

⁹⁹Ru(⁴⁸Ti,3p3nγ) 2004Po13,2003Ma95

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 187,1 (2023)	12-Oct-2022

Includes ¹¹⁴Sn(³²S,3p2nγ) from 2004Po13.

2003Ma95: ⁹⁹Ru(⁴⁸Ti,3p3nγ) E=240 MeV. Measured Eγ, Iγ, γγ, γγ(θ), γ(lin pol), (charged particle)γ coin with the EUROBALL III array of cluster, clover and tapered detectors, and the charged-particle detector array ISIS, consisting of 40 Si detector telescopes. Based on these measurements 2003Ma95 adopted γ-ray multiplicities and J^π values; however there is no supporting evidence, except for the J^π values on their level scheme drawing.

2004Po13: ¹¹⁴Sn(³²S,3p2nγ) E=160 MeV. Measured lifetimes by the Doppler-Shift Attenuation Method (DSAM) using the EUROBALL IV array, consisting of 14 cluster, 26 clover and 30 individual Compton-suppressed Ge detectors; EUROBALL also equipped with an inner BGO ball and the particle detector array EUCLIDES. This experiment was performed to minimize sidefeeding lifetimes.

2003Ma95 and 2004Po13 are published by essentially the same group of authors. The levels scheme is from 2003Ma95.

¹⁴¹Eu Levels

E(level) [†]	J ^π [‡]	T _{1/2} [#]	Comments
0.0	5/2 ⁺		
96.45 ^{@b} 7	11/2 ⁻	2.7 s 3	Additional information 1. T _{1/2} : from Adopted Levels.
622.4 ^b 3	15/2 ⁻		
671.5 6	13/2		
1154.5 7	15/2		
1309.5 7	17/2		
1344.6 ^b 4	19/2 ⁻		
1605.5 6	17/2		
1635.5 7	15/2		
1902.5 ^d 6	17/2 ⁽⁺⁾		
2030.5 ^d 7	19/2 ⁽⁺⁾		
2176.7 ^b 5	23/2 ⁻		
2229.6 ^d 9	21/2 ⁽⁺⁾		
2441.6 ^d 12	23/2 ⁽⁺⁾		
2595.6 ^e 12	25/2 ⁽⁺⁾ ^a		
2750.6 ^g 16	(25/2 ⁺)		
2848.6 ^d 16	(25/2 ⁺)		
3008.0 ^h 7	(25/2 ⁻)		
3023.8 ^b 6	27/2 ⁻		
3075.4 ^h 6	27/2 ⁻		
3162.5 6	27/2 ⁻ &		
3181.6 ^e 16	(29/2 ⁺) ^a		
3416.7 ^h 6	29/2 ⁻	0.76 ps +28-21	
3446.6 ^g 19			
3590.6 ^d 19	(29/2 ⁺)		
3595.9 ^b 7	31/2 ⁻		
3683.0 ^h 6	31/2 ⁻	1.7 ps +7-3	
3856.8 ^f 11			
4037.6 ^e 19	(33/2 ⁺) ^a		
4154.7 ^h 6	33/2 ⁻	0.76 ps +28-21	
4368.9 ^b 11	35/2 ⁻		

Continued on next page (footnotes at end of table)

⁹⁹Ru(⁴⁸Ti,3p3nγ) 2004Po13,2003Ma95 (continued)

¹⁴¹Eu Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2} [#]	E(level) [†]	J ^π [‡]	T _{1/2} [#]
4563.6 ^d 21	(33/2 ⁺)		5976.8 ^c 25		
4583.6 ^g 21			5992.0 ⁱ 8	43/2 ⁻	0.55 ps 14
4649.0 7	(35/2)		6325.5 ^c 25		
4765.8 ^f 14			6431.9 ^b 15	(43/2 ⁻)	
4845.0 ^h 7	35/2 ⁻		6619.7 ⁱ 8	(45/2 ⁻)	0.20 ps +14-10
4933.6 ^e 21	(37/2 ⁺) ^a		6728 ^c 3		
5019.2 ⁱ 7	37/2 ⁻		7047.9 ^b 18	(47/2 ⁻)	
5189.4 ⁱ 7	39/2 ⁻		7197 ^c 3		
5389.9 ^b 14	(39/2 ⁻)		7640 ^c 3		
5392.6 23			7860.9 ^b 20	(51/2 ⁻)	
5400.6 23			7963.9 20		
5641.6 ^c 24			8113 ^c 3		
5655.7 ⁱ 8	41/2 ⁻	0.38 ps +17-14	8544 ^c 3		
5675.8 ^f 15			9036 ^c 3		

[†] From least-squares fit to Eγ's; ΔEγ=0.3 keV for transitions whose energy is given to one decimal place. For all other transitions, ΔEγ=1 keV was assigned.

[‡] Given by 2004Po13 and 2003Ma95 (they can differ from those adopted in Adopted Levels, Gammas dataset).

[#] From 2004Po14, unless mentioned otherwise.

@ From Adopted Levels, Gammas dataset.

& From 2004Po13 only.

^a From Adopted Levels, Gammas dataset.

^b Band(A): 11/2⁻ band.

^c Band(B): magnetic rotational band #1.

^d Band(b): Band based on 17/2⁽⁺⁾.

^e Band(C): Band based on 25/2⁽⁺⁾.

^f Seq.(F): γ sequence.

^g Seq.(G): γ second cascade based on (25/2⁺).

^h Band(D): νh_{11/2}⁻²πh_{11/2}¹, magnetic rotational band #2.

ⁱ Band(E): πh_{11/2}¹⊗νh_{11/2}⁻⁴ magnetic rotational band #3. This band was assigned the configuration (νh_{11/2}⁻²πh_{11/2} g_{9/2}⁻²) in 2003Ma95.

γ(¹⁴¹Eu)

E _γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.
52	3075.4	27/2 ⁻	3023.8	27/2 ⁻	
53	2229.6	21/2 ⁽⁺⁾	2176.7	23/2 ⁻	
67.4	3075.4	27/2 ⁻	3008.0	(25/2 ⁻)	
96	96.45	11/2 ⁻	0.0	5/2 ⁺	
128	2030.5	19/2 ⁽⁺⁾	1902.5	17/2 ⁽⁺⁾	
154	2595.6	25/2 ⁽⁺⁾	2441.6	23/2 ⁽⁺⁾	
170.2	5189.4	39/2 ⁻	5019.2	37/2 ⁻	M1+E2 [‡]
174.3	5019.2	37/2 ⁻	4845.0	35/2 ⁻	M1+E2 [‡]
199	2229.6	21/2 ⁽⁺⁾	2030.5	19/2 ⁽⁺⁾	
212	2441.6	23/2 ⁽⁺⁾	2229.6	21/2 ⁽⁺⁾	
241	5641.6		5400.6		
249	5641.6		5392.6		
261	1605.5	17/2	1344.6	19/2 ⁻	

Continued on next page (footnotes at end of table)

$^{99}\text{Ru}(^{48}\text{Ti},3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95 (continued) $\gamma(^{141}\text{Eu})$ (continued)

E_γ^\dagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
266.3	3683.0	31/2 ⁻	3416.7	29/2 ⁻	M1+E2 \ddagger	
267	1902.5	17/2 ⁽⁺⁾	1635.5	15/2		
297	1902.5	17/2 ⁽⁺⁾	1605.5	17/2		
309	2750.6	(25/2 ⁺)	2441.6	23/2 ⁽⁺⁾		
335	5976.8		5641.6			
336.3 [#]	5992.0	43/2 ⁻	5655.7	41/2 ⁻	M1+E2 \ddagger	E_γ : 336.3 and 341.2 form a doublet structure.
341.2	3416.7	29/2 ⁻	3075.4	27/2 ⁻	M1+E2 \ddagger	E_γ : 336.3 and 341.2 form a doublet structure.
349	6325.5		5976.8			
366	2595.6	25/2 ⁽⁺⁾	2229.6	21/2 ⁽⁺⁾		
392.9	3416.7	29/2 ⁻	3023.8	27/2 ⁻		
403	6728		6325.5			
407	2848.6	(25/2 ⁺)	2441.6	23/2 ⁽⁺⁾		
425	2030.5	19/2 ⁽⁺⁾	1605.5	17/2		
431	8544		8113			
434	3595.9	31/2 ⁻	3162.5	27/2 ⁻		
443	7640		7197			
466.3 [#]	5655.7	41/2 ⁻	5189.4	39/2 ⁻	M1+E2 \ddagger	E_γ : 466.3 and 471.7 form a doublet structure.
469	7197		6728			
471.7	4154.7	33/2 ⁻	3683.0	31/2 ⁻	M1+E2 \ddagger	E_γ : 466.3 and 471.7 form a doublet structure.
473	8113		7640			
483	1154.5	15/2	671.5	13/2		
492	9036		8544			
494.3	4649.0	(35/2)	4154.7	33/2 ⁻		
526.0	622.4	15/2 ⁻	96.45	11/2 ⁻		
532	1154.5	15/2	622.4	15/2 ⁻		
558	1902.5	17/2 ⁽⁺⁾	1344.6	19/2 ⁻		
572.0	3595.9	31/2 ⁻	3023.8	27/2 ⁻		
575	671.5	13/2	96.45	11/2 ⁻		
586	3181.6	(29/2 ⁺)	2595.6	25/2 ⁽⁺⁾		
593	1902.5	17/2 ⁽⁺⁾	1309.5	17/2		
607.6	3683.0	31/2 ⁻	3075.4	27/2 ⁻		
616	7047.9	(47/2 ⁻)	6431.9	(43/2 ⁻)		
627.7	6619.7	(45/2 ⁻)	5992.0	43/2 ⁻		
638	1309.5	17/2	671.5	13/2		
659	3683.0	31/2 ⁻	3023.8	27/2 ⁻		
684	6325.5		5641.6			
687	1309.5	17/2	622.4	15/2 ⁻		
690.4	4845.0	35/2 ⁻	4154.7	33/2 ⁻		
696	3446.6		2750.6	(25/2 ⁺)		
721	2030.5	19/2 ⁽⁺⁾	1309.5	17/2		
722.2	1344.6	19/2 ⁻	622.4	15/2 ⁻		
738.0	4154.7	33/2 ⁻	3416.7	29/2 ⁻		
742	3590.6	(29/2 ⁺)	2848.6	(25/2 ⁺)		
748	1902.5	17/2 ⁽⁺⁾	1154.5	15/2		
751	6728		5976.8			
756	6431.9	(43/2 ⁻)	5675.8			
773	4368.9	35/2 ⁻	3595.9	31/2 ⁻		
802.6	5992.0	43/2 ⁻	5189.4	39/2 ⁻		
813	7860.9	(51/2 ⁻)	7047.9	(47/2 ⁻)		
829	5392.6		4563.6	(33/2 ⁺)		
832.1	2176.7	23/2 ⁻	1344.6	19/2 ⁻		
833	3856.8		3023.8	27/2 ⁻		
837	5400.6		4563.6	(33/2 ⁺)		
847.1	3023.8	27/2 ⁻	2176.7	23/2 ⁻		

Continued on next page (footnotes at end of table)

$^{99}\text{Ru}(^{48}\text{Ti},3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95 (continued) $\gamma(^{141}\text{Eu})$ (continued)

E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π
856	4037.6	(33/2 ⁺)	3181.6	(29/2 ⁺)	934	1605.5	17/2	671.5	13/2
864.5	5019.2	37/2 ⁻	4154.7	33/2 ⁻	964	1635.5	15/2	671.5	13/2
872	7197		6325.5		973	4563.6	(33/2 ⁺)	3590.6	(29/2 ⁺)
896	4933.6	(37/2 ⁺)	4037.6	(33/2 ⁺)	983	1605.5	17/2	622.4	15/2 ⁻
898.7	3075.4	27/2 ⁻	2176.7	23/2 ⁻	985.8	3162.5	27/2 ⁻	2176.7	23/2 ⁻
904	8544		7640		1013	1635.5	15/2	622.4	15/2 ⁻
909	4765.8		3856.8		1021	5389.9	(39/2 ⁻)	4368.9	35/2 ⁻
910	5675.8		4765.8		1042	6431.9	(43/2 ⁻)	5389.9	(39/2 ⁻)
912	7640		6728		1137	4583.6		3446.6	
916	7963.9		7047.9	(47/2 ⁻)	1161.9	4845.0	35/2 ⁻	3683.0	31/2 ⁻
916	8113		7197		1231	1902.5	17/2 ⁽⁺⁾	671.5	13/2
923	9036		8113		1280	1902.5	17/2 ⁽⁺⁾	622.4	15/2 ⁻

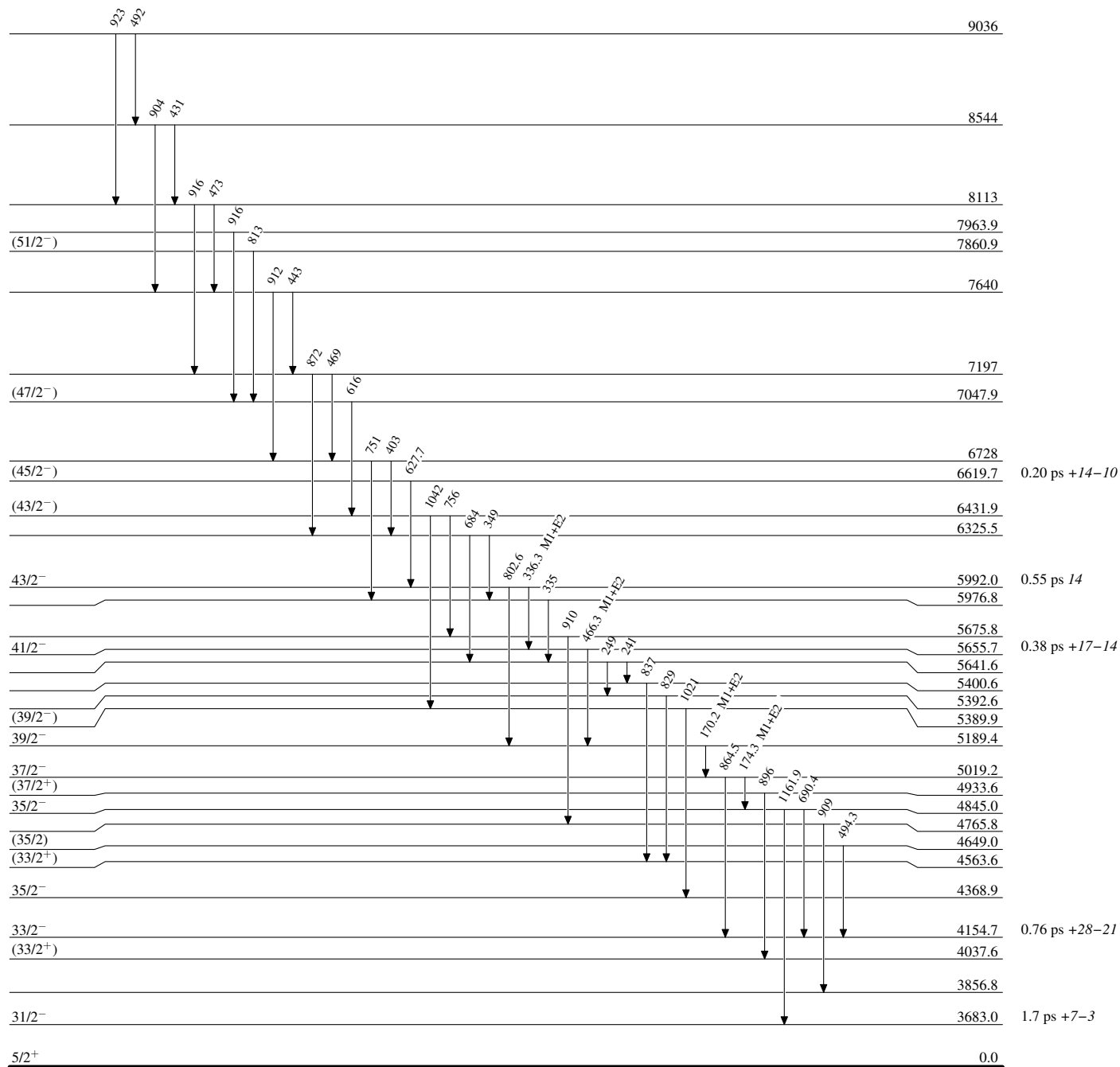
† The E_γ values with decimal point are from 2004Po13, while 2003Ma95 gave only rounded-off E_γ values.

‡ According to 2004Po13, multipolarity assigned to transitions is based on values of the DCO ratio, obtained by gating on low-lying E2 transitions, which range from 0.3 to 0.6. Transition has spin change of $\Delta J=1$. Based on polarization measurements mentioned by 2003Ma95 M1+E2 character was established.

The ordering of the 336.3-466.3 cascade (with 336 γ at higher excitation energy as adopted here) was reversed in 2003Ma95.

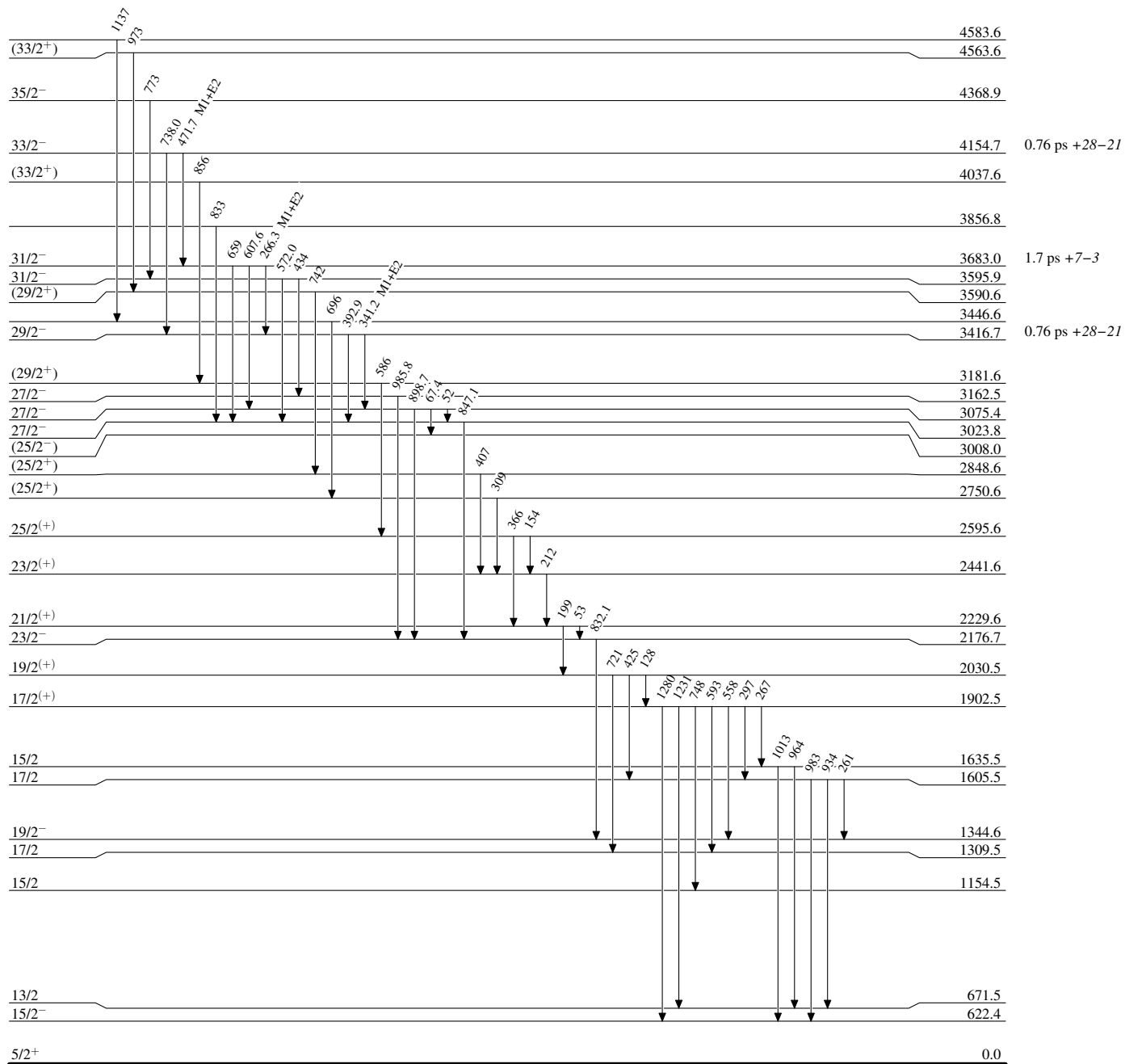
$^{99}\text{Ru}(^{48}\text{Ti},3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95

Level Scheme



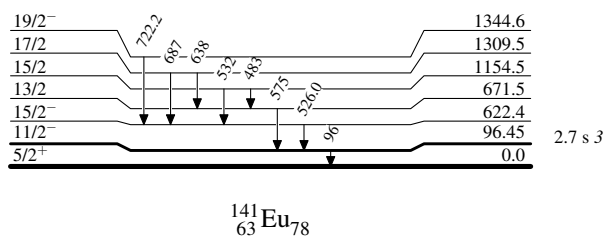
$^{99}\text{Ru}(^{48}\text{Ti},3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95

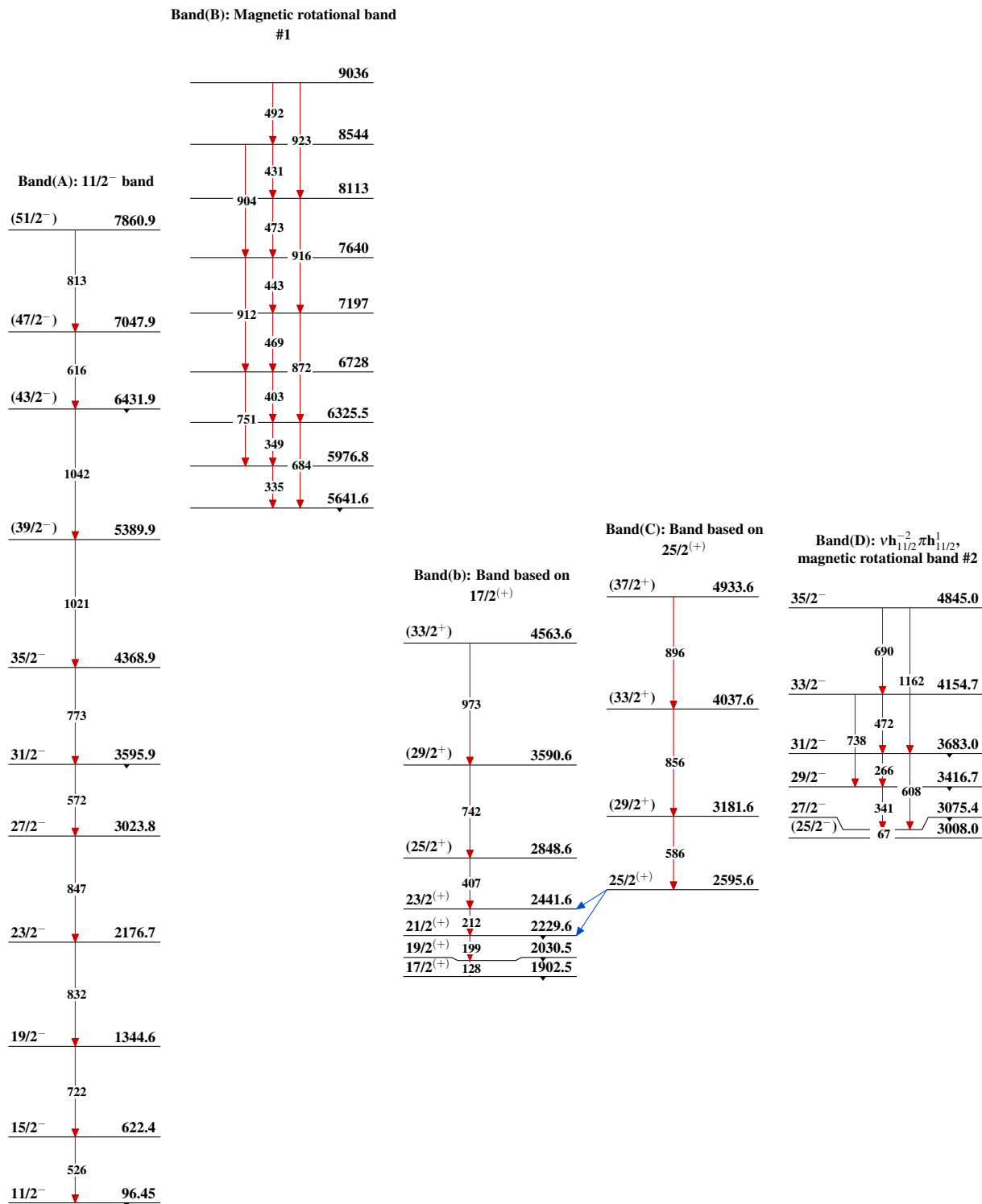
Level Scheme (continued)



$^{99}\text{Ru}(^{48}\text{Ti},3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95

Level Scheme (continued)



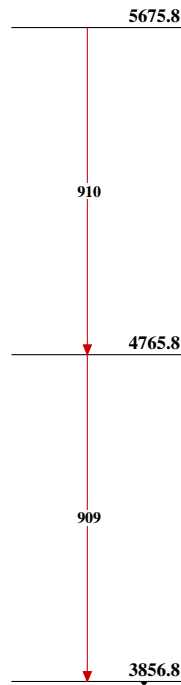
$^{99}\text{Ru}(^{48}\text{Ti}, 3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95

$^{99}\text{Ru}(^{48}\text{Ti}, 3\text{p}3\text{n}\gamma)$ 2004Po13,2003Ma95 (continued)

Band(E): $\pi h_{1/2}^1 \otimes \nu h_{1/2}^{-4}$
magnetic rotational band
#3



Seq.(F): γ sequence



Seq.(G): γ second
cascade based on
(25/2⁺)

