sup> )	365.33 10	100 20	570.96	(11/2 <sup>+</sup> )
		724.60 10	42 9	211.72	(9/2 <sup>+</sup> )
967.9		181.0 7	28 14	786.55	(7/2 <sup>+</sup> )
		367.2 5	100 14	600.72	(3/2 <sup>+</sup> )
		704.9 7	31 3	263.21	(3/2 <sup>+</sup> )
978.0		626.8 5	40.0 20	351.35	(5/2 <sup>+</sup> )
		715.1 4	100 3	263.21	(3/2 <sup>+</sup> )
1008.9		657.8 5	86 4	351.35	(5/2 <sup>+</sup> )
		745.9 5	83 4	263.21	(3/2 <sup>+</sup> )
		1008.7 6	100 7	0.0	(7/2 <sup>+</sup> )
1034.0		247.0 8	5.×10 <sup>1</sup> 3	786.55	(7/2 <sup>+</sup> )
		682.8 8	58 17	351.35	(5/2 <sup>+</sup> )
		770.9 7	100 8	263.21	(3/2 <sup>+</sup> )
1060.9		226.0 7	30 15	834.36	(5/2 <sup>+</sup> )
		274.7 7	33 4	786.55	(7/2 <sup>+</sup> )
		709.4 5	100 5	351.35	(5/2 <sup>+</sup> )
		797.8 6	85 4	263.21	(3/2 <sup>+</sup> )
		1061.2 6	93 7	0.0	(7/2 <sup>+</sup> )
1071.0	(11/2 <sup>+</sup> )	286.5		784.8	(9/2 <sup>+</sup> )
		491.7 <sup>‡</sup>		578.98	(7/2 <sup>+</sup> )
1075.73	(15/2 <sup>+</sup> )	391.18 10	100 14	684.67	(13/2 <sup>+</sup> )
		631.65 10	62 8	444.01	(11/2 <sup>+</sup> )
1138.5	(11/2 <sup>+</sup> )	352.7 <sup>‡</sup>	100	786.55	(7/2 <sup>+</sup> )
1206.4		994.7 5	100	211.72	(9/2 <sup>+</sup> )
1258.62	(9/2 <sup>+</sup> )	424.26 10	100	834.36	(5/2 <sup>+</sup> )
1259.9		348	100	911.92	(9/2 <sup>+</sup> )
1284.26	(15/2 <sup>+</sup> )	347.84 10	100 20	936.33	(13/2 <sup>+</sup> )
		599.45 10	46 9	684.67	(13/2 <sup>+</sup> )
		713.40 10	23 5	570.96	(11/2 <sup>+</sup> )
		840.3 1		444.01	(11/2 <sup>+</sup> )
1320.22	(17/2 <sup>+</sup> )	244.48 10	51 10	1075.73	(15/2 <sup>+</sup> )
		635.55 10	100 16	684.67	(13/2 <sup>+</sup> )
1412.0	(17/2 <sup>+</sup> )	475.7 7	100	936.33	(13/2 <sup>+</sup> )
1463.9		1112.2 10	7.×10 <sup>1</sup> 6	351.35	(5/2 <sup>+</sup> )
		1464.3 10	100 15	0.0	(7/2 <sup>+</sup> )
1485.2		906.2 8	73 9	578.98	(7/2 <sup>+</sup> )
		1133.9 8	1.0×10 <sup>2</sup> 3	351.35	(5/2 <sup>+</sup> )
1529.8		1318.4 7	100	211.72	(9/2 <sup>+</sup> )
1673.62	(17/2 <sup>+</sup> )	389.36 10	100 20	1284.26	(15/2 <sup>+</sup> )
		737.34 10	65 13	936.33	(13/2 <sup>+</sup> )
1775.49	(19/2 <sup>+</sup> )	455.34 10	100 20	1320.22	(17/2 <sup>+</sup> )
		699.76 10	38 12	1075.73	(15/2 <sup>+</sup> )

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Adopted Levels, Gammas (continued) $\gamma(^{113}\text{Rh})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$
1843.4		1631.7 6	100	211.72	(9/2 <sup>+</sup> )
1908.6		1123.0 8	33 10	785.13	(7/2 <sup>-</sup> )
		1645.7 7	100 20	263.21	(3/2 <sup>+</sup> )
1945.8		1367.6 6	100 8	578.98	(7/2 <sup>+</sup> )
		1593.8 7	83 8	351.35	(5/2 <sup>+</sup> )
1965.8		1180.4 7	1.0×10 <sup>2</sup> 5	785.13	(7/2 <sup>-</sup> )
		1614.7 8	1.0×10 <sup>2</sup> 5	351.35	(5/2 <sup>+</sup> )
2025.31	(19/2 <sup>+</sup> )	351.65 10	100 20	1673.62	(17/2 <sup>+</sup> )
		740.95 10	23 5	1284.26	(15/2 <sup>+</sup> )
		949.61 10	69 14	1075.73	(15/2 <sup>+</sup> )
2037.98	(21/2 <sup>+</sup> )	262.55 10	44 9	1775.49	(19/2 <sup>+</sup> )
		717.66 10	100 20	1320.22	(17/2 <sup>+</sup> )
2058.4	(9/2 <sup>-</sup> )	1225.0 10	30 20	834.36	(5/2 <sup>+</sup> )
		1846.1 8	100 10	211.72	(9/2 <sup>+</sup> )
		2058.4 13	15 15	0.0	(7/2 <sup>+</sup> )
2122.0		1770.2 7	79 9	351.35	(5/2 <sup>+</sup> )
		1858.1 7	100 6	263.21	(3/2 <sup>+</sup> )
		1911.0 9	32 3	211.72	(9/2 <sup>+</sup> )
		2121.8 11	21 3	0.0	(7/2 <sup>+</sup> )
2133.19	(21/2 <sup>+</sup> )	357.67 10	100	1775.49	(19/2 <sup>+</sup> )
		813.0 1		1320.22	(17/2 <sup>+</sup> )
2191.3		246.4 11	7 4	1945.8	
		1223.3 7	38 4	967.9	
		1367.6 6	64 22	823.4	
		1840.8 7	64 4	351.35	(5/2 <sup>+</sup> )
		1927.6 7	100 7	263.21	(3/2 <sup>+</sup> )
		2191.0 8	64 22	0.0	(7/2 <sup>+</sup> )
2221.4		1160.8 9	19 3	1060.9	
		1213.1 7	36 3	1008.9	
		1869.7 7	64 6	351.35	(5/2 <sup>+</sup> )
		1957.8 7	100 8	263.21	(3/2 <sup>+</sup> )
2287.5		1226.6 6	100 3	1060.9	
		1936.3 10	19 8	351.35	(5/2 <sup>+</sup> )
		2023.9 10	24 11	263.21	(3/2 <sup>+</sup> )
2297.4		2034.5 10	47 6	263.21	(3/2 <sup>+</sup> )
		2297.1 9	100 18	0.0	(7/2 <sup>+</sup> )
2367.9	(9/2 <sup>-</sup> )	1534.6 11	10 5	834.36	(5/2 <sup>+</sup> )
		1583.1 6	100 10	785.13	(7/2 <sup>-</sup> )
		1922.9 7	100 10	444.01	(11/2 <sup>+</sup> )
		2156.5 11	20 5	211.72	(9/2 <sup>+</sup> )
		2368.0 9	40 9	0.0	(7/2 <sup>+</sup> )
2398.49	(21/2 <sup>+</sup> )	373.09 10	100	2025.31	(19/2 <sup>+</sup> )
		724.95 10	60	1673.62	(17/2 <sup>+</sup> )
2417.5	(9/2 <sup>-</sup> )	888.1 8	10 3	1529.8	
		1973.2 6	100 10	444.01	(11/2 <sup>+</sup> )
		2417.6 10	12 4	0.0	(7/2 <sup>+</sup> )
2446.50	(23/2 <sup>+</sup> )	313.35 10	100	2133.19	(21/2 <sup>+</sup> )
2470.33	(23/2 <sup>+</sup> )	432.26 10	100 20	2037.98	(21/2 <sup>+</sup> )
		694.87 10	74 15	1775.49	(19/2 <sup>+</sup> )
2525.7		403.4 5	100 21	2122.0	
		1548.9 7	71 4	978.0	
		2173.6 8	21 4	351.35	(5/2 <sup>+</sup> )
2623.6		2360.4 9	100	263.21	(3/2 <sup>+</sup> )
2675.4		2324.0 13	100	351.35	(5/2 <sup>+</sup> )
2723.25	(25/2 <sup>+</sup> )	252.95 10	69 14	2470.33	(23/2 <sup>+</sup> )

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**Adopted Levels, Gammas (continued)** $\gamma(^{113}\text{Rh})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$
2723.25	(25/2 <sup>+</sup> )	685.32 10	100 20	2037.98	(21/2 <sup>+</sup> )
2776.90	(25/2 <sup>+</sup> )	330.45 10	100 20	2446.50	(23/2 <sup>+</sup> )
		643.66 10	56 11	2133.19	(21/2 <sup>+</sup> )
3090.77	(27/2 <sup>+</sup> )	367.67 10	100 20	2723.25	(25/2 <sup>+</sup> )
		620.35 10	40 8	2470.33	(23/2 <sup>+</sup> )
3133.07	(27/2 <sup>+</sup> )	356.1 <sup>‡</sup>		2776.90	(25/2 <sup>+</sup> )
		686.57 10	100	2446.50	(23/2 <sup>+</sup> )
3334.76	(29/2 <sup>+</sup> )	244.0 1		3090.77	(27/2 <sup>+</sup> )
		611.45 10	100	2723.25	(25/2 <sup>+</sup> )
3770.05	(31/2 <sup>+</sup> )	435.24 10		3334.76	(29/2 <sup>+</sup> )
		679.33 10	100	3090.77	(27/2 <sup>+</sup> )
4006.04	(33/2 <sup>+</sup> )	236.0 1		3770.05	(31/2 <sup>+</sup> )
		671.27 10	100	3334.76	(29/2 <sup>+</sup> )

<sup>†</sup> If possible, taken from [2004Lu03](#), otherwise from [2002Ku18](#).

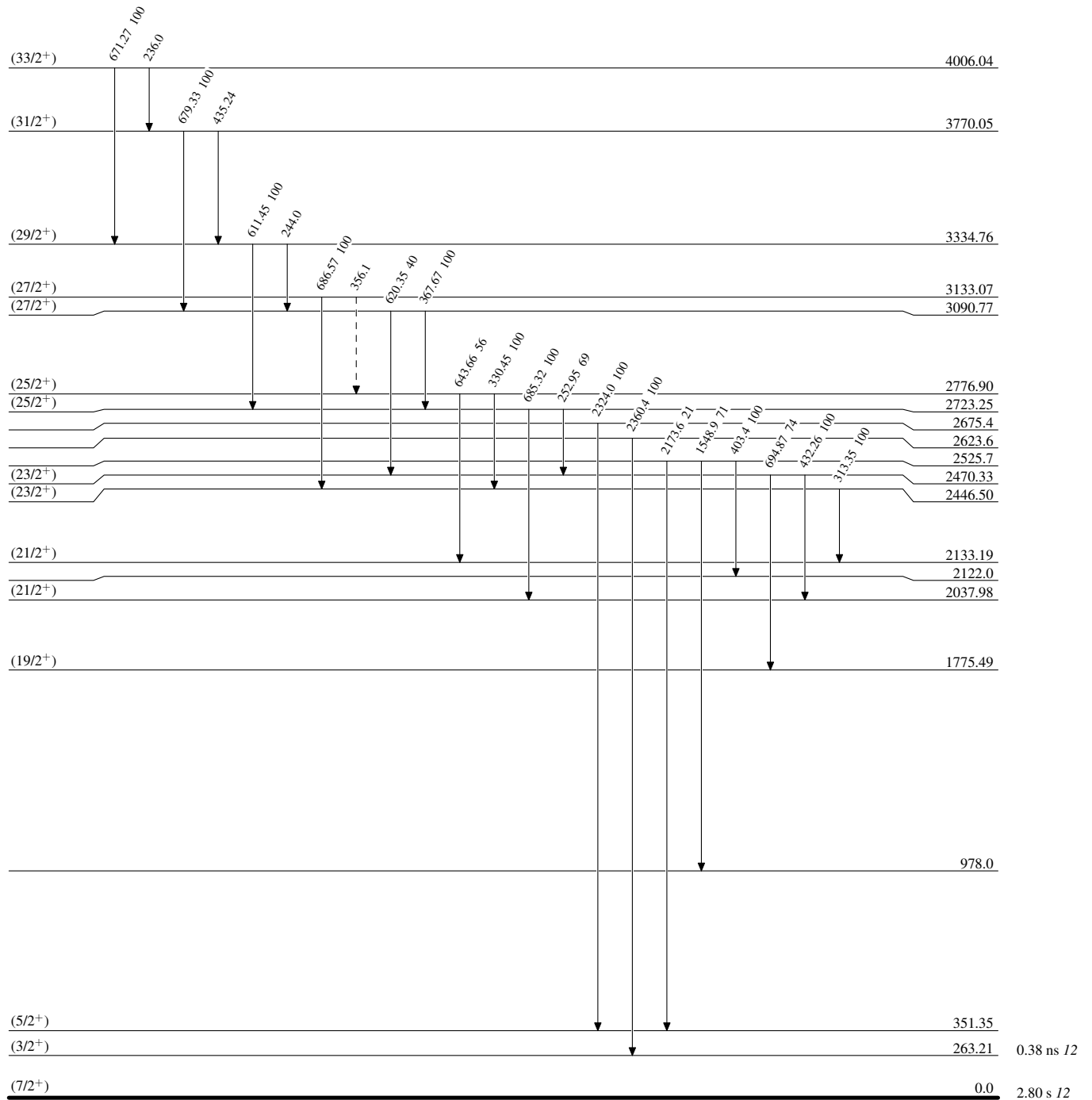
<sup>‡</sup> Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

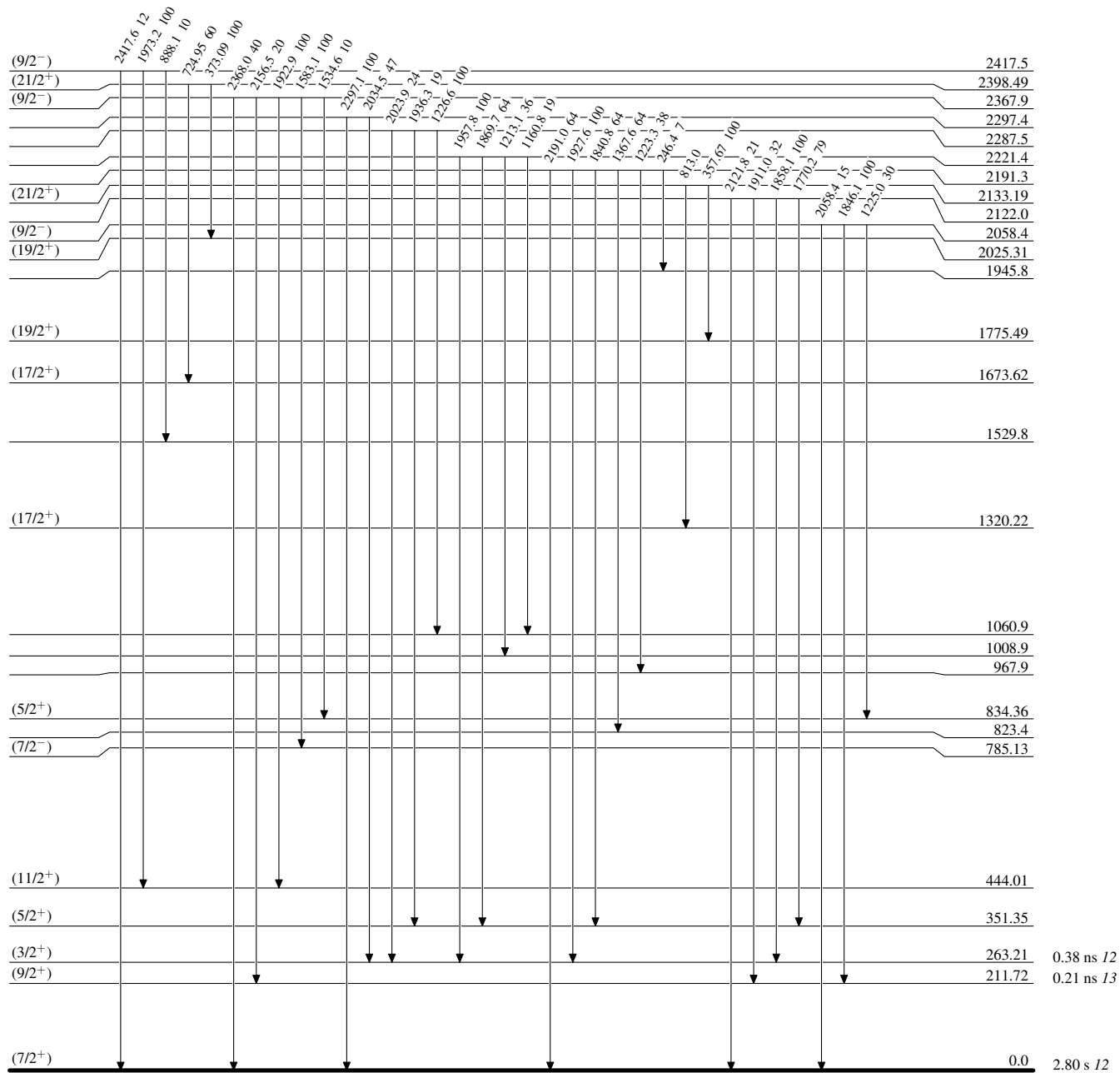
Intensities: Relative photon branching from each level

-----▶  $\gamma$  Decay (Uncertain) $^{113}_{45}\text{Rh}_{68}$

**Adopted Levels, Gammas**

**Level Scheme (continued)**

Intensities: Relative photon branching from each level



$^{113}_{45}\text{Rh}_{68}$

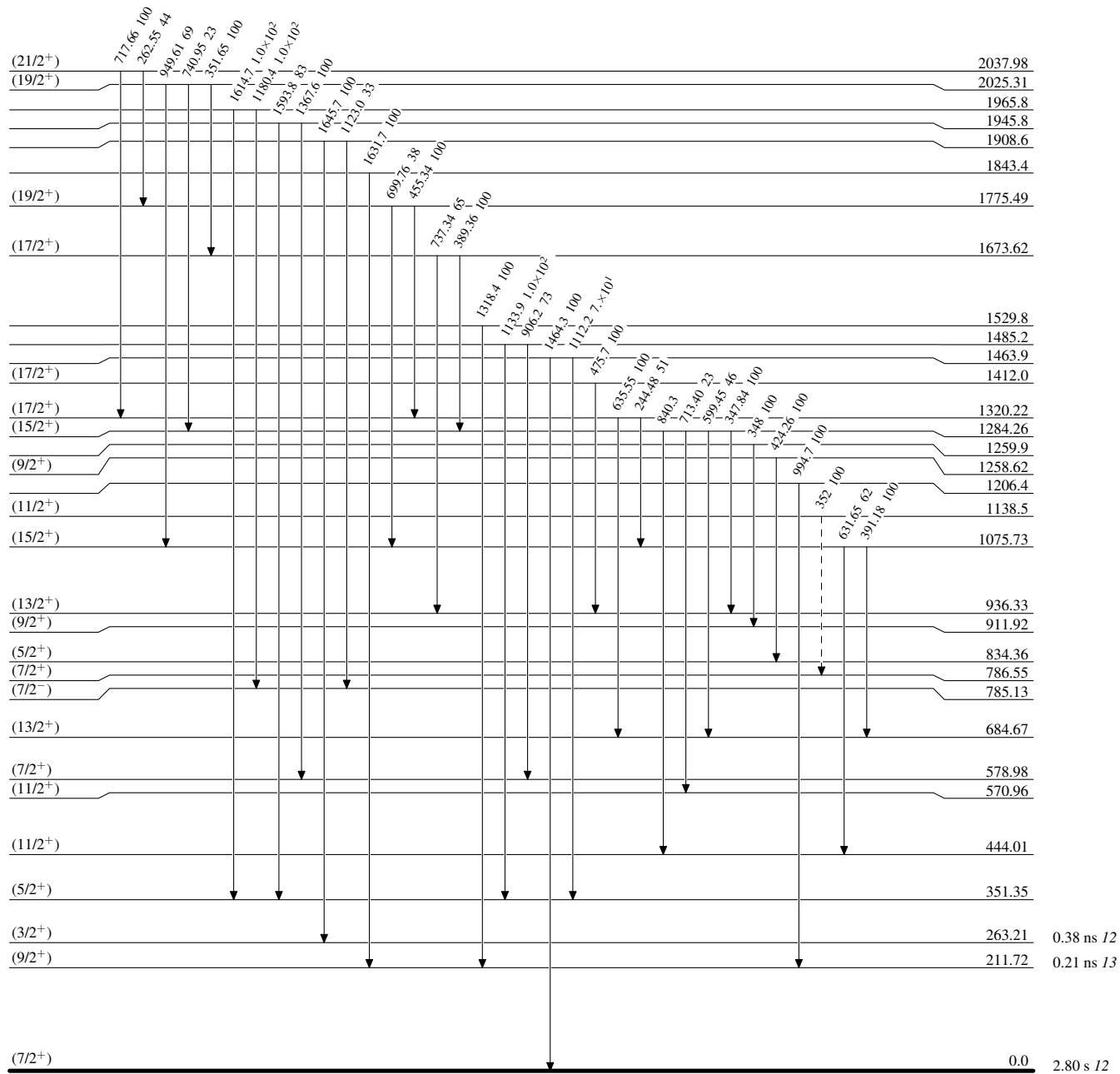
**Adopted Levels, Gammas**

Legend

**Level Scheme (continued)**

Intensities: Relative photon branching from each level

-----▶  $\gamma$  Decay (Uncertain)



$^{113}_{45}\text{Rh}_{68}$



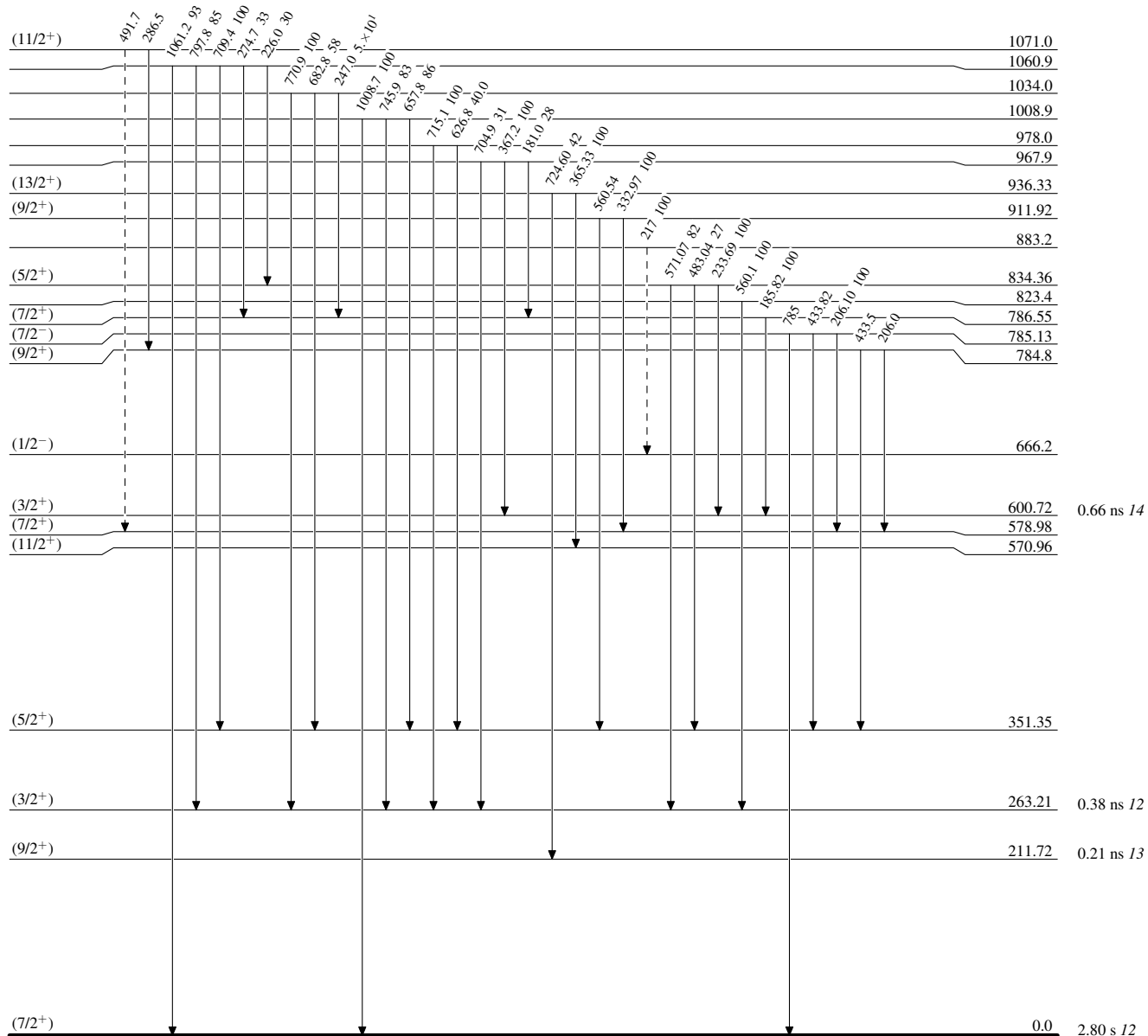
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶  $\gamma$  Decay (Uncertain)



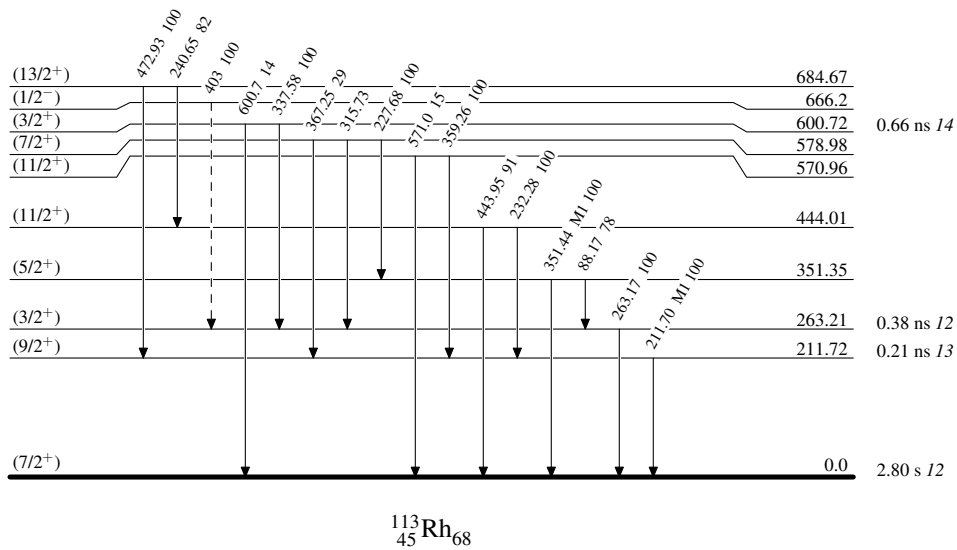
<sup>113</sup>Rh<sub>45</sub>

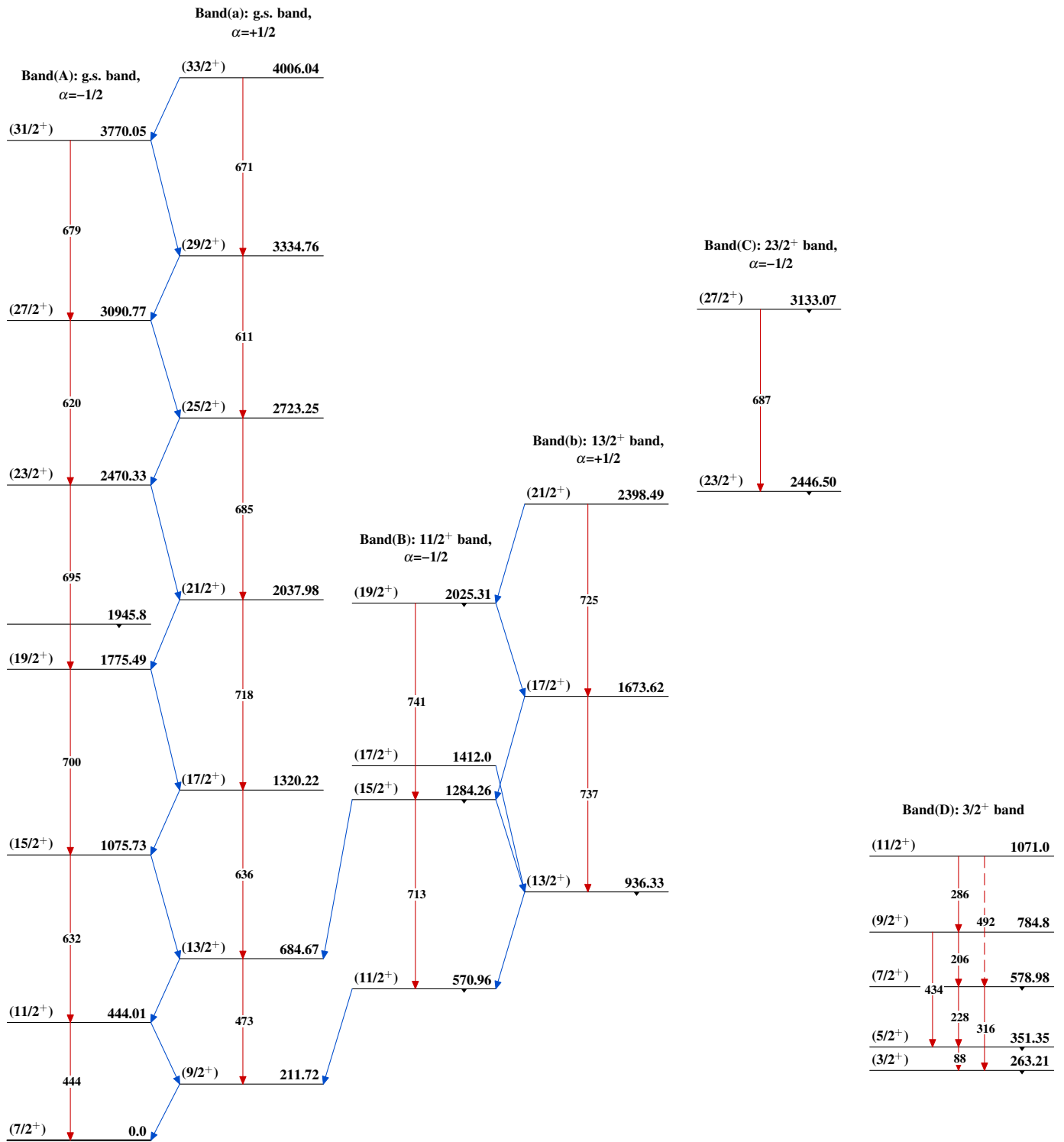
Adopted Levels, Gammas

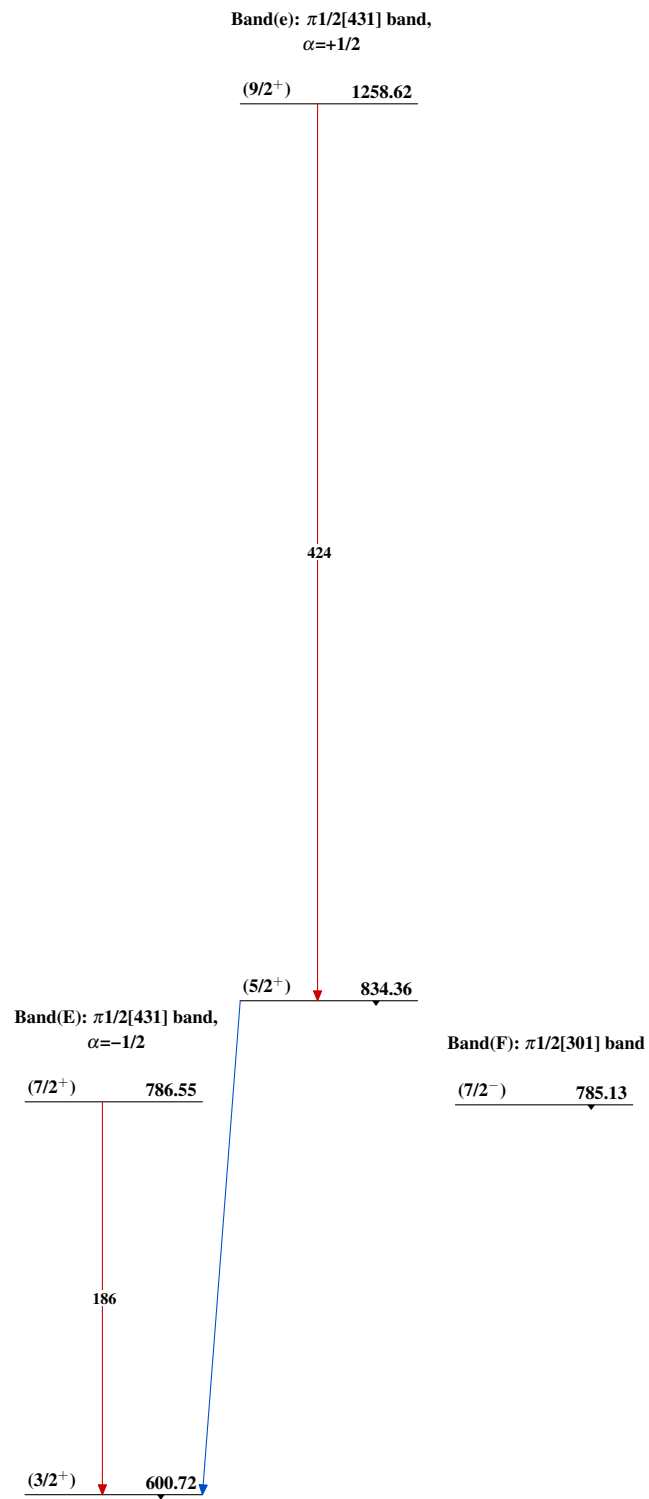
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

----->  $\gamma$  Decay (Uncertain) $^{113}_{45}\text{Rh}_{68}$

Adopted Levels, Gammas $^{113}_{45}\text{Rh}_{68}$

**Adopted Levels, Gammas (continued)** $^{113}_{45}\text{Rh}_{68}$