Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 112,1163 (2011)	15-Dec-2010

Q(β^-)=−8205 *4*; S(n)=10987 *4*; S(p)=5580 *4*; Q(α)=−4627 *5* 2012Wa38
Note: Current evaluation has used the following Q record −8203.0 610986 55578 6 −4624 6 2003Au03,2009AuZZ.
Q(β^-), S(n), S(p), Q(α): from 2009AuZZ (cf. −8090 syst, 10930 syst, 5620 *90*, −4690 *90*, respectively, from 2003Au03).
ΔS_n=310 from systematics (2003Au03).
Q(ε-p)=2305 *5* (2009AuZZ) (cf. 2250 *90* (2003Au03)).

^{93}Ru Levels

The adopted level scheme is taken from (^{40}Ca,4pnγ), with the addition of the 734-keV isomeric state. The adopted order of the 168γ-177γ cascade is established by the observed 168γ-721γ coincidence, and is the reverse of that suggested in the (α,3nγ) data set.

Cross Reference (XREF) Flags

A ^{92}Mo(α,3nγ), D ^{93}Rh ε decay
B ^{93}Ru IT decay E ^{9}Be(^{107}Ag,Xγ)
C ^{58}Ni(^{40}Ca,4pnγ),

E(level)†	J$^\pi$‡	$T_{1/2}$	XREF	Comments
0#	(9/2)$^+$	59.7 s *6*	ABCDE	%ε+%β^+=100 $T_{1/2}$: from decay of strongest γ rays in ^{93}Tc following ^{93}Ru ε decay (1976De37). Others: 1976DiZP (54.9 s *17*), 1973Ni04, 1972Do04, 1955At22. J$^\pi$: log *ft*=5.3 to J^π=9/2$^+$; log *ft*=6.3 to J^π=(7/2$^+$); log *ft*=7.5, log $f^{1u}t$=9.0 to J^π=(13/2)$^-$.
734.40 *10*	(1/2)$^-$	10.8 s *3*	B	%IT=22.0 *23*; %ε+%β^+=78.0 *23*; %εp=0.027 *5* (1983Ay01) J$^\pi$: log *ft*=4.5 to J^π=1/2$^-$,3/2$^-$; systematics of N=49 isotones; similarity of ^{93m}Ru and ^{91m}Mo decay schemes. $T_{1/2}$: from IT decay.
1359.42 *10*			D	J$^\pi$: 1359γ to (9/2)$^+$ g.s.
1392.11# *20*	(13/2)$^+$		A CDE	J$^\pi$: E2 1392γ to (9/2)$^+$ g.s.; band assignment.
1629.92 *10*			D	
1842.1 *3*			D	J$^\pi$: 1842γ to (9/2)$^+$ g.s.
1936.3# *3*	(17/2)$^+$		A C E	J$^\pi$: E2 544γ to (13/2)$^+$ 1392; band assignment.
2082.5# *9*	(21/2)$^+$	2.49 μs *15*	A C E	μ=+8.970 *21*; Q=+0.04 *1* μ: from TDPAD (Ag host) (1989Ra17, from g=0.850 *2* from 1983Gr33 and adopted J); no Knight shift correction applied. Q: time differential perturbed angular distribution (1991Ha04, (^{32}S,p3nγ)). J$^\pi$: E2 146γ to (17/2)$^+$ 1936; band assignment. $T_{1/2}$: unweighted average of 2.6 μs *2* from (^{40}Ca,4pnγ), 2.6 μs *3* and 2.05 μs *10* from (α,3nγ) and 2.7 μs *2* from fragment-γ(t) in ^{9}Be(^{107}Ag,Xγ); the weighted average is 2.27 μs *17*.
2112.8# *7*	(15/2$^+$)		A C	XREF: A(2103). J$^\pi$: D γ to J^π=(17/2)$^+$ and to (13/2)$^+$; band assignment; shell-model predicts a 15/2$^+$ level in ^{93}Ru lying ≈50 keV above a 21/2$^+$ level (1976Se01).
2129.4# *7*	(17/2$^+$)		C	
2273.53 *14*			D	
2280.5@ *7*	(17/2$^-$)	35 ns *4*	A C	μ=+4.36 *17* μ: From DPAD (1989Ra17) and adopted J; no Knight shift correction applied,

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{93}Ru Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
			but this is expected to be small for the Ag host used. Based on g=0.51 *2* (1983Gr33). Jπ: 168γ to J^{π}=(15/2$^+$) 2113; shell-model predicts a 17/2$^-$ level at an energy within 120 keV of this level (1976Se01). $T_{1/2}$: from (α,3nγ).
2713.3[@] *10*	(19/2$^-$)	C	
2733.7[#] *11*	(23/2$^+$)	C	
3121.1[#] *11*	(25/2$^+$)	C	
3240.5[@] *10*	(21/2$^-$)	C	
3375.5[#] *12*	(25/2$^+$)	C	
3722.7[@] *11*	(25/2$^-$)	C	
4022.0[#] *12*	(27/2$^+$)	C	
4237.0[@] *13*	(27/2$^-$)	C	
4500.2[#] *12*	(29/2$^+$)	C	
4787.2[@] *15*	(29/2$^-$)	C	
4850.2[@] *14*	(31/2$^-$)	C	
5271.7[#] *14*	(31/2$^+$)	C	
5342.7[#] *13*	(33/2$^+$)	C	
5971.0[@] *14*	(35/2$^-$)	C	
6376.8[&] *14*	(33/2$^+$)[&]	C	
7849.6 *14*	(37/2$^+$)	C	
7864.9 *15*	(35/2$^+$,37/2$^+$)	C	
7981.0 *14*	(37/2$^+$)	C	Possible configuration: ^{88}Sr(2$^+$) ⊗ (33/2$^+$ 6377 level) (1994Ar33). Supported by preferred decay to 6377 level.
8204.1 *16*	(39/2$^-$)	C	Possible configuration: $\pi(f_{5/2})^{-1}\ \pi(p^2_{1/2}g^5_{9/2})\ \nu(\gamma_{9/2})^{-1}$ (1994Ar33).
8331.1 *16*	(37/2$^-$,39/2$^-$)	C	Possible configuration: $\pi(p_{3/2})^{-1}\ \pi(p^2_{1/2}g^5_{9/2})\ \nu(\gamma_{9/2})^{-1}$ (1994Ar33); if correct, J=37/2 is preferred.
8463.9 *15*	(39/2$^+$)	C	
8735.7 *16*	(39/2$^+$)	C	
8962.1 *15*	(37/2$^-$)	C	
9145.8 *15*	(39/2$^+$,41/2$^+$)	C	
9425.7 *15*	(39/2$^-$)	C	
9637.4 *15*	(39/2$^-$)	C	
9694.0 *18*	(41/2$^+$ to 45/2$^+$)	C	
10049.3 *17*	(41/2$^-$)	C	
10083.7 *20*	(43/2$^+$ to 47/2$^+$)	C	
10365.7 *15*	(41/2$^-$)	C	
10684.1 *16*	(43/2$^-$)	C	
10884.4 *20*	(45/2$^+$ to 49/2$^+$)	C	
11400.8 *17*	(45/2$^-$)	C	
11950.2 *19*	(47/2$^-$)	C	

[†] From least-squares fit to Eγ.

[‡] From (^{40}Ca,4pnγ), based on measured γ anisotropies and decay patterns, and structure suggested by shell-model calculations and systematics of N=49 isotones and N=50 isotones (unless noted otherwise). See 1994Ar33 for further discussion of the likely configurations for ^{93}Ru states.

[#] Band(A): $(\pi\ (p^2_{1/2}g^4_{9/2}))(\nu\ g^{-1}_{9/2})$ states. Principal configuration suggested by 1994Ar33.

[@] Band(B): $(\pi\ (p_{1/2}g^5_{9/2}))(\nu\ g^{-1}_{9/2})$ states. Principal configuration suggested by 1994Ar33.

[&] Probable configuration=$(\pi\ g^6_{9/2})(\nu\ g^{-1}_{9/2})$ (1994Ar33).

Adopted Levels, Gammas (continued)

γ(^{93}Ru)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
734.40	(1/2)$^-$	734.4 *1*	100	0	(9/2)$^+$	[M4]	0.0287	B(M4)(W.u.)=7.8 *9* E_γ: from ^{93}Ru IT decay.
1359.42		1359.4[‡] *1*	100[‡]	0	(9/2)$^+$			
1392.11	(13/2)$^+$	1392.1 *2*	100	0	(9/2)$^+$	E2		E_γ,Mult.: from (α,3nγ).
1629.92		1629.9[‡] *1*	100[‡]	0	(9/2)$^+$			
1842.1		482.6[‡] *3*	65[‡] *23*	1359.42				
		1842.4[‡] *6*	100[‡] *42*	0	(9/2)$^+$			
1936.3	(17/2)$^+$	544.2 *2*	100	1392.11	(13/2)$^+$	E2		E_γ,Mult.: from (α,3nγ).
2082.5	(21/2)$^+$	146.3 *10*	100	1936.3	(17/2)$^+$	E2	0.331 *10*	B(E2)(W.u.)=0.102 *7* Mult.: Q from γ(θ) in (α,3nγ); not M2 from RUL.
2112.8	(15/2$^+$)	176.6 *10*	100 *4*	1936.3	(17/2)$^+$	D		Order of 177γ and 168γ is reversed in (α,3nγ) data set.
		720.7 *10*	60 *6*	1392.11	(13/2)$^+$	D		
2129.4	(17/2$^+$)	193.3 *10*	54 *11*	1936.3	(17/2)$^+$			
		737.3 *10*	100 *16*	1392.11	(13/2)$^+$	Q		
2273.53		643.6[‡] *1*	88[‡] *17*	1629.92				
		2273.8[‡] *9*	100[‡] *27*	0	(9/2)$^+$			
2280.5	(17/2$^-$)	151.3 *10*	23.6 *16*	2129.4	(17/2$^+$)	[E1]	0.0422 *10*	B(E1)(W.u.)=4.7×10^{-7} *7*
		167.8 *10*	100 *4*	2112.8	(15/2$^+$)	(E1)	0.0313 *7*	B(E1)(W.u.)=1.44×10^{-6} *19* Mult.: D from (^{40}Ca,4pnγ); Δπ=(yes) from level scheme. Order of 177γ and 168γ is reversed in (α,3nγ) data set.
		343.8 *10*	10.2 *26*	1936.3	(17/2)$^+$	[E1]		B(E1)(W.u.)=1.7×10^{-8} *5*
2713.3	(19/2$^-$)	432.6 *10*	100	2280.5	(17/2$^-$)	D		
2733.7	(23/2$^+$)	651.2 *10*	100	2082.5	(21/2)$^+$	D		
3121.1	(25/2$^+$)	387.2 *10*	100 *3*	2733.7	(23/2$^+$)	D		
		1038.4 *10*	2.6 *9*	2082.5	(21/2)$^+$			
3240.5	(21/2$^-$)	527.1 *10*	100 *5*	2713.3	(19/2$^-$)	D		
		960.1 *10*	68 *5*	2280.5	(17/2$^-$)			
3375.5	(25/2$^+$)	1293.1 *10*	100	2082.5	(21/2)$^+$	Q		
3722.7	(25/2$^-$)	482.1 *10*	52.4 *22*	3240.5	(21/2$^-$)	Q		
		601.5 *10*	100 *3*	3121.1	(25/2$^+$)			
		989.1 *10*	25.2 *20*	2733.7	(23/2$^+$)	D		
4022.0	(27/2$^+$)	646.6 *10*	100 *7*	3375.5	(25/2$^+$)	D		
		900.7 *10*	20 *3*	3121.1	(25/2$^+$)			
4237.0	(27/2$^-$)	514.3 *10*	100	3722.7	(25/2$^-$)	D		
4500.2	(29/2$^+$)	478.1 *10*	100 *4*	4022.0	(27/2$^+$)	D		
		1379.2 *10*	35 *3*	3121.1	(25/2$^+$)			
4787.2	(29/2$^-$)	550.3 *10*	100	4237.0	(27/2$^-$)	D		
4850.2	(31/2$^-$)	63.1 *10*	76 *7*	4787.2	(29/2$^-$)	D		
		613.0 *10*	100 *5*	4237.0	(27/2$^-$)	Q		

$^{93}_{44}Ru_{49}$-3

Adopted Levels, Gammas (continued)

γ(^{93}Ru) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.†	Comments
5271.7	(31/2$^+$)	771.5 *10*	100	4500.2	(29/2$^+$)	D	
5342.7	(33/2$^+$)	71.2 *10*	20 *3*	5271.7	(31/2$^+$)		
		492.4 *10*	16 *4*	4850.2	(31/2$^-$)		
		842.3 *10*	100 *6*	4500.2	(29/2$^+$)	Q	
5971.0	(35/2$^-$)	1120.9 *10*	100	4850.2	(31/2$^-$)	Q	
6376.8	(33/2$^+$)	1104.8 *10*	100 *38*	5271.7	(31/2$^+$)	D	
		1876.9 *10*	<797	4500.2	(29/2$^+$)		Iγ=735 *62* for doublet.
7849.6	(37/2$^+$)	1473.1 *10*	18 *8*	6376.8	(33/2$^+$)		
		1878.7 *10*	<319	5971.0	(35/2$^-$)		Iγ=294 *25* for doublet.
		2506.9 *10*	100 *15*	5342.7	(33/2$^+$)	Q	
7864.9	(35/2$^+$,37/2$^+$)	2521.9 *10*	100	5342.7	(33/2$^+$)	D	
7981.0	(37/2$^+$)	1604.0 *10*	100 *10*	6376.8	(33/2$^+$)	(Q)	
		2638.5 *10*	33 *6*	5342.7	(33/2$^+$)		
8204.1	(39/2$^-$)	2233.0 *10*	100	5971.0	(35/2$^-$)		
8331.1	(37/2$^-$,39/2$^-$)	349.9 *10*	100 *11*	7981.0	(37/2$^+$)		
8463.9	(39/2$^+$)	598.8 *10*		7864.9	(35/2$^+$,37/2$^+$)		
		614.4 *10*	100 *33*	7849.6	(37/2$^+$)		
8735.7	(39/2$^+$)	886.0 *10*	100	7849.6	(37/2$^+$)		
8962.1	(37/2$^-$)	2990.9 *10*	100	5971.0	(35/2$^-$)	D	
9145.8	(39/2$^+$,41/2$^+$)	410.0 *10*	100 *13*	8735.7	(39/2$^+$)		
		682.0 *10*	73 *10*	8463.9	(39/2$^+$)		
		1280.8 *10*		7864.9	(35/2$^+$,37/2$^+$)		
		1296.4 *10*	90 *18*	7849.6	(37/2$^+$)		
9425.7	(39/2$^-$)	463.6 *10*	100 *8*	8962.1	(37/2$^-$)	D	
		1221.3 *10*	36 *8*	8204.1	(39/2$^-$)	(D)	
		3454.8 *10*	17 *7*	5971.0	(35/2$^-$)		
9637.4	(39/2$^-$)	675.0 *10*	75 *10*	8962.1	(37/2$^-$)		
		1656.5 *10*	100 *15*	7981.0	(37/2$^+$)		
9694.0	(41/2$^+$ to 45/2$^+$)	548.1 *10*	100	9145.8	(39/2$^+$,41/2$^+$)		
10049.3	(41/2$^-$)	411.8 *10*	100	9637.4	(39/2$^-$)	D	
10083.7	(43/2$^+$ to 47/2$^+$)	389.7 *10*	100	9694.0	(41/2$^+$ to 45/2$^+$)	D	
10365.7	(41/2$^-$)	728.4 *10*	19 *7*	9637.4	(39/2$^-$)		
		939.6 *10*	100 *13*	9425.7	(39/2$^-$)	D	
		1403.9 *10*	19 *7*	8962.1	(37/2$^-$)		
		2034.5 *10*	20 *7*	8331.1	(37/2$^-$,39/2$^-$)		
		2161.9 *10*	29 *10*	8204.1	(39/2$^-$)		
10684.1	(43/2$^-$)	318.3 *10*	100 *5*	10365.7	(41/2$^-$)	D	
		1046.5 *10*	20 *3*	9637.4	(39/2$^-$)		
		1258.7 *10*	15 *3*	9425.7	(39/2$^-$)	(Q)	
10884.4	(45/2$^+$ to 49/2$^+$)	800.7 *10*	100 *15*	10083.7	(43/2$^+$ to 47/2$^+$)	D	
		1190.5 *10*		9694.0	(41/2$^+$ to 45/2$^+$)		
11400.8	(45/2$^-$)	716.8 *10*	100 *42*	10684.1	(43/2$^-$)		

$^{93}_{44}Ru_{49}$-4

Adopted Levels, Gammas (continued)

$\gamma(^{93}Ru)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]
11400.8	(45/2$^-$)	1351.4 *10*		10049.3	(41/2$^-$)	
11950.2	(47/2$^-$)	1266.1 *10*	100	10684.1	(43/2$^-$)	Q

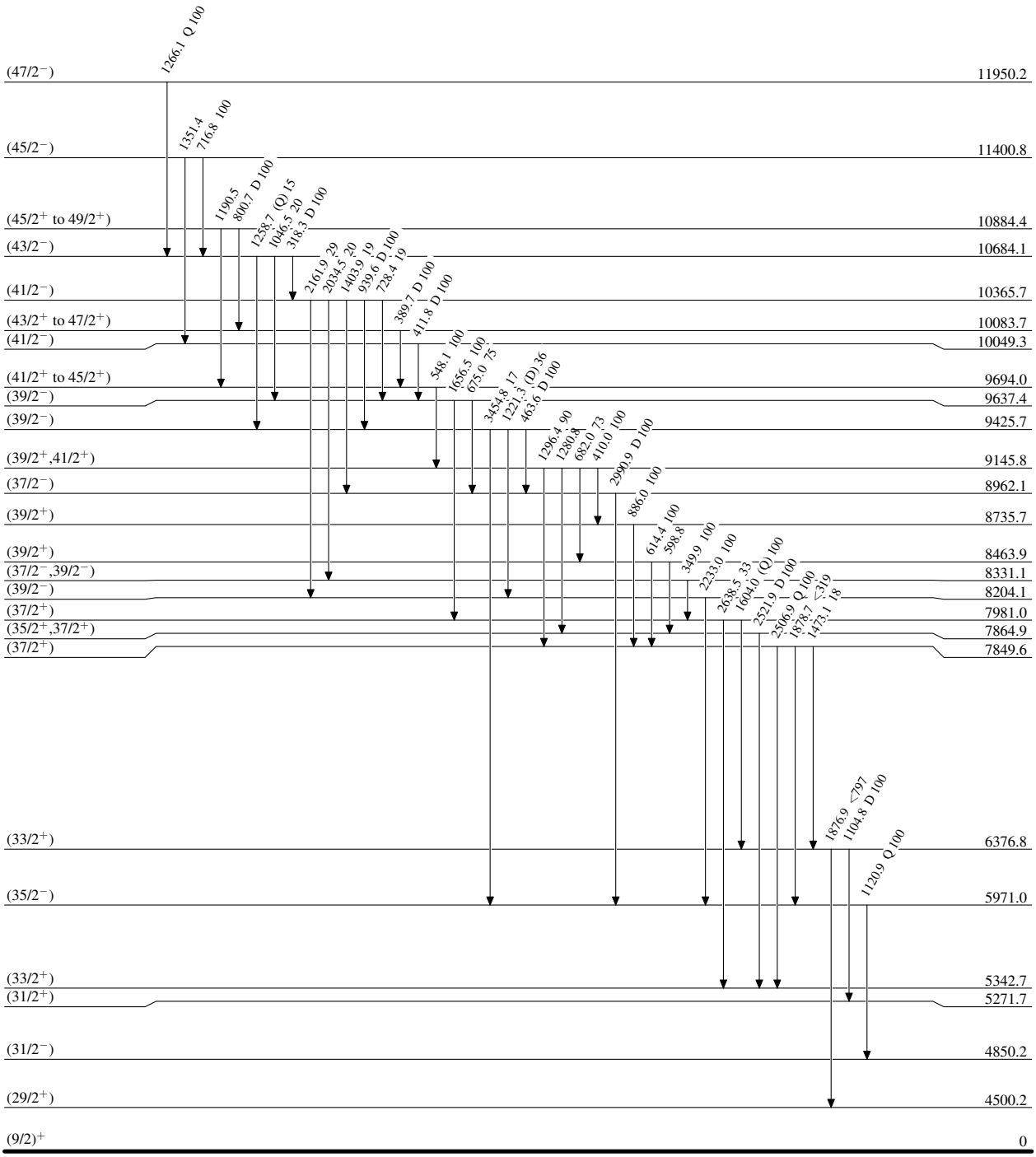
† From (^{40}Ca,4pnγ), if not indicated otherwise. The uncertainty in Eγ ranges from 0.2 to 1.0 keV; the evaluator has assigned the upper limit (1.0 keV) to all data.
‡ From ^{93}Rh ε decay.
# Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

$^{93}_{44}Ru_{49}$-5

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

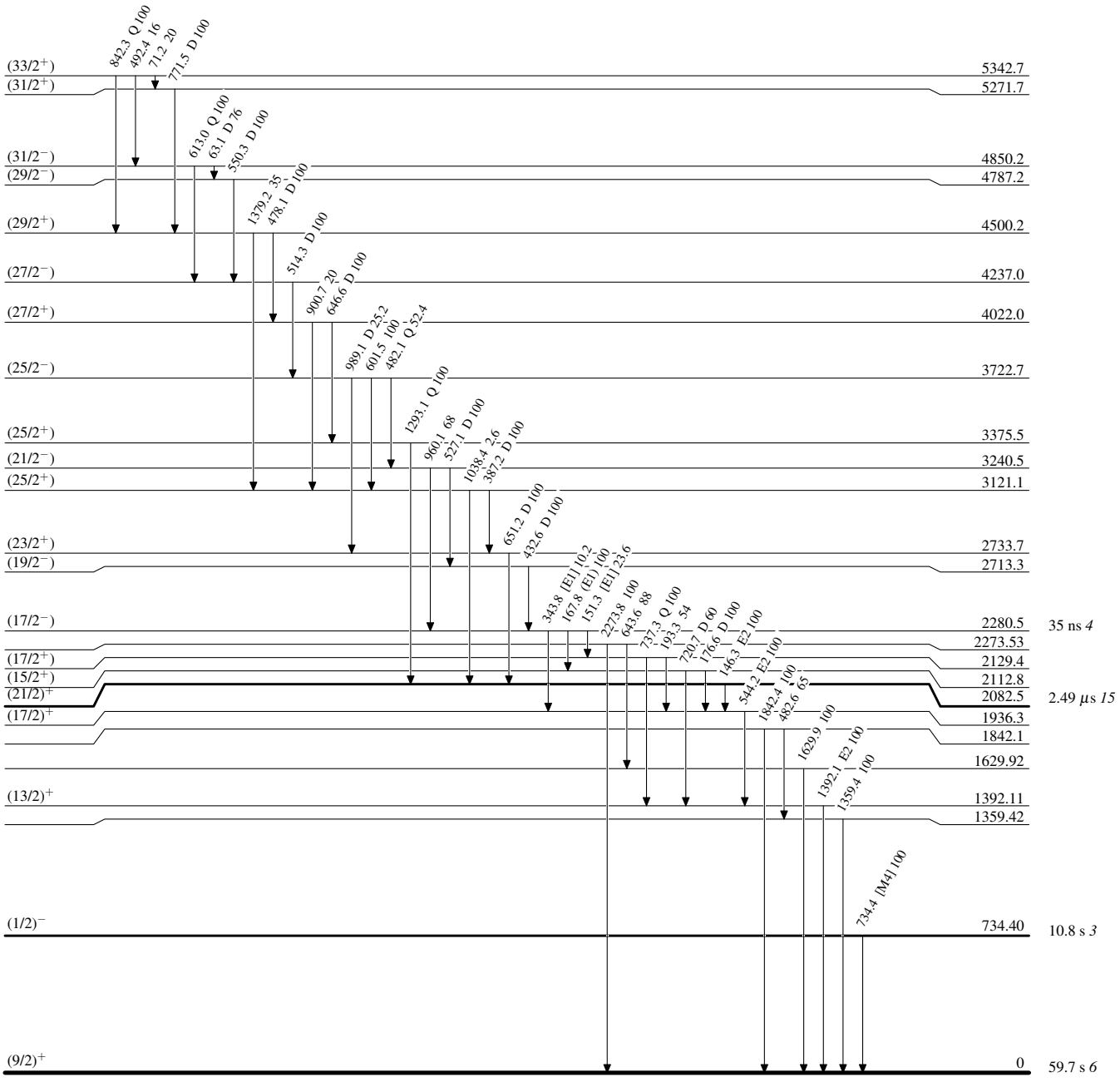


$^{93}_{44}Ru_{49}$

Adopted Levels, Gammas

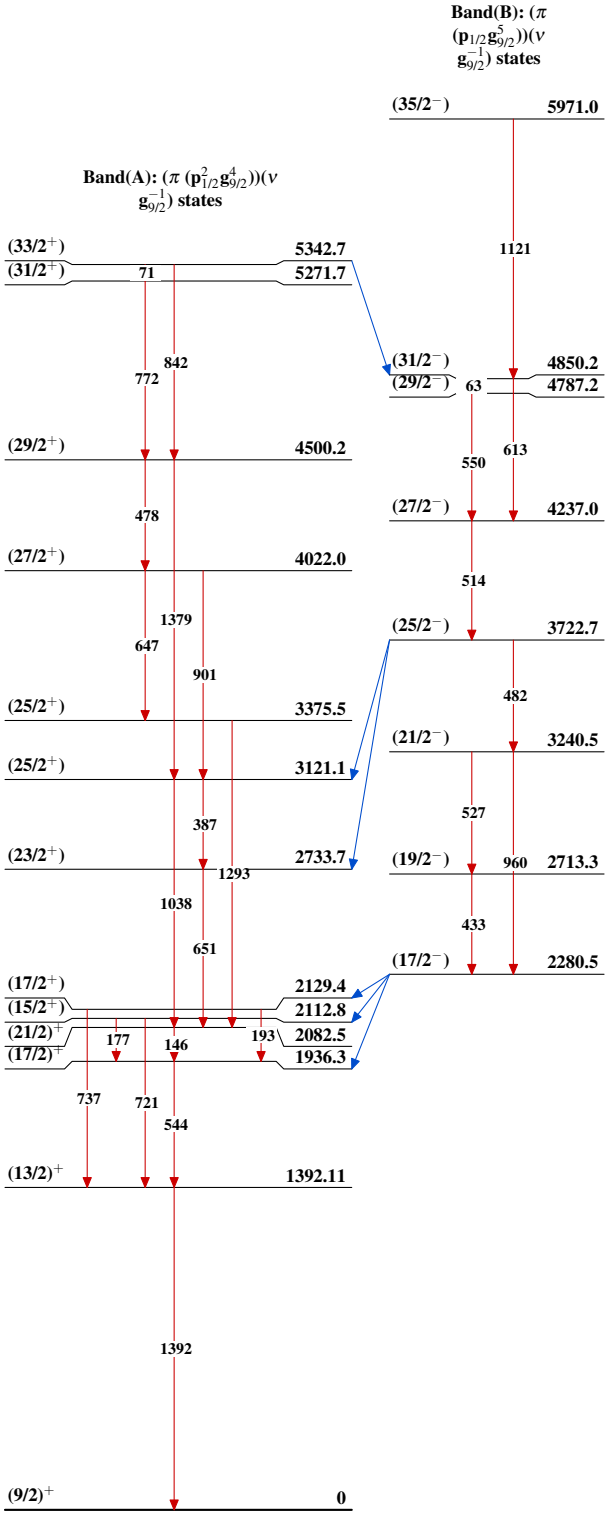
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{93}_{44}Ru_{49}$

Adopted Levels, Gammas



$^{93}_{44}Ru_{49}$