

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jean Blachot	NDS 110, 1239 (2009)	1-Feb-2008

Q(β⁻)=5521 12; S(n)=4784 13; S(p)=13040 13; Q(α)=-6650 14 [2012Wa38](#)

Note: Current evaluation has used the following Q record.

Q(β⁻)=5.69×10³ 8; S(n)=4.76×10³ 9; S(p)=1.299×10⁴ 11; Q(α)=-6.15×10³ 18 [2003Au03](#)

An approximately 1 min activity tentatively ascribed to ¹¹¹Ru by [1971Ri02](#) is unconfirmed.

The 213.2, 368.8, 542.6, 571.0, 766.8, 824.6, 863.5, 1048.5 levels seen only in ¹¹¹Tc β⁻ decay have not been adopted.

¹¹¹Ru Levels

Cross Reference (XREF) Flags

- A ¹¹¹Tc β⁻ decay
- B ²⁵²Cf SF decay
- C ²⁴⁸Cm SF decay
- D ²³⁸U(α,Fγ)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
0.0 [#]	5/2 ⁺	2.12 s 7	ABCD	%β ⁻ =100 T _{1/2} : from 1988Pe13 after mass separation. Others: 3 s 1 (1978Fr16) growth-decay curve of 275γ. 1.5 s 3 (1975Fe12) timed-separation method; Ru activity from thermal ²³⁵ U(n,F) chem; 23-min ¹¹¹ Pd β ⁻ counted. 2.1 s 6 (1976MaYL) ²⁵² Cf SF, timed gas-separation method, 275γ-decay curve. E(level): g.s. assignment was confirmed by 1988Pe13 using on-line isotope separator facility IGISOL. J ^π : strong beta feeding to (7/2 ⁺) ¹¹¹ Rh g.s.
9.7 ^a 3	(1/2 ⁺)		C	
39.3 ^{&} 3	(3/2 ⁺)		C	
150.17 [@] 13	7/2 ⁺		ABCD	J ^π : M1+E2 γ to (5/2 ⁺).
185.30 ^a 20	(5/2 ⁺)		C	
213.2 3	(9/2 ⁺)		A	
253.97 ^c 14	7/2 ⁻	14 ns	BCD	T _{1/2} : T _{1/2} (104γ)=14 ns (1970Jo20), <4 ns (1974CIZX).
279.72 17			A C	
306.2 ^{&} 3	(7/2 ⁺)		C	
316.79 ^b 17	9/2 ⁻	5 ns	ABCD	T _{1/2} : T _{1/2} (167γ)=5 ns (1970Jo20), 2.4 ns 5 (1974CIZX).
356.04 [#] 15	9/2 ⁺		A CD	
368.80 16	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	7.2 ns 16	A	
392.44 ^c 18	11/2 ⁻		BCD	
489.4 ^e 3			A C	
531.3 ^a 3	(9/2 ⁺)		C	
542.68 18			A	
571.0 3			A	
581.47 [@] 18	11/2 ⁺		CD	
668.95 19	(9/2 ⁻)		C	
695.52 ^b 21	13/2 ⁻		BCD	
705.65 ^d 19	11/2 ⁻		C	
746.0 ^{&} 3	(11/2 ⁺)		C	
750.13 ^c 21	15/2 ⁻		BCD	
766.8 8			A	
824.6 7			A	

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Adopted Levels, Gammas (continued)

¹¹¹Ru Levels (continued)

E(level) [†]	J ^{π‡}	XREF	E(level) [†]	J ^{π‡}	XREF	E(level) [†]	J ^{π‡}	XREF
851.21 [#] 20	13/2 ⁺	CD	1805.3 [@] 3	19/2 ⁺	CD	3380.3 [@] 11	27/2 ⁺	D
856.40 ^e 22	(13/2 ⁻)	BCD	1888.3 ^b 3	21/2 ⁻	BCD	3391.3 [@] 11		C
863.5 6		A	1915.3 ^c 3	23/2 ⁻	BCD	3500.8 ^b 11	29/2 ⁻	CD
1022.8 ^a 3	(13/2 ⁺)	C	2029.5 ^{&} 4	(19/2 ⁺)	C	3522.0 ^c 5	31/2 ⁻	BCD
1026.3 4		A	2133.9 ^e 10		C	3746.1 [#] 15	29/2 ⁺	D
1048.5 6		A	2152.1 [#] 3	21/2 ⁺	CD	4247.3 [@] 15	31/2 ⁺	D
1132.40 ^d 21	15/2 ⁻	BCD	2367.5 ^a 4	(21/2 ⁺)	C	4409.8 ^b 15	33/2 ⁻	D
1139.3 [@] 3	15/2 ⁺	CD	2505.1 ^d 3	(23/2 ⁻)	BC	4439.0 ^c 11	35/2 ⁻	D
1227.33 ^b 24	17/2 ⁻	BCD	2561.3 [@] 4	23/2 ⁺	CD	4635.1 [#] 18	33/2 ⁺	D
1264.4 ^c 3	19/2 ⁻	BCD	2653.8 ^b 4	25/2 ⁻	BCD	5169.3 [@] 18	35/2 ⁺	D
1331.0 ^{&} 4	(15/2 ⁺)	C	2676.0 ^c 4	27/2 ⁻	BCD	5377.8 ^b 18	37/2 ⁻	D
1431.85 ^e 24	(17/2 ⁻)	C	2809.3 ^{&} 5		C	5409.0 ^c 15	39/2 ⁻	D
1435.2 5		A	2919.1 [#] 11	25/2 ⁺	D	6413.1 ^c 18	43/2 ⁻	D
1456.6 [#] 3	17/2 ⁺	CD	2922.1 [#] 4		C	6437.8 ^b 20	41/2 ⁻	D
1640.8 ^a 4	(17/2 ⁺)	C	3178.5 ^a 11		C	7497.1 ^c 21	47/2 ⁻	D
1757.63 ^d 24	19/2 ⁻	BCD	3345.1 ^d 10		C	7543.9 ^b 23	45/2 ⁻	D

[†] From least-squares fit to E_γ values.

[‡] Based on gamma multipolarities and band assignments.

[#] Band(A): g.s. band, α=+1/2.

[@] Band(a): g.s. band, α=-1/2.

[&] Band(B): (1/2⁺) band, α=-1/2. Assigned to ¹¹¹Ru based on the ratio of intensities of the 1180.0 keV line in ¹³⁵Te and the 1278.9 keV line in ¹³⁴Te, I_γ(1180.0)/I_γ(1278.9), as such a ratio is correlated with the mass of the gated Ru isotope.

^a Band(b): (1/2⁺) band, α=+1/2. See comment for the other signature partner of this band.

^b Band(C): 7/2⁻ band, α=+1/2.

^c Band(c): 7/2⁻ band, α=-1/2.

^d Band(D): 11/2⁻ band.

^e Band(E): γ-sequence based on (9/2⁻).

γ(¹¹¹Ru)

E _i (level)	J _i ^π	E _γ	I _γ	E _f	J _f ^π	Mult. [†]	α [‡]	Comments
150.17	7/2 ⁺	150.2 2	100	0.0	5/2 ⁺	M1+E2	0.20 10	α=0.20 10
185.30	(5/2 ⁺)	146.0 2	62 6	39.3	(3/2 ⁺)	D		
		175.6 2	100 6	9.7	(1/2 ⁺)	E2		
		185.3 2	48 6	0.0	5/2 ⁺	D		
213.2	(9/2 ⁺)	212.8 7	100	0.0	5/2 ⁺			
253.97	7/2 ⁻	103.8 2	100 5	150.17	7/2 ⁺	E1	0.125	α=0.125 Mult.: T _{1/2} (14 ns) eliminates M2 assignment (2003UrZZ).
		254.0 2	4.4 5	0.0	5/2 ⁺			
279.72		279.7 2	100	0.0	5/2 ⁺			
306.2	(7/2 ⁺)	267.0 2	100	39.3	(3/2 ⁺)	E2		
316.79	9/2 ⁻	62.8 2	88 4	253.97	7/2 ⁻	M1+E2	4 3	α(K)exp=2.7 9 α=4 3 Mult.: T _{1/2} (5 ns) eliminates M2 assignment (2003UrZZ).
		166.6 2	100 4	150.17	7/2 ⁺	D		

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Adopted Levels, Gammas (continued)

$\gamma(^{111}\text{Ru})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [†]	α^\ddagger	Comments
356.04	9/2 ⁺	205.9 2	54 3	150.17	7/2 ⁺	E2		
		356.0 2	100 11	0.0	5/2 ⁺	E2		
368.80	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	218.5 2	5.8 6	150.17	7/2 ⁺			
		368.8 2	100 4	0.0	5/2 ⁺	M1,E2		
392.44	11/2 ⁻	75.7 2	100 4	316.79	9/2 ⁻	D		
		138.6 2	17.7 11	253.97	7/2 ⁻	E2	0.405	$\alpha=0.405$
489.4		172.6 3	100	316.79	9/2 ⁻			
531.3	(9/2 ⁺)	225.1 2	8 3	306.2	(7/2 ⁺)	D		
		346.0 2	100 7	185.30	(5/2 ⁺)	E2		
542.68		392.1 [#] 3	13 2	150.17	7/2 ⁺			
		542.8 2	100 5	0.0	5/2 ⁺			
571.0		571.0 3	100.	0.0	5/2 ⁺			
581.47	11/2 ⁺	225.5 2	19 4	356.04	9/2 ⁺			
		431.3 2	100 5	150.17	7/2 ⁺	E2		
668.95	(9/2 ⁻)	389.2 2	94 30	279.72				
		415.0 2	100 25	253.97	7/2 ⁻			
695.52	13/2 ⁻	303.3 2	95 4	392.44	11/2 ⁻	D		
		378.7 2	100 4	316.79	9/2 ⁻	E2		
705.65	11/2 ⁻	388.8 2	70 16	316.79	9/2 ⁻	D		
		451.6 2	100 12	253.97	7/2 ⁻	D		
746.0	(11/2 ⁺)	439.8 2	100	306.2	(7/2 ⁺)	E2		
750.13	15/2 ⁻	357.8 2	100	392.44	11/2 ⁻	E2		Mult.: +0.14 6.
766.8		616.5 7	100.	150.17	7/2 ⁺			
824.6		674.3 6	100.	150.17	7/2 ⁺			
851.21	13/2 ⁺	269.8 2	10 3	581.47	11/2 ⁺			
		495.1 2	100 7	356.04	9/2 ⁺	E2		
856.40	(13/2 ⁻)	463.8 2	100	392.44	11/2 ⁻	E2		
863.5		713.2 5	100.	150.17	7/2 ⁺			
1022.8	(13/2 ⁺)	277 2	4.3 14	746.0	(11/2 ⁺)			
		491.5 2	100 6	531.3	(9/2 ⁺)	E2		
1026.3		1026.3 4	100	0.0	5/2 ⁺			
1048.5		898.2 5	100.	150.17	7/2 ⁺			
1132.40	15/2 ⁻	275.6 2	87 6	856.40	(13/2 ⁻)			
		382.9 2	23 8	750.13	15/2 ⁻			
		426.6 2	87 9	705.65	11/2 ⁻	E2		
1139.3	15/2 ⁺	557.8 2	100	581.47	11/2 ⁺	E2		
1227.33	17/2 ⁻	477.0 2	52 5	750.13	15/2 ⁻			
		532.0 2	100 6	695.52	13/2 ⁻	E2		
1264.4	19/2 ⁻	514.1 2	100	750.13	15/2 ⁻	E2		Mult.: +0.09 3.
1331.0	(15/2 ⁺)	585.0 2	100	746.0	(11/2 ⁺)	E2		
1431.85	(17/2 ⁻)	575.7 2	51 9	856.40	(13/2 ⁻)			
		681.6 2	100 17	750.13	15/2 ⁻	E2		
1435.2		1435.2 5	100	0.0	5/2 ⁺			
1456.6	17/2 ⁺	605.4 2	100	851.21	13/2 ⁺	E2		
1640.8	(17/2 ⁺)	618.0 2	100	1022.8	(13/2 ⁺)	E2		
1757.63	19/2 ⁻	325.9 2	16 3	1431.85	(17/2 ⁻)			
		493.0 2	6 3	1264.4	19/2 ⁻			
		625.3 2	100 14	1132.40	15/2 ⁻			
1805.3	19/2 ⁺	666.0 2	100	1139.3	15/2 ⁺	E2		
1888.3	21/2 ⁻	661.0 2	100	1227.33	17/2 ⁻			
1915.3	23/2 ⁻	650.9 2	100	1264.4	19/2 ⁻	E2		Mult.: +0.07 3.
2029.5	(19/2 ⁺)	698.4 2	100	1331.0	(15/2 ⁺)	E2		
2133.9		702 1	100	1431.85	(17/2 ⁻)			
2152.1	21/2 ⁺	695.5 2	100	1456.6	17/2 ⁺			
2367.5	(21/2 ⁺)	726.7 2	100	1640.8	(17/2 ⁺)			

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Adopted Levels, Gammas (continued) $\gamma(^{111}\text{Ru})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [†]
2505.1	(23/2 ⁻)	747.5 2	100	1757.63	19/2 ⁻	
2561.3	23/2 ⁺	756.0 2	100	1805.3	19/2 ⁺	
2653.8	25/2 ⁻	765.5 2	100	1888.3	21/2 ⁻	
2676.0	27/2 ⁻	760.7 2	100	1915.3	23/2 ⁻	E2
2809.3		779.8 2	100	2029.5	(19/2 ⁺)	
2919.1	25/2 ⁺	767 1		2152.1	21/2 ⁺	
2922.1		770.0 2	100	2152.1	21/2 ⁺	
3178.5		811 [#] 1	100	2367.5	(21/2 ⁺)	
3345.1		840 [#] 1	100	2505.1	(23/2 ⁻)	
3380.3	27/2 ⁺	819 1	100	2561.3	23/2 ⁺	
3391.3		830 [#] 1	100	2561.3	23/2 ⁺	
3500.8	29/2 ⁻	847 1	100	2653.8	25/2 ⁻	
3522.0	31/2 ⁻	846.0 3	100	2676.0	27/2 ⁻	
3746.1	29/2 ⁺	827 1	100	2919.1	25/2 ⁺	
4247.3	31/2 ⁺	867 1	100	3380.3	27/2 ⁺	
4409.8	33/2 ⁻	909 1	100	3500.8	29/2 ⁻	
4439.0	35/2 ⁻	917 1	100	3522.0	31/2 ⁻	
4635.1	33/2 ⁺	889 1	100	3746.1	29/2 ⁺	
5169.3	35/2 ⁺	922 1	100	4247.3	31/2 ⁺	
5377.8	37/2 ⁻	968 1	100	4409.8	33/2 ⁻	
5409.0	39/2 ⁻	970 1	100	4439.0	35/2 ⁻	
6413.1	43/2 ⁻	1004 1	100	5409.0	39/2 ⁻	
6437.8	41/2 ⁻	1060 1	100	5377.8	37/2 ⁻	
7497.1	47/2 ⁻	1084 1	100	6413.1	43/2 ⁻	
7543.9	45/2 ⁻	1106 1	100	6437.8	41/2 ⁻	

[†] Based on angular correlation and polarization measurement in SF 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.

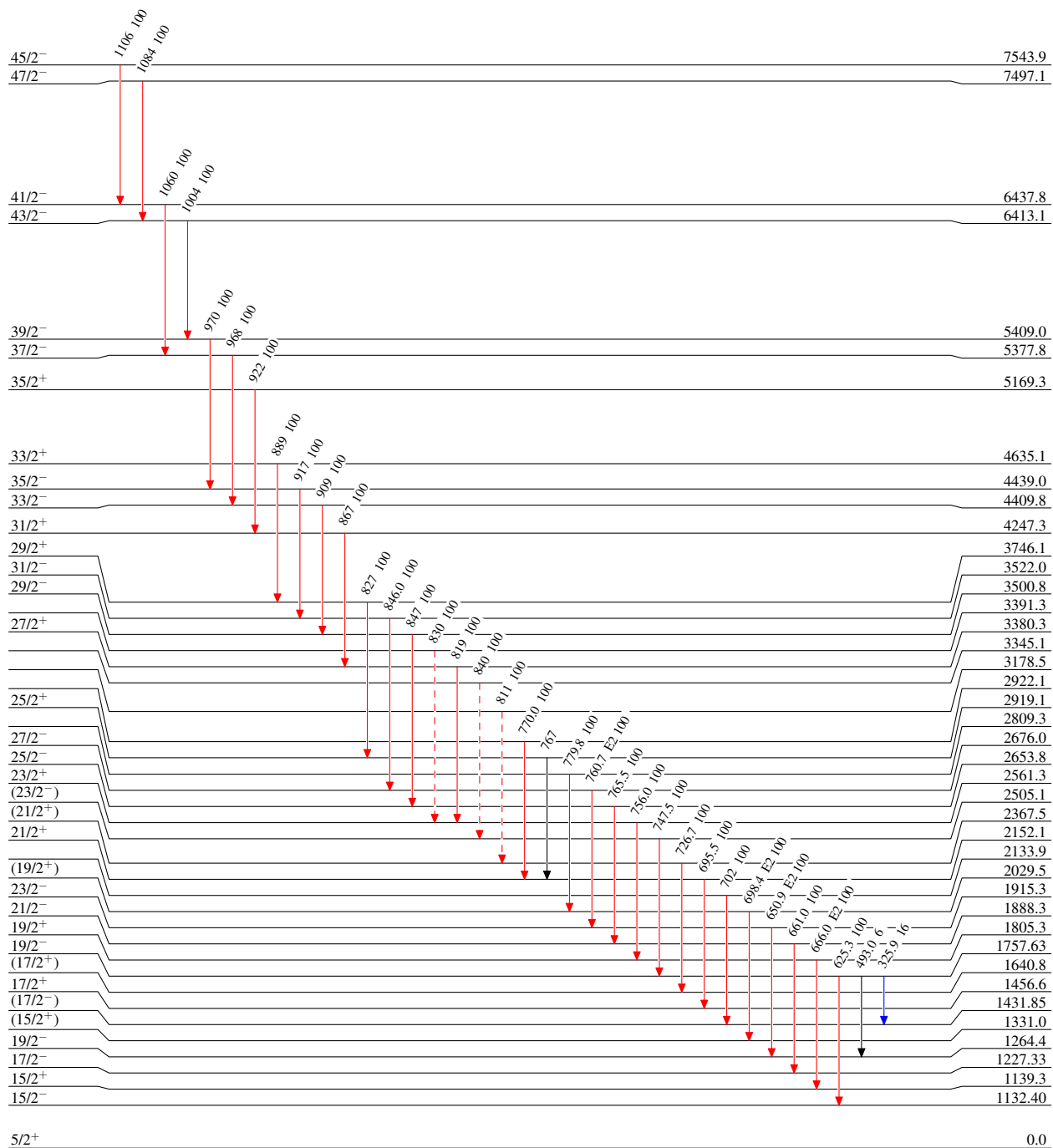
[#] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme
 Intensities: Type not specified

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - -→ γ Decay (Uncertain)



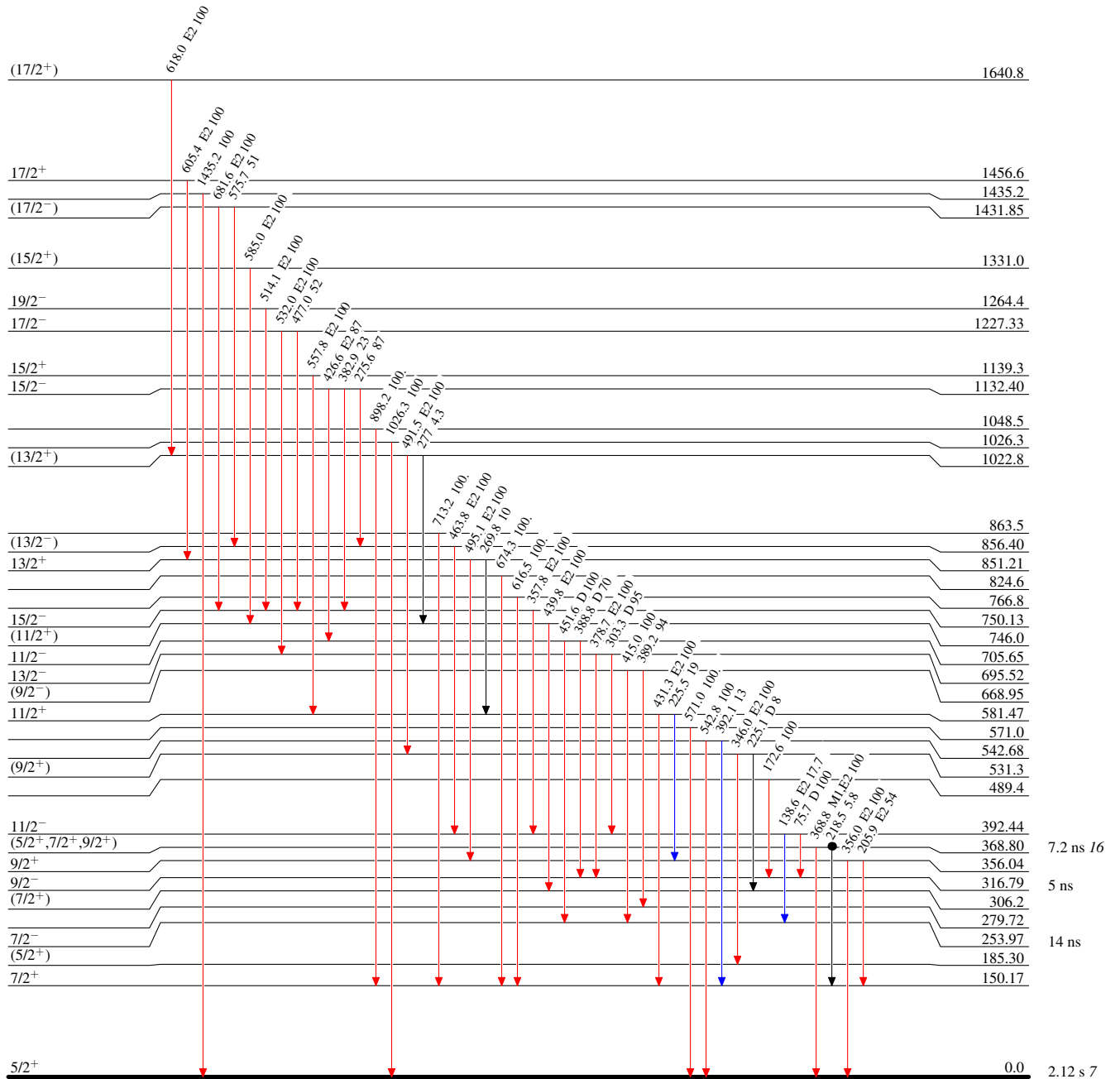
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Type not specified

- ▶ I_γ < 2% × I_γ^{max}
- ▶ I_γ < 10% × I_γ^{max}
- ▶ I_γ > 10% × I_γ^{max}
- Coincidence



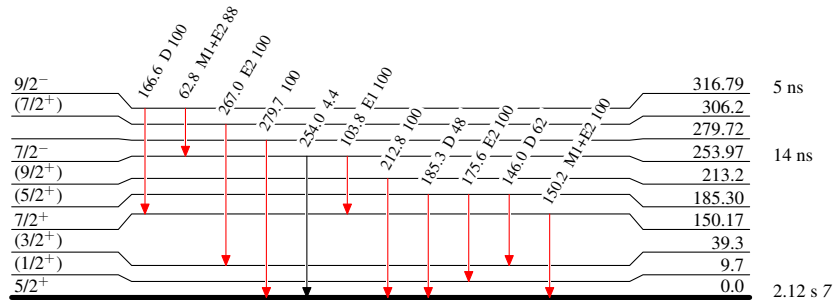
¹¹¹Ru₆₇

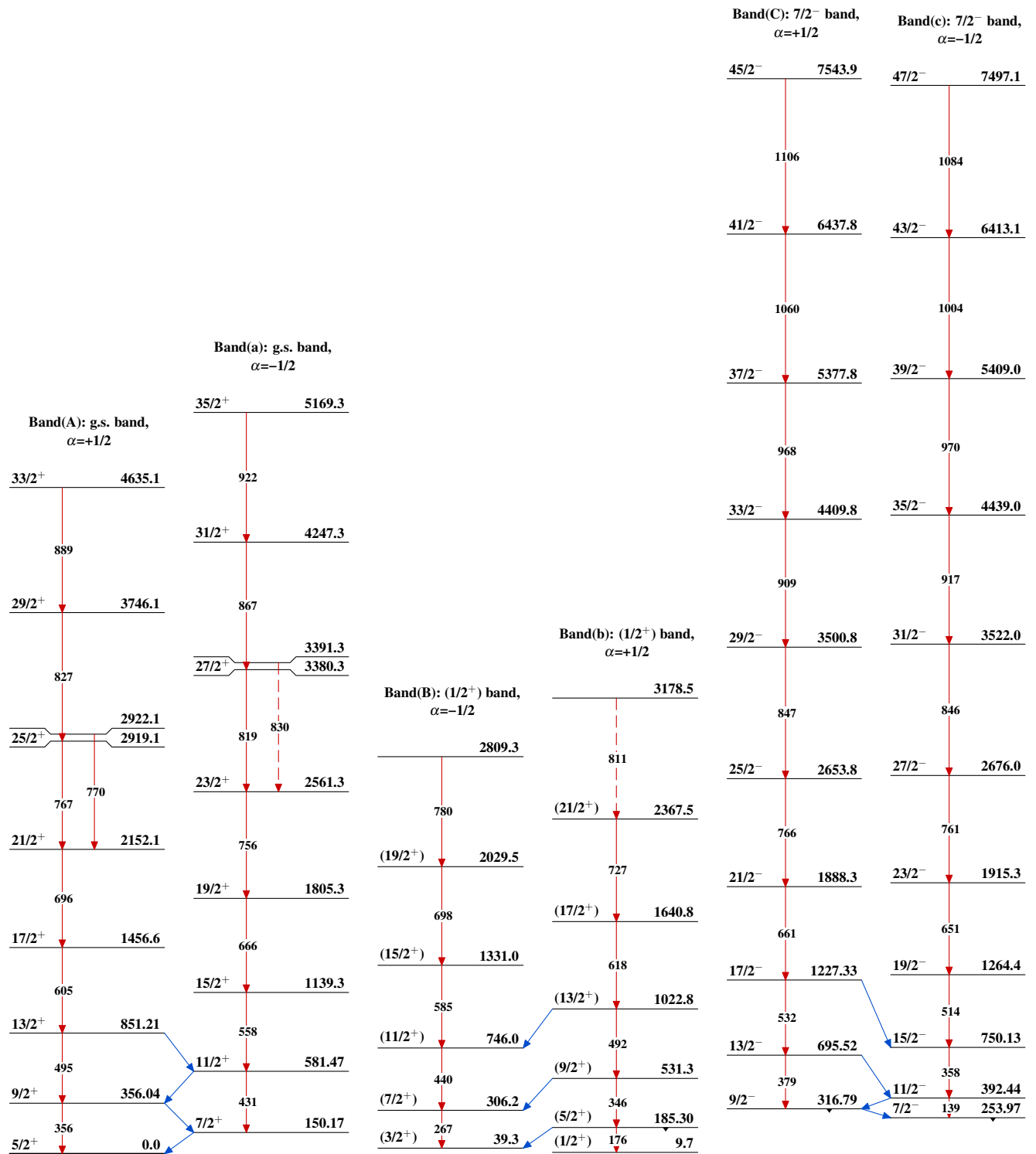
Adopted Levels, Gammas**Level Scheme (continued)**

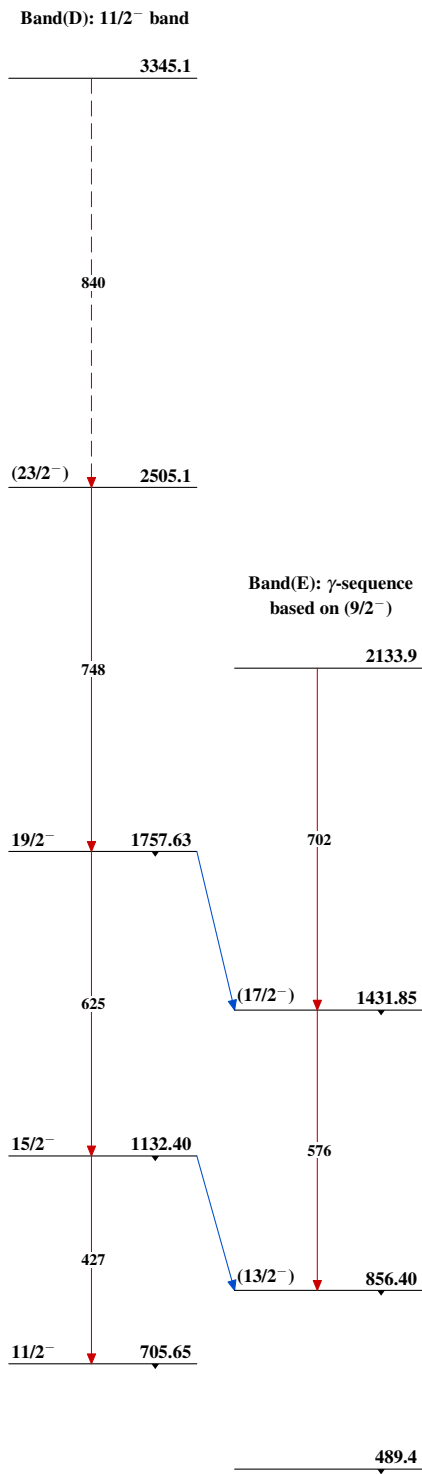
Intensities: Type not specified

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$

 $^{111}\text{Ru}_{67}$

Adopted Levels, Gammas $^{111}_{44}\text{Ru}_{67}$

Adopted Levels, Gammas (continued) $^{111}_{44}\text{Ru}_{67}$