Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Q(β^-)=−6260 *30*; S(n)=10320 *40*; S(p)=1780 *40*; Q(α)=4020 *40* 2021Wa16
S(2n)=18650 *30*, S(2p)=6490 *40*, Q(εp)=380 *40*, Q(ε)=5120 *40* (2021Wa16).
Measured εK/β^+=0.57 *11* (1989Me02) from Ta I(K x ray) and I($\gamma^{\pm}$) in coincidence with 497γ, implying Q(ε)=5590 *+300−240* (1989Me02) for ^{167}W ε decay, compared to 6260 *30* from 2021Wa16.
1969Ar22: ^{167}Ta known as the ε parent of ^{167}Hf. 1969Ar22 base the nuclidic assignment on the observation of ^{167}Lu and ^{167}Yb γ rays in the tantalum fraction following 660 MeV proton spallation of Hg and Re. Detailed level and band structure has been deduced using the ^{142}Nd(^{30}Si,p4nγ) and ^{120}Sn(^{51}V,4nγ) reactions.
Mass measurement: 2000Ra23.
Theoretical structure calculations and systematics:
2021Bu05: calculated triaxiality, moment of inertia and inertial parameters, one phonon and two phonon wobbling excitation energies, B(E2), B(M1), B(M1)/B(E2) using semiclassical treatment for a triaxial rotor Hamiltonian.
2013Ha02: comparison of level energies in π $i_{13/2}$, π $h_{9/2}$ and π $h_{11/2}$ bands in ^{167}Ta and neighboring odd-A nuclides.
2010Su27: particle + triaxially−deformed rotor calculations; calculated TSD bands, level energies, B(M1)/B(E2).
2001Fe12: analysis of level energies and B(M1); deduced triaxial deformation.
2001Je09: cranked mean-field approach; analyzed bands, calculated deformation, potential energy surface.
1996Su12: calculated high-spin levels, J^{π}, transition energies using projected shell model.
1995Wu04: analyzed rotational spectra; deduced role of decoupling parameter in band crossing frequency shift.
1994Ch72: analyzed crossing frequencies anomalous delays; deduced deformation driving effect, role of pairing mean fields using mean field theory.
1994Su10: calculated rotational frequency vs angular momentum for proton bands; deduced role of quadrupole pairing interaction in delaying crossing point using angular momentum projection theory.
Additional information 1.
The level scheme and band assignments are adopted from (^{51}V,4nγ) (2011Ha25).

^{167}Ta Levels

Quasiparticle nomenclature for orbitals:
A: first $i_{13/2}$ neutron, α=+1/2.
B: first $i_{13/2}$ neutron, α=−1/2.
C: second $i_{13/2}$ neutron, α=+1/2.
D: second $i_{13/2}$ neutron, α=+1/2.
E: lowest π=− orbital, α=+1/2.
F: lowest π=− orbital, α=−1/2.

Cross Reference (XREF) Flags

A ^{167}W ε decay (19.9 s)
B ^{120}Sn(^{51}V,4nγ)
C ^{142}Nd(^{30}Si,p4nγ)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	XREF	Comments
0.0[h]	(3/2$^+$)	80 s *4*	ABC	%ε+%β^+=100 J$^{\pi}$: 94.4γ, M1+E2 from (5/2$^+$) bandhead of π5/2[402] band; possible member of configuration=π1/2[411] (1992Th02). $T_{1/2}$: from 1992HeZV. Others: 80 s *20* (1989Br19 and 1987Es08 from the same authors, $T_{1/2}$ from 140γ decay curve, quoted as 1.3 min *3* in 1987Es08); 1.4 min *3* (1982Li17, γ decay curves for several α rays); 2.9 min *15* (1969Ar22). Additional information 2.

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Adopted Levels, Gammas (continued)

^{167}Ta Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
94.66[i] *15*	(5/2+)	ABC	
175.86[g] *17*	(5/2+)	B	
205.19[j] *20*	(7/2+)	ABC	
206.3[#] *3*	(9/2−)	BC	
214.7 *3*		C	
232.95[h] *13*	(7/2+)	ABC	
254.68[n] *17*	(7/2+)	AB	
289.49 *24*	(5/2+,7/2+,9/2+)	A	Jπ: M1(+E2) 84γ to 205, (7/2+) level.
305.38[@] *24*	(11/2−)	BC	
374.73[i] *18*	(9/2+)	BC	
392.0 *4*	(≤7/2)	A	E(level): 175.4 *3* also possible; order of 175γ and 392γ uncertain. Jπ: γ to (3/2+).
431.79[m] *18*	(9/2+)	B	
496.2[#] *3*	(13/2−)	BC	
496.73[c] *16*	(5/2−)	AB	
503.13[g] *17*	(9/2+)	AB	
527.6 *4*		B	Jπ: 321γ to (9/2−) 206.
567.4 *5*		A	
574.64[j] *18*	(11/2+)	BC	
610.46[h] *20*	(11/2+)	B	
611.09[c] *17*	(9/2−)	ABC	
656.67[n] *19*	(11/2+)	B	
663.2 *4*		A	
678.7[@] *3*	(15/2−)	BC	
790.92[i] *19*	(13/2+)	BC	
852.95[c] *25*	(13/2−)	BC	
874.12[m] *21*	(13/2+)	B	
939.97[g] *20*	(13/2+)	B	
947.3[#] *3*	(17/2−)	BC	
1036.21[j] *21*	(15/2+)	BC	
1091.04[h] *23*	(15/2+)	B	
1133.4[b] *3*	(13/2−)	B	
1156.25[n] *21*	(15/2+)	B	
1165.5[@] *3*	(19/2−)	BC	
1216.5[c] *3*	(17/2−)	BC	
1285.07[i] *20*	(17/2+)	BC	
1394.16[m] *25*	(17/2+)	B	
1456.73[g] *21*	(17/2+)	B	
1493.2[#] *3*	(21/2−)	BC	
1557.32[j] *22*	(19/2+)	BC	
1638.7[h] *3*	(19/2+)	B	
1641.4[b] *3*	(17/2−)	B	
1678.7[c] *4*	(21/2−)	BC	
1722.7[n] *3*	(19/2+)	B	
1732.3[@] *3*	(23/2−)	BC	
1820.04[i] *23*	(21/2+)	BC	
1950.40[m] *24*	(21/2+)	B	
2019.25[g] *24*	(21/2+)	B	

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Adopted Levels, Gammas (continued)

^{167}Ta Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
2056.96[o] 22	(21/2+)	B	
2088.86[j] 25	(23/2+)	BC	
2096.5[#] 3	(25/2−)	BC	
2199.1[b] 3	(21/2−)	B	
2213.8[c] 4	(25/2−)	BC	
2222.0[h] 4	(23/2+)	B	
2234.3 4		B	
2327.9[i] 3	(25/2+)	BC	
2348.9[@] 3	(27/2−)	BC	
2462.77[m] 24	(25/2+)	B	
2477.37[o] 23	(25/2+)	B	
2566.2[j] 3	(27/2+)	BC	
2579.6[&] 3	(25/2−)	BC	
2634.8 3	(27/2+)	B	
2651.8[a] 4	(27/2−)	B	
2717.6[#] 4	(29/2−)	BC	
2753.3[&] 3	(29/2−)	BC	
2780.9[i] 3	(29/2+)	BC	
2810.0[c] 4	(29/2−)	BC	XREF: C(2798.2).
2815.0 3	(29/2+)	B	
2821.0[h] 4	(27/2+)	B	
2874.2[a] 4	(31/2−)	BC	
2962.8[o] 3	(29/2+)	B	
2968.1[j] 3	(31/2+)	BC	
2979.5[@] 4	(31/2−)	BC	
3007.4[l] 3	(31/2+)	B	
3041.7[&] 4	(33/2−)	BC	
3211.8[i] 3	(33/2+)	BC	
3235.0[a] 4	(35/2−)	BC	
3253.0[k] 4	(33/2+)	B	
3326.2[#] 4	(33/2−)	BC	
3346.2[h] 7	(31/2+)	B	
3392.5[c] 4	(33/2−)	BC	XREF: C(3380.8).
3426.7[j] 3	(35/2+)	BC	
3468.7[&] 4	(37/2−)	BC	
3474.0[l] 3	(35/2+)	B	
3480.2[o] 4	(33/2+)	B	
3594.3[@] 4	(35/2−)	BC	
3720.7[i] 3	(37/2+)	BC	
3733.6[a] 4	(39/2−)	BC	
3772.1[k] 4	(37/2+)	B	
3880.6[h] 9	(35/2+)	B	
3913.1[#] 4	(37/2−)	B	
3974.1[c] 5	(37/2−)	BC	XREF: C(3977.2).
3990.9[j] 3	(39/2+)	BC	
4023.4[&] 4	(41/2−)	BC	

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Adopted Levels, Gammas (continued)

^{167}Ta Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
4026.0[l] 4	(39/2+)	B	
4045.2[o] 4	(37/2+)	B	
4133.1[p] 6	(35/2+)	B	
4189.9[@] 4	(39/2−)	B	
4304.7[i] 4	(41/2+)	BC	
4347.9[a] 4	(43/2−)	BC	
4360.3[k] 4	(41/2+)	B	
4489.3[h] 10	(39/2+)	B	
4501.3[#] 4	(41/2−)	B	
4557.2[c] 5	(41/2−)	BC	XREF: C(4607.8).
4607.9[j] 4	(43/2+)	BC	
4658.3[l] 4	(43/2+)	B	
4661.0[o] 5	(41/2+)	B	
4684.1[&] 4	(45/2−)	BC	
4687.7[p] 5	(39/2+)	B	
4799.8[@] 4	(43/2−)	B	
4920.4[i] 4	(45/2+)	BC	XREF: C(4925.6).
5008.7[k] 4	(45/2+)	B	
5053.5[a] 4	(47/2−)	BC	
5126.7[#] 4	(45/2−)	B	
5186.6[c] 5	(45/2−)	B	
5206.6[d] 5	(45/2−)	B	
5235.9[j] 4	(47/2+)	B	
5293.3[p] 6	(43/2+)	B	
5326.2[o] 5	(45/2+)	B	
5345.1[l] 4	(47/2+)	B	
5426.5[&] 4	(49/2−)	BC	
5465.0[@] 4	(47/2−)	B	
5514.7[e] 5	(47/2−)	B	
5550.3[i] 4	(49/2+)	B	
5697.4[k] 4	(49/2+)	B	
5802.3[#] 4	(49/2−)	B	
5824.7[a] 5	(51/2−)	BC	
5849.5[d] 5	(49/2−)	B	
5888.3[j] 4	(51/2+)	B	
5890.2[c] 5	(49/2−)	B	
5949.4[p] 6	(47/2+)	B	
6035.6[o] 5	(49/2+)	B	
6054.5[l] 4	(51/2+)	B	
6182.1[@] 4	(51/2−)	B	
6205.7[e] 5	(51/2−)	B	
6221.7[i] 4	(53/2+)	B	
6226.3[&] 5	(53/2−)	BC	
6421.7[k] 4	(53/2+)	B	
6518.4[#] 5	(53/2−)	B	
6593.2[d] 7	(53/2−)	B	

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Adopted Levels, Gammas (continued)

^{167}Ta Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
6598.8[j] 4	(55/2+)	B	8278.0[d] 10	(61/2−)	B	10250.4[j] 6	(71/2+)	B
6637.6[a] 5	(55/2−)	BC	8294.2[c] 6	(61/2−)	B	10267.3[q] 12	(69/2+)	B
6642.9[c] 5	(53/2−)	BC	8324.4[f] 6	(61/2−)	B	10424.2[@] 8	(71/2−)	B
6653.7[p] 6	(51/2+)	B	8354.4[a] 5	(63/2−)	B	10681.3[i] 6	(73/2+)	B
6674.2[f] 6	(53/2−)	B	8398.6[o] 7	(61/2+)	B	10825.6[&] 6	(73/2−)	B
6779.9[o] 6	(53/2+)	B	8437.2[q] 9	(61/2+)	B	10906.1[p] 13	(71/2+)	B
6799.9[q] 6	(53/2+)	B	8564.2[@] 5	(63/2−)	B	10986.8[#] 8	(73/2−)	B
6815.9[l] 4	(55/2+)	B	8564.3[l] 5	(63/2+)	B	11031.8?[k] 13	(73/2+)	B
6919.6[@] 5	(55/2−)	B	8685.4[i] 5	(65/2+)	B	11200.4[o] 10	(73/2+)	B
6963.5[i] 4	(57/2+)	B	8744.8[e] 8	(63/2−)	B	11225.3[a] 6	(75/2−)	B
6987.6[e] 5	(55/2−)	B	8843.6[&] 5	(65/2−)	B	11239.3?[q] 16	(73/2+)	B
7063.8[&] 5	(57/2−)	BC	9020.7[#] 6	(65/2−)	B	11346.1[j] 8	(75/2+)	B
7213.8[k] 4	(57/2+)	B	9030.4[k] 5	(65/2+)	B	11434.7[@] 9	(75/2−)	B
7292.8[#] 5	(57/2−)	B	9054.3[p] 11	(63/2+)	B	11756.5[i] 6	(77/2+)	B
7389.2[j] 4	(59/2+)	B	9204.7[d] 12	(65/2−)	B	11907.0[&] 6	(77/2−)	B
7405.4[d] 9	(57/2−)	B	9206.8[c] 8	(65/2−)	B	11910.9[p] 14	(75/2+)	B
7406.1[p] 8	(55/2+)	B	9219.6[j] 5	(67/2+)	B	12065.5[#] 9	(77/2−)	B
7438.6[c] 6	(57/2−)	B	9222.6[f] 8	(65/2−)	B	12240.4[o] 11	(77/2+)	B
7471.7[f] 6	(57/2−)	B	9267.2[a] 5	(67/2−)	B	12271.0[a] 8	(79/2−)	B
7480.3[a] 5	(59/2−)	BC	9280.0[o] 7	(65/2+)	B	12486.2[j] 9	(79/2+)	B
7565.8[o] 6	(57/2+)	B	9331.8[q] 11	(65/2+)	B	12492.8[@] 11	(79/2−)	B
7596.3[q] 8	(57/2+)	B	9466.0[@] 6	(67/2−)	B	12871.9[i] 8	(81/2+)	B
7654.4[l] 5	(59/2+)	B	9654.1[i] 5	(69/2+)	B	12968.0[p] 15	(79/2+)	B
7716.3[@] 5	(59/2−)	B	9805.1[&] 6	(69/2−)	B	13047.3[&] 7	(81/2−)	B
7785.8[i] 5	(61/2+)	B	9954.1[p] 12	(67/2+)	B	13343.4?[o] 15	(81/2+)	B
7830.2[e] 6	(59/2−)	B	9972.8[#] 6	(69/2−)	B	13357.6[a] 9	(83/2−)	B
7933.5[&] 5	(61/2−)	B	10019.8[k] 7	(69/2+)	B	13596.2[@] 12	(83/2−)	B
8085.3[k] 5	(61/2+)	B	10143.7[f] 10	(69/2−)	B	14025.6[i] 9	(85/2+)	B
8128.2[#] 5	(61/2−)	B	10158.7[c] 9	(69/2−)	B	14229.9[&] 7	(85/2−)	B
8205.6[p] 9	(59/2+)	B	10213.8[o] 9	(69/2+)	B	14483.0[a] 11	(87/2−)	B
8263.5[j] 5	(63/2+)	B	10223.8[a] 6	(71/2−)	B			

† From a least-squares fit to Eγ data. Note that J=1/2 member of 1/2[411] band has not been identified and may lie below the g.s. level shown here.

‡ From (^{51}V,4nγ), based on deduced band structure and measured angular distribution ratios. Consistent with conclusions from (^{30}Si,p4nγ), based largely on systematics of transition energies, signature splittings and alignments in the light odd-A Ta and Lu isotopes, and on deduced transition multipolarities, except as noted.

[#] Band(A): π9/2[514],α=+1/2. Band parameters: E_0=118.5, A=13.4 (J=9/2 to 19/2 band members). First band crossing at ħω≈0.29 MeV (alignment gain 9 ħ), second crossing at ħω≈0.35 MeV. Configuration=π$h_{11/2}$ → π$h_{11/2}$BC → π$h_{11/2}$BCAD.

[@] Band(a): π9/2[514],α=−1/2. See comments for α=+1/2 signature band for band crossings and configurations.

[&] Band(B): π$h_{11/2}$⊗AB,α=+1/2. Band crossing at ħω≈0.41 MeV. Configuration=π$h_{11/2}$AB → π$h_{11/2}$ABCD. Configuration=π9/2[514]⊗ν$i_{(13/2)}^2$ in 1992Th02.

[a] Band(b): π$h_{11/2}$⊗AB,α=−1/2. See comment for signature partner band.

[b] Band(C): α=+1/2 band. Continuation of π$h_{11/2}$⊗AB,α=+1/2 band.

[c] Band(D): π1/2[541],α=+1/2. Band parameters: E_0=538, A=8.5, B=−44.9, a=5.3 (J=5/2 through 21/2 levels). Decoupled band,

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Adopted Levels, Gammas (continued)

^{167}Ta Levels (continued)

analogous to bands observed in many neighboring odd-A, even-N nuclei; the large decoupling parameter shifts unfavored signature levels to energies so high they are not normally observed in (HI,xnγ) studies. Note that energies for J>25/2 band members differ from those deduced in (^{30}Si,p4nγ) because the J=1/2 band member not identified yet. 631γ-596γ-583γ-583γ cascade reported there has been replaced by the 629γ-583γ-582γ-583γ-596γ cascade adopted from (^{51}V,4nγ). Band crossing at $\hbar\omega\approx$0.29 MeV. Configuration=$\pi h_{9/2} \rightarrow \pi h_{9/2}$AB.

[d] Band(E): Band based on $45/2^-$,α=+1/2. Possible configuration=$\pi d_{5/2}\otimes$AEBC.

[e] Band(e): Band based on $(45/2^-)$,α=−1/2. See comment for signature partner band.

[f] Band(F): Band based on $53/2^-$,α=+1/2. Possible configuration=$\pi d_{3/2}\otimes$AEBC.

[g] Band(G): π1/2[411],α=+1/2. J=1/2 band member has not been identified yet; decoupling parameter implies that it will be lowest-energy member of band. Band parameters: E_0=−44.2, A=21.4, B=−41.6, a=−0.66 (J=3/2 through 13/2 levels).

[h] Band(g): π1/2[411],α=−1/2. See comment for signature partner band.

[i] Band(H): π5/2[402],α=+1/2. Band parameters: E_0=−44.0, A=18.1, B=−41.6, a=−0.66 (J=3/2 through 13/2 levels). In-band decay properties, transition energy systematics in nearby odd-A Ta isotopes, and small negative signature splitting favor $d_{5/2}$ orbital assignment over $g_{7/2}$ (1992Th02). First band crossing at $\hbar\omega\approx$0.24 MeV, second crossing at $\hbar\omega>$0.24 MeV, third band crossing at $\hbar\omega\approx$0.31 MeV. Configuration=$\pi d_{5/2} \rightarrow \pi d_{5/2}$AB $\rightarrow \pi h_{11/2}$AE $\rightarrow \pi h_{11/2}$AEBC.

[j] Band(h): π5/2[402],α=−1/2. See comment for α=−1/2 signature band for band crossings and configurations.

[k] Band(I): $\pi h_{11/2}\otimes$AF,α=+1/2. Band crossing at $\hbar\omega\approx$0.35 MeV. Configuration=$\pi h_{11/2}$AF $\rightarrow \pi h_{11/2}$AFBC.

[l] Band(i): $\pi h_{11/2}\otimes$AF,α=−1/2. See comment for α=+1/2 signature band for band crossing and configuration.

[m] Band(J): π7/2[404],α=+1/2.

[n] Band(j): π7/2[404],α=−1/2.

[o] Band(K): π1/2[660],α=+1/2. band parameters: E_0=517.3, A=5.73, a=−13.4 (J=21/2 to 37/2). Reported as TSD-1 band based on $\pi i_{13/2}$ orbital by 2009Ha33.

[p] Band(k): Triaxial $\pi i_{13/2}$,α=−1/2. Reported as TSD-2 band by 2009Ha33; shares a common structure with TSD-1 band. One-phonon wobbling-mode excitation, n_w=1 band.

[q] Band(L): $\pi i_{13/2}$ (?),α=+1/2. Band based on $53/2^+$, and reported as TSD-3 band by 2009Ha33. Band assignment and configuration are tentative.

Adopted Levels, Gammas (continued)

γ(^{167}Ta)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	δ	α[#]	Comments
94.66	(5/2$^+$)	94.4[‡] *2*	100[‡]	0.0	(3/2$^+$)	M1+E2		4.9 *3*	Mult.: from ^{167}W ε decay. Other Eγ: 94.9 *2* from (^{51}V,4nγ).
175.86	(5/2$^+$)	175.9 *2*	100	0.0	(3/2$^+$)	(M1+E2)		0.67 *21*	
205.19	(7/2$^+$)	110.6 *2*	100	94.66	(5/2$^+$)	M1+E2		2.9 *4*	Mult.: from ^{167}W ε decay.
214.7		120.1 *10*	100	94.66	(5/2$^+$)				
232.95	(7/2$^+$)	138.1 *2*	10.7 *11*	94.66	(5/2$^+$)	(M1+E2)		1.4 *4*	
		233.1 *2*	100 *11*	0.0	(3/2$^+$)	[E2]		0.180 *3*	
254.68	(7/2$^+$)	160.0 *2*	100	94.66	(5/2$^+$)	(M1+E2)		0.9 *3*	Eγ: presumed to be the same as the Eγ=159.7 *4* transition reported in ε decay. Mult.: Δπ from level scheme.
289.49	(5/2$^+$,7/2$^+$,9/2$^+$)	84.4[‡] *2*	100[‡] *7*	205.19	(7/2$^+$)	M1(+E2)	≤1.25	7.25 *15*	Mult.,δ: from ^{167}W ε decay.
		194.6[‡] *3*	55[‡] *7*	94.66	(5/2$^+$)				
305.38	(11/2$^-$)	99.1 *2*	100	206.3	(9/2$^-$)	(M1+E2)		4.2 *4*	
374.73	(9/2$^+$)	120.0 *2*		254.68	(7/2$^+$)	(M1+E2)		2.2 *4*	Mult.: Δπ from level scheme.
		160.0 *2*	61	214.7					
		169.6	100	205.19	(7/2$^+$)	(M1+E2)		0.75 *23*	Mult.: Δπ from level scheme.
		280.1 *2*	31 *11*	94.66	(5/2$^+$)				
392.0	(≤7/2)	392.0[‡] *4*	100[‡]	0.0	(3/2$^+$)				
431.79	(9/2$^+$)	177.3 *2*	≈100	254.68	(7/2$^+$)	(M1+E2)		0.65 *21*	
		337.1 *2*	≈52	94.66	(5/2$^+$)	(E2)		0.0582 *8*	Mult.: Δπ from level scheme.
496.2	(13/2$^-$)	190.8 *2*	≈100	305.38	(11/2$^-$)	(M1+E2)		0.52 *18*	
		289.9 *2*	≈21	206.3	(9/2$^-$)				Other Iγ: 42 *14* from (^{30}Si,p4nγ).
496.73	(5/2$^-$)	263.7[‡] *3*	10[‡] *3*	232.95	(7/2$^+$)				
		496.8 *2*	100 *9*	0.0	(3/2$^+$)	(E1+M2)		0.09 *8*	I_γ: from ε decay.
503.13	(9/2$^+$)	270.2[‡] *2*	100[‡] *25*	232.95	(7/2$^+$)	(M1+E2)		0.19 *8*	
		327.3 *2*	100 *25*	175.86	(5/2$^+$)	(E2)		0.0634 *9*	
527.6		321.4 *2*	100	206.3	(9/2$^-$)				
567.4		175.4[‡] *3*	100[‡]	392.0	(≤7/2)				
574.64	(11/2$^+$)	143.1 *2*	6.5 *6*	431.79	(9/2$^+$)	(M1+E2)		1.3 *3*	
		199.9 *2*	98 *8*	374.73	(9/2$^+$)	(M1+E2)		0.46 *16*	
		319.8 *2*	10.5 *13*	254.68	(7/2$^+$)				
		369.4 *2*	100 *6*	205.19	(7/2$^+$)				
610.46	(11/2$^+$)	377.5 *2*	100	232.95	(7/2$^+$)				
611.09	(9/2$^-$)	83.7 *5*	1.9 *6*	527.6					
		114.4 *2*	4.0 *4*	496.73	(5/2$^-$)	(E2)		2.20 *4*	
		305.7 *2*	5.0 *12*	305.38	(11/2$^-$)	(M1+E2)		0.13 *6*	
		356.4 *2*	8.1 *10*	254.68	(7/2$^+$)	(E1)			
		378.1 *2*	100 *8*	232.95	(7/2$^+$)	(E1+M2)		0.20 *19*	
656.67	(11/2$^+$)	224.8 *2*	68 *8*	431.79	(9/2$^+$)	(M1+E2)		0.32 *12*	

$^{167}_{73}Ta_{94}$-7

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
656.67	(11/2$^+$)	402.0 *2*	100 *18*	254.68	(7/2$^+$)			
663.2		430.2[‡] *3*	100[‡]	232.95	(7/2$^+$)			
678.7	(15/2$^-$)	182.5 *2*	100 *8*	496.2	(13/2$^-$)	(M1+E2)	0.60 *20*	Other Iγ: 74 *4* and 93 from (^{30}Si,p4nγ).
		373.4 *2*	100 *6*	305.38	(11/2$^-$)	(E2)	0.0436 *6*	
790.92	(13/2$^+$)	134.1 *2*	6.5 *5*	656.67	(11/2$^+$)	(M1+E2)	1.5 *4*	
		216.3 *2*	66 *5*	574.64	(11/2$^+$)			Other Iγ: 53 *6* and 73 from (^{30}Si,p4nγ).
		416.2 *2*	100 *7*	374.73	(9/2$^+$)	(E2)	0.0324 *5*	
852.95	(13/2$^-$)	241.9 *2*	100	611.09	(9/2$^-$)	(E2)	0.160 *2*	
874.12	(13/2$^+$)	217.5 *2*	36 *5*	656.67	(11/2$^+$)	(M1+E2)	0.36 *13*	
		442.3 *2*	100 *9*	431.79	(9/2$^+$)	(E2)	0.0276 *4*	
939.97	(13/2$^+$)	329.5 *2*	24 *6*	610.46	(11/2$^+$)			
		436.9 *2*	100 *17*	503.13	(9/2$^+$)	(E2)	0.0285 *4*	
947.3	(17/2$^-$)	268.5 *2*	100 *6*	678.7	(15/2$^-$)	(M1+E2)	0.19 *8*	
		451.0 *2*	54 *4*	496.2	(13/2$^-$)	(E2)	0.0262 *4*	Other Iγ: 80 *5* from (^{30}Si,p4nγ).
1036.21	(15/2$^+$)	97.0 *5*	<0.32	939.97	(13/2$^+$)			
		245.2 *2*	54 *6*	790.92	(13/2$^+$)	(M1+E2)	0.25 *10*	Other Iγ: 82 from (^{30}Si,p4nγ).
		461.6 *2*	100 *8*	574.64	(11/2$^+$)	(E2)	0.0247 *4*	
1091.04	(15/2$^+$)	480.6 *2*	100	610.46	(11/2$^+$)	(E2)	0.0223 *3*	
1133.4	(13/2$^-$)	454.7 *2*	44 *8*	678.7	(15/2$^-$)			
		637.1 *2*	100 *12*	496.2	(13/2$^-$)			
1156.25	(15/2$^+$)	282.2 *2*	18 *4*	874.12	(13/2$^+$)			
		499.6 *2*	100 *11*	656.67	(11/2$^+$)			
1165.5	(19/2$^-$)	218.2 *2*	54 *4*	947.3	(17/2$^-$)	(M1+E2)	0.35 *13*	Other Iγ: 33 *3* and 49 from (^{30}Si,p4nγ).
		486.8 *2*	100 *7*	678.7	(15/2$^-$)	(E2)	0.0216 *3*	
1216.5	(17/2$^-$)	363.6 *2*	100	852.95	(13/2$^-$)	(E2)	0.0469 *7*	
1285.07	(17/2$^+$)	128.9 *2*	2.84 *21*	1156.25	(15/2$^+$)			
		248.9 *2*	52 *4*	1036.21	(15/2$^+$)	(M1+E2)	0.24 *10*	Other Iγ: 46 *5* and 66 from (^{30}Si,p4nγ).
		494.1 *2*	100 *8*	790.92	(13/2$^+$)	(E2)	0.0208 *3*	
1394.16	(17/2$^+$)	520.0 *2*	100	874.12	(13/2$^+$)	(E2)		
1456.73	(17/2$^+$)	365.7 *2*	26 *8*	1091.04	(15/2$^+$)	(M1)	0.1186 *17*	
		516.8 *2*	100 *38*	939.97	(13/2$^+$)			
1493.2	(21/2$^-$)	327.7 *2*	100 *7*	1165.5	(19/2$^-$)	(M1+E2)	0.11 *5*	Other Iγ: 85 *7* from (^{30}Si,p4nγ).
		546.0 *2*	100 *7*	947.3	(17/2$^-$)	(E2)		
1557.32	(19/2$^+$)	272.4 *2*	41 *4*	1285.07	(17/2$^+$)	(M1+E2)	0.19 *8*	
		521.0 *2*	100 *8*	1036.21	(15/2$^+$)	(E2)		
1638.7	(19/2$^+$)	547.7 *2*	100	1091.04	(15/2$^+$)	(E2)		
1641.4	(17/2$^-$)	475.9 *2*	90 *10*	1165.5	(19/2$^-$)			
		508.1 *2*	63 *8*	1133.4	(13/2$^-$)			
		694.2 *2*	100 *13*	947.3	(17/2$^-$)	(M1)	0.0221 *3*	Mult.: Δπ from level scheme.
		962.7 *2*	38 *5*	678.7	(15/2$^-$)			
1678.7	(21/2$^-$)	462.2 *2*	100	1216.5	(17/2$^-$)	(E2)	0.0246 *4*	

$^{167}_{73}Ta_{94}$-8

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
1722.7	(19/2$^+$)	566.4 *2*	100	1156.25	(15/2$^+$)			
1732.3	(23/2$^-$)	239.1 *2*	32 *3*	1493.2	(21/2$^-$)	(M1+E2)	0.27 *11*	
		566.8 *2*	100 *8*	1165.5	(19/2$^-$)	(E2)		
1820.04	(21/2$^+$)	262.7 *2*	39 *4*	1557.32	(19/2$^+$)	(M1+E2)	0.21 *9*	Other Iγ: 43 *5* and 59 from (^{30}Si,p4nγ).
		534.9 *2*	100	1285.07	(17/2$^+$)	(E2)		
1950.40	(21/2$^+$)	556.2 *2*	100	1394.16	(17/2$^+$)	(E2)		
2019.25	(21/2$^+$)	380.5 *5*	19 *8*	1638.7	(19/2$^+$)			
		562.5 *2*	100 *17*	1456.73	(17/2$^+$)			
2056.96	(21/2$^+$)	600.3 *2*	100 *16*	1456.73	(17/2$^+$)			
		771.9 *2*	89 *11*	1285.07	(17/2$^+$)	(E2)		Mult.: Δπ from level scheme.
2088.86	(23/2$^+$)	268.8 *2*	47 *4*	1820.04	(21/2$^+$)	(M1)	0.272 *4*	
		531.6 *2*	100 *8*	1557.32	(19/2$^+$)	(E2)		
2096.5	(25/2$^-$)	364.2 *2*	60 *5*	1732.3	(23/2$^-$)	(M1+E2)	0.08 *4*	Other Iγ: 92 *14* and 68 from (^{30}Si,p4nγ).
		603.3 *2*	100 *8*	1493.2	(21/2$^-$)			
2199.1	(21/2$^-$)	466.8 *2*	56 *6*	1732.3	(23/2$^-$)	(M1+E2)	0.043 *20*	Mult.: Δπ from level scheme.
		557.7 *2*	100 *11*	1641.4	(17/2$^-$)			
		705.8 *2*	68 *8*	1493.2	(21/2$^-$)			
2213.8	(25/2$^-$)	535.1 *2*	100	1678.7	(21/2$^-$)	(E2)		
2222.0	(23/2$^+$)	583.3 *2*	100	1638.7	(19/2$^+$)	(E2)		
2234.3		592.8 *2*	100	1641.4	(17/2$^-$)			
2327.9	(25/2$^+$)	239.0 *2*	71 *6*	2088.86	(23/2$^+$)			
		507.8 *2*	100 *8*	1820.04	(21/2$^+$)			
2348.9	(27/2$^-$)	252.3 *2*	26.6 *13*	2096.5	(25/2$^-$)	(M1+E2)	0.23 *10*	Other Iγ: 73 *23* and 28 from (^{30}Si,p4nγ).
		616.5 *2*	100 *5*	1732.3	(23/2$^-$)	(E2)		Other Eγ: 617.3 *5* from (^{30}Si,p4nγ).
2462.77	(25/2$^+$)	512.4 *2*	65 *9*	1950.40	(21/2$^+$)			
		642.7 *2*	100 *11*	1820.04	(21/2$^+$)			
2477.37	(25/2$^+$)	420.5 *2*	83 *10*	2056.96	(21/2$^+$)	(E2)	0.0315 *5*	
		458.1 *2*	24 *5*	2019.25	(21/2$^+$)			
		526.9 *2*	100 *12*	1950.40	(21/2$^+$)	(E2)		Mult.: Δπ from level scheme.
2566.2	(27/2$^+$)	238.3 *2*	100 *7*	2327.9	(25/2$^+$)			
		477.3 *2*	75 *6*	2088.86	(23/2$^+$)	(E2)	0.0227 *3*	
2579.6	(25/2$^-$)	345.3 *2*	10.0 *9*	2234.3				
		380.4 *2*	45 *6*	2199.1	(21/2$^-$)			
		483.2 *2*	61 *6*	2096.5	(25/2$^-$)	(M1)	0.0570 *8*	Mult.: interpreted as ΔJ=0, dipole from R_q in (^{51}V,4nγ); Δπ from level scheme.
		847.2 *2*	37 *3*	1732.3	(23/2$^-$)	(M1)		Mult.: Δπ from level scheme.
		1086.4 *2*	100 *9*	1493.2	(21/2$^-$)	(E2)		Mult.: Δπ from level scheme.
2634.8	(27/2$^+$)	546.0 *2*	100	2088.86	(23/2$^+$)			
2717.6	(29/2$^-$)	368.7 *2*	68 *6*	2348.9	(27/2$^-$)	(M1+E2)	0.08 *4*	Other Iγ: 40 *17* and 62 from (^{30}Si,p4nγ).
		621.2 *2*	100 *10*	2096.5	(25/2$^-$)	(E2)		
2753.3	(29/2$^-$)	101.5 *2*	76 *5*	2651.8	(27/2$^-$)	(M1)	4.18 *6*	

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
2753.3	(29/2$^-$)	404.2 *2*	100 *10*	2348.9	(27/2$^-$)	(M1+E2)	0.063 *1*	
		539.6 *2*	67 *5*	2213.8	(25/2$^-$)	(E2)		
		656.9 *2*	95 *10*	2096.5	(25/2$^-$)	(E2)		Mult.: Δπ from level scheme. Other Iγ: 167 from (^{30}Si,p4nγ).
2780.9	(29/2$^+$)	214.7 *2*	100 *8*	2566.2	(27/2$^+$)			
		453.0 *2*	59 *5*	2327.9	(25/2$^+$)	(E2)	0.0259 *4*	Other Iγ: 108 *33* and 75 from (^{30}Si,p4nγ).
2810.0	(29/2$^-$)	596.2 *2*	100	2213.8	(25/2$^-$)	(E2)		
2815.0	(29/2$^+$)	180.3 *2*	29 *3*	2634.8	(27/2$^+$)			
		248.7 *2*	36 *4*	2566.2	(27/2$^+$)			
		487.1 *2*	100 *8*	2327.9	(25/2$^+$)			
2821.0	(27/2$^+$)	599.0 *2*	100	2222.0	(23/2$^+$)			Mult.: R_θ in (^{51}V,4nγ) implies ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
2874.2	(31/2$^-$)	120.9 *2*	100 *11*	2753.3	(29/2$^-$)	(M1+E2)	2.2 *4*	
		156.6 *2*	9.4 *11*	2717.6	(29/2$^-$)			
		222.4 *2*	≈11	2651.8	(27/2$^-$)			
2962.8	(29/2$^+$)	485.4 *2*	100 *10*	2477.37	(25/2$^+$)	(E2)		
		500.0 *2*	40 *4*	2462.77	(25/2$^+$)	Q		
2968.1	(31/2$^+$)	153.2 *2*	7.8 *6*	2815.0	(29/2$^+$)	(M1)	1.293 *18*	Mult.: Δπ from level scheme.
		187.2 *2*	100 *6*	2780.9	(29/2$^+$)	(M1+E2)	0.55 *19*	
		333.3 *2*	18.1 *16*	2634.8	(27/2$^+$)	(E2)	0.0217 *3*	Other Iγ: 5.8 *5* from (^{30}Si,p4nγ). Mult.: Δπ from level scheme.
		401.9 *2*	47 *6*	2566.2	(27/2$^+$)	(E2)	0.0356 *5*	Other Iγ: 93 *27* and 50 from (^{30}Si,p4nγ).
2979.5	(31/2$^-$)	261.8 *2*	29.6 *19*	2717.6	(29/2$^-$)	(M1+E2)	0.21 *9*	Other Iγ: 48 (from (^{30}Si,p4nγ)).
		630.6 *2*	100 *7*	2348.9	(27/2$^-$)	(E2)		
3007.4	(31/2$^+$)	226.6 *2*	100 *9*	2780.9	(29/2$^+$)	(M1+E2)	0.32 *12*	Mult.: Δπ from level scheme.
		441.3 *2*	63 *6*	2566.2	(27/2$^+$)	(E2)	0.0277 *4*	Mult.: Δπ from level scheme.
3041.7	(33/2$^-$)	167.5 *2*	100 *9*	2874.2	(31/2$^-$)	(M1+E2)	0.78 *23*	
		288.4 *2*	15.5 *17*	2753.3	(29/2$^-$)			
3211.8	(33/2$^+$)	204.5 *2*	19.7 *19*	3007.4	(31/2$^+$)	(M1)	0.576 *8*	Mult.: Δπ from level scheme.
		243.7 *2*	100 *8*	2968.1	(31/2$^+$)	(M1+E2)	0.26 *10*	
		396.6 *2*	10.6 *17*	2815.0	(29/2$^+$)			Mult.: R_θ in (^{51}V,4nγ) implies ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
		431.0 *2*	61 *6*	2780.9	(29/2$^+$)	(E2)	0.0295 *4*	
3235.0	(35/2$^-$)	193.3 *2*	100 *12*	3041.7	(33/2$^-$)	(M1+E2)	0.50 *17*	
		360.8 *2*	34 *3*	2874.2	(31/2$^-$)	(E2)	0.0480 *7*	
3253.0	(33/2$^+$)	245.7 *2*	100	3007.4	(31/2$^+$)	(M1+E2)	0.25 *10*	
3326.2	(33/2$^-$)	346.8 *2*	67 *8*	2979.5	(31/2$^-$)	(M1)	0.137 *2*	Other Iγ: 34 *7* and 48 from (^{30}Si,p4nγ).
		608.6 *2*	100 *8*	2717.6	(29/2$^-$)	(E2)		
3346.2	(31/2$^+$)	525.2 *5*	100	2821.0	(27/2$^+$)			
3392.5	(33/2$^-$)	582.5 *2*	100	2810.0	(29/2$^-$)			
3426.7	(35/2$^+$)	214.9 *2*	100 *13*	3211.8	(33/2$^+$)			

$^{167}_{73}Ta_{94}$-10

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
3426.7	(35/2$^+$)	458.6 *2*	100 *10*	2968.1	(31/2$^+$)	(E2)	0.0251 *4*	Other Iγ: 63 from (^{30}Si,p4nγ).
3468.7	(37/2$^-$)	233.7 *2*	100 *8*	3235.0	(35/2$^-$)	(M1+E2)	0.29 *11*	
		427.0 *2*	40 *8*	3041.7	(33/2$^-$)			Other Iγ: 56 *8* and 38 from (^{30}Si,p4nγ).
3474.0	(35/2$^+$)	221.1 *2*	30 *3*	3253.0	(33/2$^+$)	(M1)	0.464 *7*	
		262.2 *2*	31 *3*	3211.8	(33/2$^+$)	(M1)	0.291 *5*	Mult.: Δπ from level scheme.
		466.7 *2*	100 *11*	3007.4	(31/2$^+$)	(E2)	0.0240 *4*	
3480.2	(33/2$^+$)	517.4 *2*	100	2962.8	(29/2$^+$)	(E2)		
3594.3	(35/2$^-$)	268.1 *2*	57 *7*	3326.2	(33/2$^-$)	(M1+E2)	0.19 *8*	
		614.8 *2*	100 *10*	2979.5	(31/2$^-$)	(E2)		
3720.7	(37/2$^+$)	246.7 *2*	20.3 *21*	3474.0	(35/2$^+$)			
		294.0 *2*	83 *7*	3426.7	(35/2$^+$)	(M1+E2)	0.15 *7*	
		508.8 *2*	100 *14*	3211.8	(33/2$^+$)			Other Eγ: 509.6 from (^{30}Si,p4nγ).
3733.6	(39/2$^-$)	264.9 *2*	100 *10*	3468.7	(37/2$^-$)	(M1+E2)	0.20 *9*	
		498.5 *2*	64 *6*	3235.0	(35/2$^-$)	(E2)	0.0203 *3*	
3772.1	(37/2$^+$)	298.2 *2*	81 *13*	3474.0	(35/2$^+$)	(M1+E2)	0.14 *6*	
		519.2 *2*	100 *13*	3253.0	(33/2$^+$)	(E2)		
3880.6	(35/2$^+$)	534.4 *5*	100	3346.2	(31/2$^+$)			
3913.1	(37/2$^-$)	318.8 *2*	94 *6*	3594.3	(35/2$^-$)	(M1+E2)	0.12 *6*	
		586.9 *2*	100 *11*	3326.2	(33/2$^-$)			
3974.1	(37/2$^-$)	581.6 *2*	100	3392.5	(33/2$^-$)			
3990.9	(39/2$^+$)	270.1 *2*	61 *5*	3720.7	(37/2$^+$)	(M1+E2)	0.19 *8*	Other Eγ: 269.4 from (^{30}Si,p4nγ).
		564.1 *2*	100 *8*	3426.7	(35/2$^+$)	(E2)		
4023.4	(41/2$^-$)	289.8 *2*	100 *10*	3733.6	(39/2$^-$)	(M1+E2)	0.16 *7*	
		554.7 *2*	94 *6*	3468.7	(37/2$^-$)	(E2)		Other Eγ: 555.1 from (^{30}Si,p4nγ).
4026.0	(39/2$^+$)	253.9 *2*	45 *4*	3772.1	(37/2$^+$)			
		552.0 *2*	100 *11*	3474.0	(35/2$^+$)	(E2)		
4045.2	(37/2$^+$)	565.0 *2*	100	3480.2	(33/2$^+$)	(E2)		
4133.1	(35/2$^+$)	653.0 *5*	100	3480.2	(33/2$^+$)			
4189.9	(39/2$^-$)	276.8 *2*	76 *5*	3913.1	(37/2$^-$)	(M1+E2)	0.18 *8*	
		595.6 *2*	100 *10*	3594.3	(35/2$^-$)	(E2)		
4304.7	(41/2$^+$)	278.8 *2*	17.4 *23*	4026.0	(39/2$^+$)			
		313.8 *2*	71 *13*	3990.9	(39/2$^+$)			Other Eγ (Iγ): 314.9 (≈133) from (^{30}Si,p4nγ).
		583.9 *2*	100 *10*	3720.7	(37/2$^+$)	(E2)		Other Eγ: 584.5 from (^{30}Si,p4nγ).
4347.9	(43/2$^-$)	324.5 *2*	100 *10*	4023.4	(41/2$^-$)	(M1+E2)	0.11 *5*	Other Eγ: 324.9 from (^{30}Si,p4nγ).
		614.4 *2*	72 *6*	3733.6	(39/2$^-$)	(E2)		Other Eγ (Iγ): 615.2 (108) from (^{30}Si,p4nγ).
4360.3	(41/2$^+$)	334.2 *2*	45 *5*	4026.0	(39/2$^+$)	(M1+E2)	0.11 *5*	
		588.2[@] *2*	100[@] *9*	3772.1	(37/2$^+$)	(E2)		
4489.3	(39/2$^+$)	608.7 *5*	100	3880.6	(35/2$^+$)			
4501.3	(41/2$^-$)	311.5 *2*	92 *8*	4189.9	(39/2$^-$)	(M1+E2)	0.13 *6*	
		588.2[@] *2*	100[@] *8*	3913.1	(37/2$^-$)			

$^{167}_{73}Ta_{94}$-11

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
4557.2	(41/2$^-$)	583.0 *2*	100	3974.1	(37/2$^-$)			
4607.9	(43/2$^+$)	247.6 *2*	8.3 *17*	4360.3	(41/2$^+$)			
		303.3 *2*	100 *9*	4304.7	(41/2$^+$)	(M1+E2)	0.14 *6*	
		582.0 *2*	41 *4*	4026.0	(39/2$^+$)			Mult.: R_θ in (^{51}V,4nγ) suggests ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
		617.0 *2*	25 *3*	3990.9	(39/2$^+$)			
4658.3	(43/2$^+$)	298.0 *2*	33 *4*	4360.3	(41/2$^+$)	(M1+E2)	0.14 *6*	
		632.3 *2*	49 *5*	4026.0	(39/2$^+$)	(E2)		
		667.3 *2*	100 *14*	3990.9	(39/2$^+$)	(E2)		Mult.: Δπ from level scheme.
4661.0	(41/2$^+$)	615.8 *2*	100	4045.2	(37/2$^+$)	(E2)		
4684.1	(45/2$^-$)	336.1 *2*	98 *8*	4347.9	(43/2$^-$)	(M1+E2)	0.10 *5*	Other Iγ: 72 *14* from (^{30}Si,p4nγ).
		660.7 *2*	100 *8*	4023.4	(41/2$^-$)	(E2)		Other Eγ: 661.3 from (^{30}Si,p4nγ).
4687.7	(39/2$^+$)	554.6 *5*	50 *17*	4133.1	(35/2$^+$)			
		642.6 *5*	100 *17*	4045.2	(37/2$^+$)	(M1)	0.0273 *4*	Mult.: Δπ from level scheme.
4799.8	(43/2$^-$)	298.5 *2*	55 *5*	4501.3	(41/2$^-$)	(M1+E2)	0.14 *6*	
		609.9 *2*	100 *7*	4189.9	(39/2$^-$)	(E2)		
4920.4	(45/2$^+$)	312.5 *2*	97 *17*	4607.9	(43/2$^+$)			Other Eγ (Iγ): 313.0 (≈50) from (^{30}Si,p4nγ).
		615.8 *2*	100 *17*	4304.7	(41/2$^+$)			Other Eγ: 617.0 from (^{30}Si,p4nγ).
5008.7	(45/2$^+$)	350.4 *2*	90 *9*	4658.3	(43/2$^+$)			
		648.4 *2*	100 *10*	4360.3	(41/2$^+$)			R_θ in (^{51}V,4nγ) suggests ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
5053.5	(47/2$^-$)	369.4 *2*	70 *7*	4684.1	(45/2$^-$)	(M1+E2)	0.08 *4*	
		705.6 *2*	100 *9*	4347.9	(43/2$^-$)	(E2)		Other Eγ: 706.5 from (^{30}Si,p4nγ).
5126.7	(45/2$^-$)	327.0 *2*	56 *6*	4799.8	(43/2$^-$)	(M1+E2)	0.11 *5*	
		625.4 *2*	100 *9*	4501.3	(41/2$^-$)	(E2)		
5186.6	(45/2$^-$)	629.4 *2*	100	4557.2	(41/2$^-$)	(E2)		
5206.6	(45/2$^-$)	649.4 *2*	100	4557.2	(41/2$^-$)	(E2)		Mult.: Δπ from level scheme.
5235.9	(47/2$^+$)	315.5 *2*	100 *18*	4920.4	(45/2$^+$)			
		627.9 *2*	24 *9*	4607.9	(43/2$^+$)	(E2)		
5293.3	(43/2$^+$)	605.7 *5*	100 *13*	4687.7	(39/2$^+$)			
		632.3 *5*	100 *13*	4661.0	(41/2$^+$)	(M1(+E2))	0.020 *9*	Mult.: Δπ from level scheme.
5326.2	(45/2$^+$)	665.2 *2*	100	4661.0	(41/2$^+$)	(E2)		
5345.1	(47/2$^+$)	336.4[@] *2*	40[@] *5*	5008.7	(45/2$^+$)			
		686.8 *2*	100 *9*	4658.3	(43/2$^+$)			
5426.5	(49/2$^-$)	373.0 *2*	68 *8*	5053.5	(47/2$^-$)	(M1+E2)	0.08 *4*	Other: Eγ=373.5, Iγ=55 *19* from (^{30}Si,p4nγ).
		742.4 *2*	100 *8*	4684.1	(45/2$^-$)	(E2)		
5465.0	(47/2$^-$)	338.3 *2*	57 *6*	5126.7	(45/2$^-$)			
		665.2 *2*	100 *10*	4799.8	(43/2$^-$)	(E2)		
5514.7	(47/2$^-$)	308.1 *5*	100 *13*	5206.6	(45/2$^-$)			
		328.0 *5*	75 *13*	5186.6	(45/2$^-$)			
5550.3	(49/2$^+$)	314.4 *2*	65 *15*	5235.9	(47/2$^+$)			
		629.9 *2*	100 *10*	4920.4	(45/2$^+$)	(E2)		

$^{167}_{73}Ta_{94}$-12

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
5697.4	(49/2$^+$)	352.4 *2*	16.4 *16*	5345.1	(47/2$^+$)			
		688.7 *2*	100 *10*	5008.7	(45/2$^+$)			
5802.3	(49/2$^-$)	337.4 *2*	39 *5*	5465.0	(47/2$^-$)			
		675.5 *2*	100 *10*	5126.7	(45/2$^-$)	(E2)		
5824.7	(51/2$^-$)	398.2 *2*	56 *6*	5426.5	(49/2$^-$)	(M1+E2)	0.07 *3*	
		771.2 *2*	100 *8*	5053.5	(47/2$^-$)	(E2)		
5849.5	(49/2$^-$)	334.8 *5*	38.5 *8*	5514.7	(47/2$^-$)			
		642.9 *5*	30.8 *8*	5206.6	(45/2$^-$)			
		662.9 *2*	100 *15*	5186.6	(45/2$^-$)			
5888.3	(51/2$^+$)	338.0 *2*	70 *5*	5550.3	(49/2$^+$)	(M1+E2)	0.10 *5*	
		652.4 *2*	100 *10*	5235.9	(47/2$^+$)	(E2)		
5890.2	(49/2$^-$)	683.7 *2*	14 *6*	5206.6	(45/2$^-$)			
		703.6 *2*	100 *12*	5186.6	(45/2$^-$)	(E2)		
5949.4	(47/2$^+$)	623.2 *5*	67 *8*	5326.2	(45/2$^+$)			
		656.1 *2*	100 *17*	5293.3	(43/2$^+$)			
6035.6	(49/2$^+$)	709.4[@] *2*	100[@]	5326.2	(45/2$^+$)	(E2)		
6054.5	(51/2$^+$)	357.1 *2*	24.6 *29*	5697.4	(49/2$^+$)			
		709.4[@] *2*	100[@] *10*	5345.1	(47/2$^+$)	(E2)		
6182.1	(51/2$^-$)	379.8 *2*	45 *6*	5802.3	(49/2$^-$)			
		667.2 *5*	9.0 *15*	5514.7	(47/2$^-$)			
		717.1 *2*	100 *10*	5465.0	(47/2$^-$)			
6205.7	(51/2$^-$)	740.7 *2*	100	5465.0	(47/2$^-$)			
6221.7	(53/2$^+$)	333.4 *2*	65 *12*	5888.3	(51/2$^+$)	(M1+E2)	0.11 *5*	
		671.3 *2*	100 *12*	5550.3	(49/2$^+$)	(E2)		
6226.3	(53/2$^-$)	401.7 *2*	38 *3*	5824.7	(51/2$^-$)	(M1+E2)	0.06 *3*	
		799.8 *2*	100 *9*	5426.5	(49/2$^-$)	(E2)		
6421.7	(53/2$^+$)	367.2 *2*	69 *8*	6054.5	(51/2$^+$)			
		724.4 *2*	100 *10*	5697.4	(49/2$^+$)			
6518.4	(53/2$^-$)	336.4[@] *2*	35[@] *6*	6182.1	(51/2$^-$)			
		716.1 *2*	100 *11*	5802.3	(49/2$^-$)			
6593.2	(53/2$^-$)	743.7 *5*	100	5849.5	(49/2$^-$)			
6598.8	(55/2$^+$)	377.2 *2*	100.0 *24*	6221.7	(53/2$^+$)	(M1)	0.1093	
		710.5 *2*	100.0 *24*	5888.3	(51/2$^+$)	(E2)		
6637.6	(55/2$^-$)	411.3 *2*	38 *4*	6226.3	(53/2$^-$)			Other Iγ: 50 from (^{30}Si,p4nγ).
		812.9 *2*	100 *12*	5824.7	(51/2$^-$)	(E2)		
6642.9	(53/2$^-$)	752.7 *2*	100	5890.2	(49/2$^-$)	(E2)		
6653.7	(51/2$^+$)	618[&] *1*	<27	6035.6	(49/2$^+$)			
		704.3 *2*	100 *18*	5949.4	(47/2$^+$)			
6674.2	(53/2$^-$)	784.0 *2*	100	5890.2	(49/2$^-$)			R_θ in (^{51}V,4nγ) suggests ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
6779.9	(53/2$^+$)	744.3 *2*	100	6035.6	(49/2$^+$)	(E2)		

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[#]	Comments
6799.9	(53/2$^+$)	764.3 *2*	100	6035.6	(49/2$^+$)	(E2)		Mult.: Δπ from level scheme.
6815.9	(55/2$^+$)	394.2 *5*	23.7 *26*	6421.7	(53/2$^+$)			
		761.4 *2*	100 *11*	6054.5	(51/2$^+$)			
6919.6	(55/2$^-$)	401.2 *2*	38 *5*	6518.4	(53/2$^-$)			
		737.5 *2*	100 *13*	6182.1	(51/2$^-$)			
6963.5	(57/2$^+$)	364.7 *2*	87 *13*	6598.8	(55/2$^+$)	(M1)	0.1195	
		741.8 *2*	100 *13*	6221.7	(53/2$^+$)	(E2)		
6987.6	(55/2$^-$)	781.9 *2*	100	6205.7	(51/2$^-$)			
7063.8	(57/2$^-$)	426.2 *2*	31 *4*	6637.6	(55/2$^-$)			I_γ: ≈33 in (^{30}Si,p4nγ).
		837.5 *2*	100 *9*	6226.3	(53/2$^-$)			R_θ in (^{51}V,4nγ) suggests ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
7213.8	(57/2$^+$)	397.9 *2*	68 *8*	6815.9	(55/2$^+$)			
		792.1 *2*	100 *12*	6421.7	(53/2$^+$)			
7292.8	(57/2$^-$)	373.3 *2*	22 *4*	6919.6	(55/2$^-$)			
		774.4 *2*	100 *11*	6518.4	(53/2$^-$)	(E2)		
7389.2	(59/2$^+$)	425.7 *2*	83 *8*	6963.5	(57/2$^+$)			
		790.3 *2*	100 *8*	6598.8	(55/2$^+$)	(E2)		
7405.4	(57/2$^-$)	812.2 *5*	100	6593.2	(53/2$^-$)			
7406.1	(55/2$^+$)	752.4 *5*	100	6653.7	(51/2$^+$)			
7438.6	(57/2$^-$)	764.4 *5*	<11	6674.2	(53/2$^-$)			
		795.7 *2*	100 *14*	6642.9	(53/2$^-$)	(E2)		
7471.7	(57/2$^-$)	797.4 *5*	75 *17*	6674.2	(53/2$^-$)			
		828.8 *2*	100 *8*	6642.9	(53/2$^-$)			
7480.3	(59/2$^-$)	416.5 *2*	36 *4*	7063.8	(57/2$^-$)			
		842.7 *2*	100 *12*	6637.6	(55/2$^-$)	(E2)		
7565.8	(57/2$^+$)	785.9 *2*	100	6779.9	(53/2$^+$)	(E2)		
7596.3	(57/2$^+$)	796.4 *5*	100 *13*	6799.9	(53/2$^+$)	(E2)		
		816[&] *1*	<38	6779.9	(53/2$^+$)			
7654.4	(59/2$^+$)	838.5 *2*	100	6815.9	(55/2$^+$)			
7716.3	(59/2$^-$)	423.5[@] *2*	25[@] *5*	7292.8	(57/2$^-$)			
		796.7 *2*	100 *13*	6919.6	(55/2$^-$)			
7785.8	(61/2$^+$)	396.7 *2*	51 *5*	7389.2	(59/2$^+$)	(M1+E2)	0.07 *3*	
		822.4 *2*	100 *14*	6963.5	(57/2$^+$)	(E2)		
7830.2	(59/2$^-$)	842.6 *2*	100	6987.6	(55/2$^-$)			
7933.5	(61/2$^-$)	453.1 *2*	33 *4*	7480.3	(59/2$^-$)			
		869.7 *2*	100 *8*	7063.8	(57/2$^-$)	(E2)		
8085.3	(61/2$^+$)	871.5 *2*	100	7213.8	(57/2$^+$)			
8128.2	(61/2$^-$)	835.4 *2*	100	7292.8	(57/2$^-$)			R_θ in (^{51}V,4nγ) suggests ΔJ=1, D+Q, but placement requires ΔJ=2, Q.
8205.6	(59/2$^+$)	799.5 *5*	100	7406.1	(55/2$^+$)			
8263.5	(63/2$^+$)	477.7 *2*	58 *8*	7785.8	(61/2$^+$)			
		874.3 *2*	100 *10*	7389.2	(59/2$^+$)	(E2)		
8278.0	(61/2$^-$)	872.6 *5*	100	7405.4	(57/2$^-$)			

Adopted Levels, Gammas (continued)

γ(^{167}Ta) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]
8294.2	(61/2$^-$)	855.6 *2*	100	7438.6	(57/2$^-$)	(E2)
8324.4	(61/2$^-$)	852.7 *2*	100	7471.7	(57/2$^-$)	
8354.4	(63/2$^-$)	420.9 *2*	42 *4*	7933.5	(61/2$^-$)	
		874.2 *2*	100 *9*	7480.3	(59/2$^-$)	(E2)
8398.6	(61/2$^+$)	832.8 *2*	100	7565.8	(57/2$^+$)	(E2)
8437.2	(61/2$^+$)	840.9 *5*	100	7596.3	(57/2$^+$)	
8564.2	(63/2$^-$)	847.9 *2*	100	7716.3	(59/2$^-$)	
8564.3	(63/2$^+$)	909.9 *2*	100	7654.4	(59/2$^+$)	
8685.4	(65/2$^+$)	421.9 *2*	32 *5*	8263.5	(63/2$^+$)	
		899.6 *2*	100 *10*	7785.8	(61/2$^+$)	(E2)
8744.8	(63/2$^-$)	914.6 *5*	100	7830.2	(59/2$^-$)	
8843.6	(65/2$^-$)	489.2 *2*	49 *5*	8354.4	(63/2$^-$)	
		910.1 *2*	100 *8*	7933.5	(61/2$^-$)	(E2)
9020.7	(65/2$^-$)	892.4 *2*	100	8128.2	(61/2$^-$)	
9030.4	(65/2$^+$)	945.1 *2*	100	8085.3	(61/2$^+$)	
9054.3	(63/2$^+$)	848.7 *5*	100	8205.6	(59/2$^+$)	
9204.7	(65/2$^-$)	926.7 *5*	100	8278.0	(61/2$^-$)	
9206.8	(65/2$^-$)	912.6 *5*	100	8294.2	(61/2$^-$)	
9219.6	(67/2$^+$)	956.1 *2*	100	8263.5	(63/2$^+$)	(E2)
9222.6	(65/2$^-$)	898.2 *5*	100	8324.4	(61/2$^-$)	
9267.2	(67/2$^-$)	423.5[@] *2*	15.6[@] *26*	8843.6	(65/2$^-$)	
		912.8 *2*	100 *10*	8354.4	(63/2$^-$)	(E2)
9280.0	(65/2$^+$)	881.4 *2*	100	8398.6	(61/2$^+$)	(E2)
9331.8	(65/2$^+$)	894.6 *5*	100	8437.2	(61/2$^+$)	
9466.0	(67/2$^-$)	901.8 *2*	100	8564.2	(63/2$^-$)	
9654.1	(69/2$^+$)	968.7 *2*	100	8685.4	(65/2$^+$)	
9805.1	(69/2$^-$)	961.4 *2*	100	8843.6	(65/2$^-$)	
9954.1	(67/2$^+$)	899.8 *5*	100	9054.3	(63/2$^+$)	
9972.8	(69/2$^-$)	952.1 *2*	100	9020.7	(65/2$^-$)	
10019.8	(69/2$^+$)	989.4 *5*	100	9030.4	(65/2$^+$)	
10143.7	(69/2$^-$)	921.1 *5*	100	9222.6	(65/2$^-$)	
10158.7	(69/2$^-$)	951.9 *5*	100	9206.8	(65/2$^-$)	
10213.8	(69/2$^+$)	933.8 *5*	100	9280.0	(65/2$^+$)	
10223.8	(71/2$^-$)	956.6 *2*	100	9267.2	(67/2$^-$)	
10250.4	(71/2$^+$)	1030.8 *2*	100	9219.6	(67/2$^+$)	
10267.3	(69/2$^+$)	935.5 *5*	100	9331.8	(65/2$^+$)	
10424.2	(71/2$^-$)	958.2 *5*	100	9466.0	(67/2$^-$)	
10681.3	(73/2$^+$)	1027.2 *2*	100	9654.1	(69/2$^+$)	
10825.6	(73/2$^-$)	1020.5 *2*	100	9805.1	(69/2$^-$)	
10906.1	(71/2$^+$)	952.0 *5*	100	9954.1	(67/2$^+$)	
10986.8	(73/2$^-$)	1014.0 *5*	100	9972.8	(69/2$^-$)	
11031.8?	(73/2$^+$)	1012[&] *1*	100	10019.8	(69/2$^+$)	
11200.4	(73/2$^+$)	986.6 *5*	100	10213.8	(69/2$^+$)	
11225.3	(75/2$^-$)	1001.5 *2*	100	10223.8	(71/2$^-$)	
11239.3?	(73/2$^+$)	972[&] *1*	100	10267.3	(69/2$^+$)	
11346.1	(75/2$^+$)	1095.7 *5*	100	10250.4	(71/2$^+$)	
11434.7	(75/2$^-$)	1010.5 *5*	100	10424.2	(71/2$^-$)	
11756.5	(77/2$^+$)	1075.2 *2*	100	10681.3	(73/2$^+$)	
11907.0	(77/2$^-$)	1081.4 *2*	100	10825.6	(73/2$^-$)	
11910.9	(75/2$^+$)	1004.7 *5*	100	10906.1	(71/2$^+$)	
12065.5	(77/2$^-$)	1078.7 *5*	100	10986.8	(73/2$^-$)	
12240.4	(77/2$^+$)	1040.0 *5*	100	11200.4	(73/2$^+$)	
12271.0	(79/2$^-$)	1045.7 *5*	100	11225.3	(75/2$^-$)	
12486.2	(79/2$^+$)	1140.1 *5*	100	11346.1	(75/2$^+$)	
12492.8	(79/2$^-$)	1058.1 *5*	100	11434.7	(75/2$^-$)	
12871.9	(81/2$^+$)	1115.4 *5*	100	11756.5	(77/2$^+$)	
12968.0	(79/2$^+$)	1057.1 *5*	100	11910.9	(75/2$^+$)	
13047.3	(81/2$^-$)	1140.3 *2*	100	11907.0	(77/2$^-$)	
13343.4?	(81/2$^+$)	1103[&] *1*	100	12240.4	(77/2$^+$)	
13357.6	(83/2$^-$)	1086.6 *5*	100	12271.0	(79/2$^-$)	
13596.2	(83/2$^-$)	1103.4 *5*	100	12492.8	(79/2$^-$)	
14025.6	(85/2$^+$)	1153.7 *5*	100	12871.9	(81/2$^+$)	
14229.9	(85/2$^-$)	1182.6 *2*	100	13047.3	(81/2$^-$)	
14483.0	(87/2$^-$)	1125.4 *5*	100	13357.6	(83/2$^-$)	

[†] From (^{51}V,4nγ), except as noted. For many levels, additional estimates of γ branching are available from (^{30}Si,p4nγ); inconsistencies are noted. Δπ=(no) has been assigned for intraband transitions. Stretched quadrupoles in the (^{51}V,4nγ) dataset are assigned (E2) here, and ΔJ=1, D or D+Q as (M1) or (M1+E2), as there appears no evidence for long-lived levels, which could permit M2 transitions.

[‡] From ^{167}W 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.

$^{167}_{73}Ta_{94}$-15

$\gamma(^{167}Ta)$ (continued)

@ Multiply placed with intensity suitably divided.
& Placement of transition in the level scheme is uncertain.

$^{167}_{73}Ta_{94}$-16

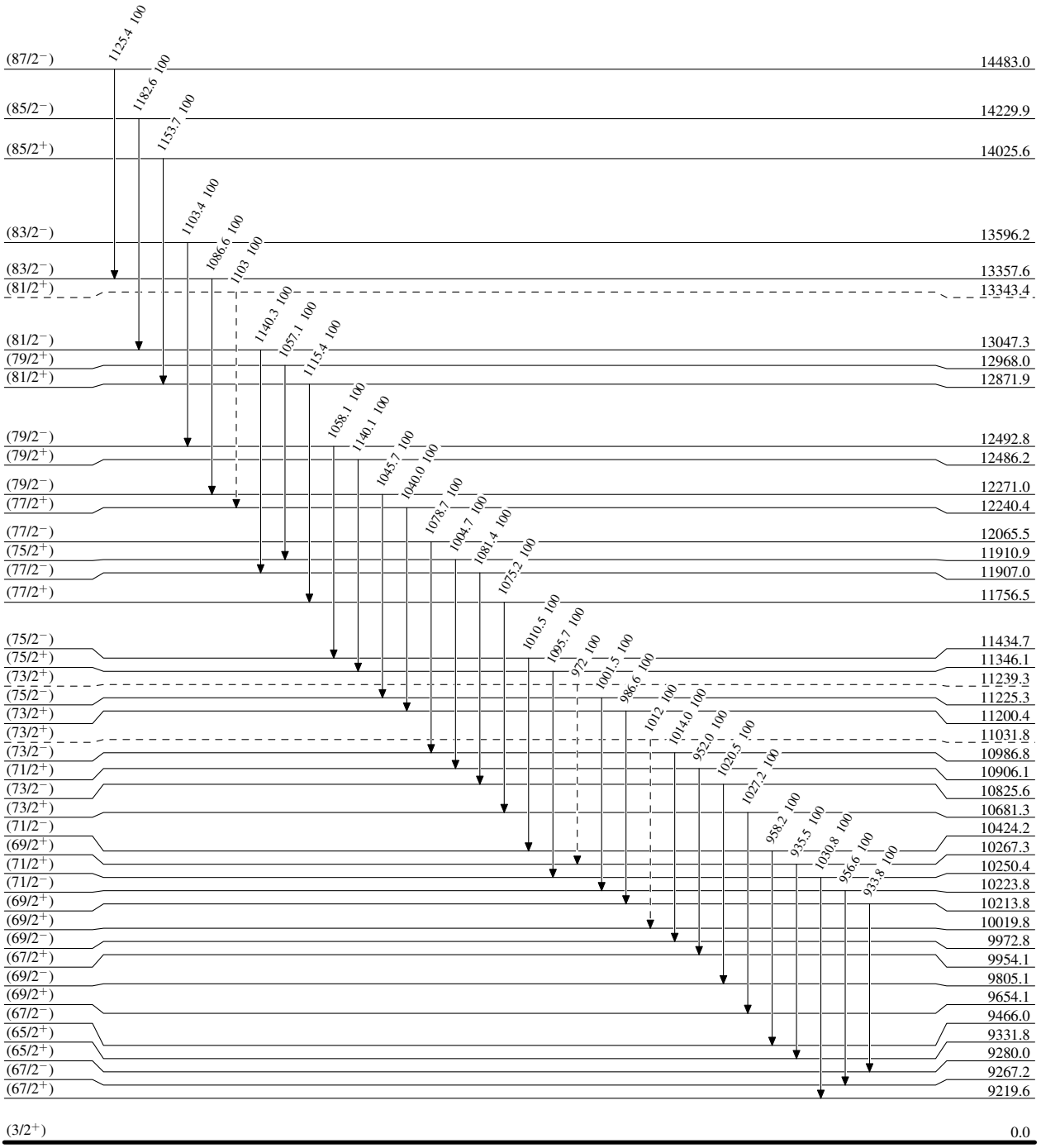
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)

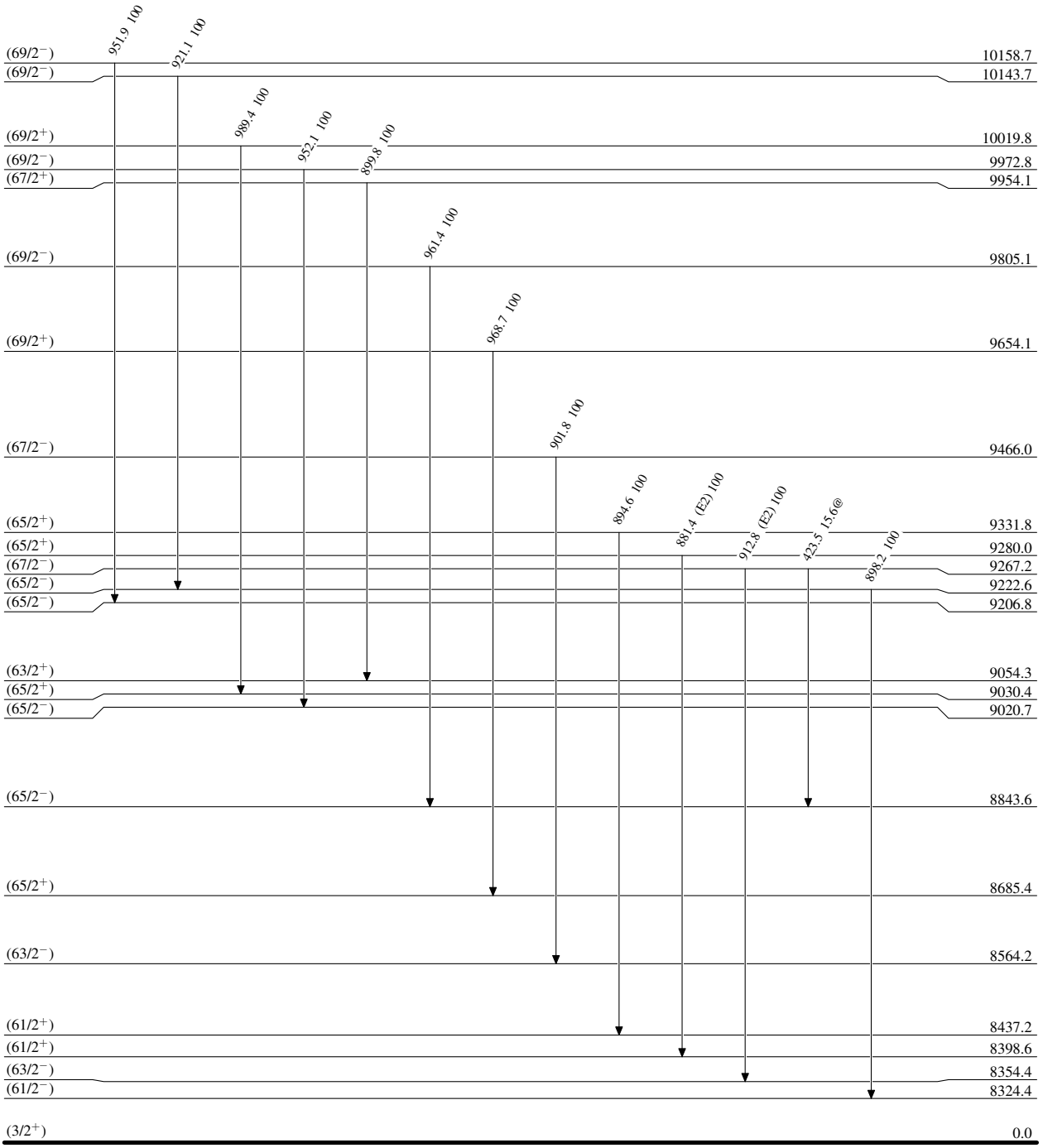


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

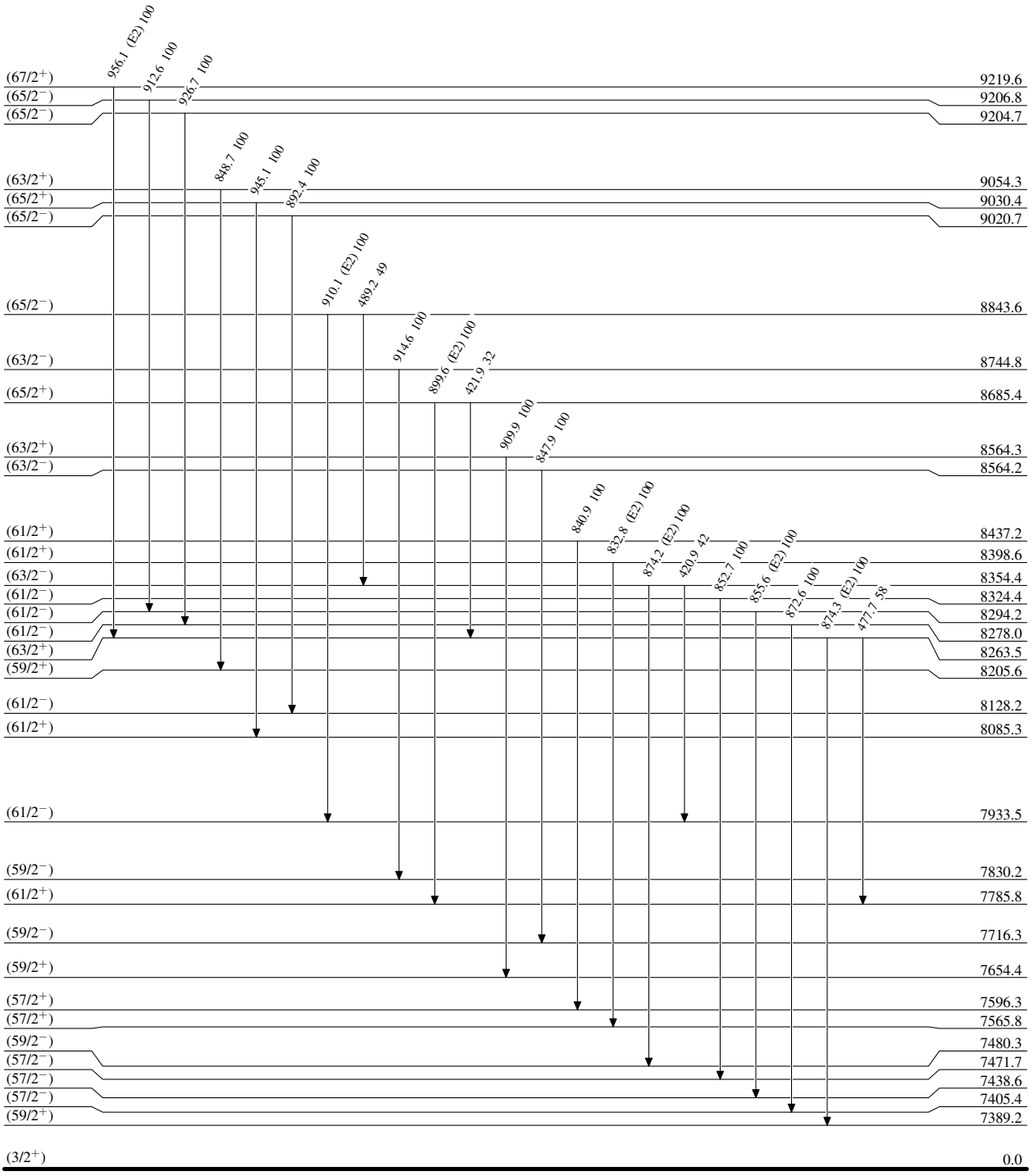


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



$^{167}_{73}Ta_{94}$

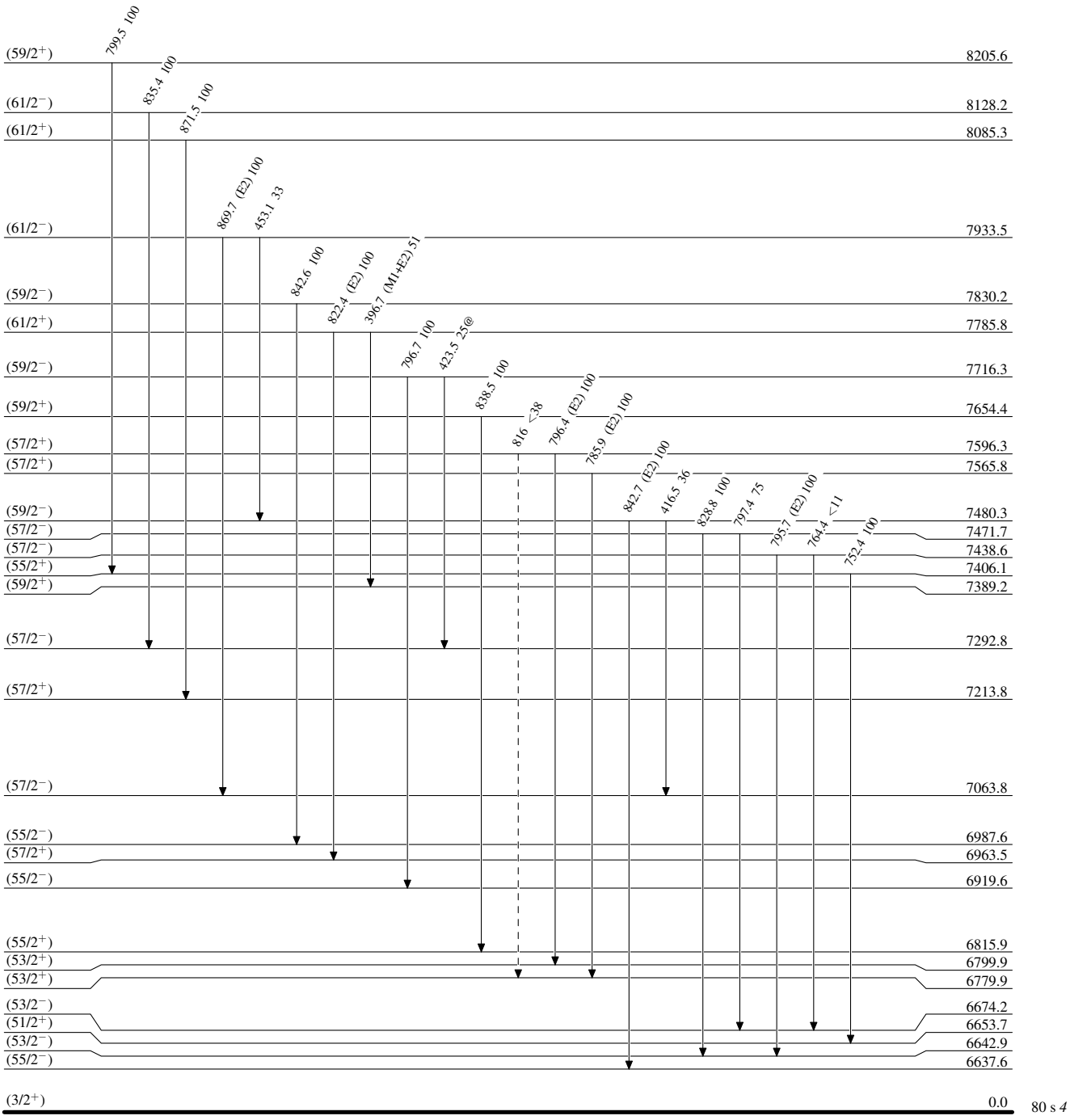
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

– – – – – – ► γ Decay (Uncertain)



$^{167}_{73}Ta_{94}$

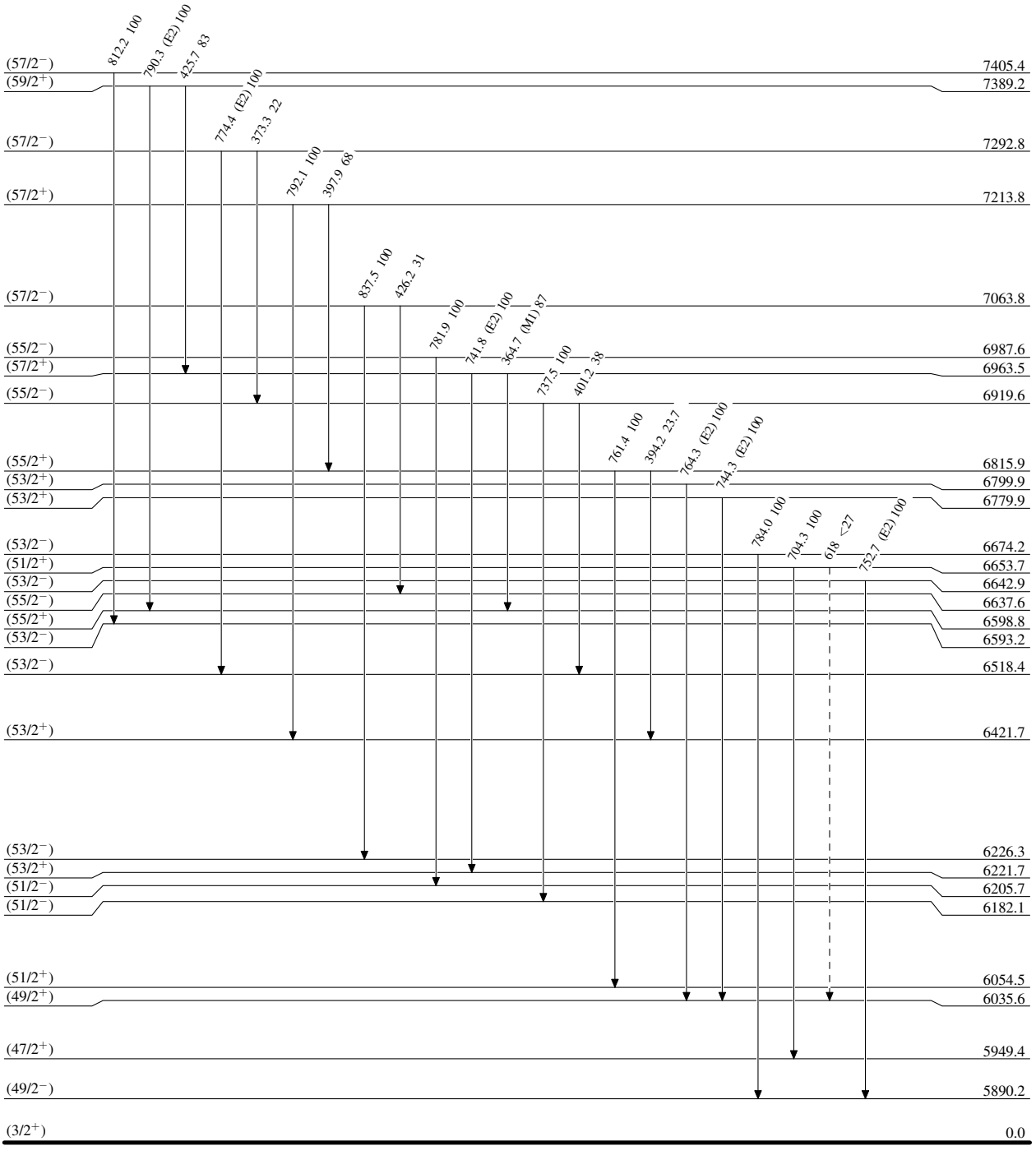
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

- - - - - - ► γ Decay (Uncertain)



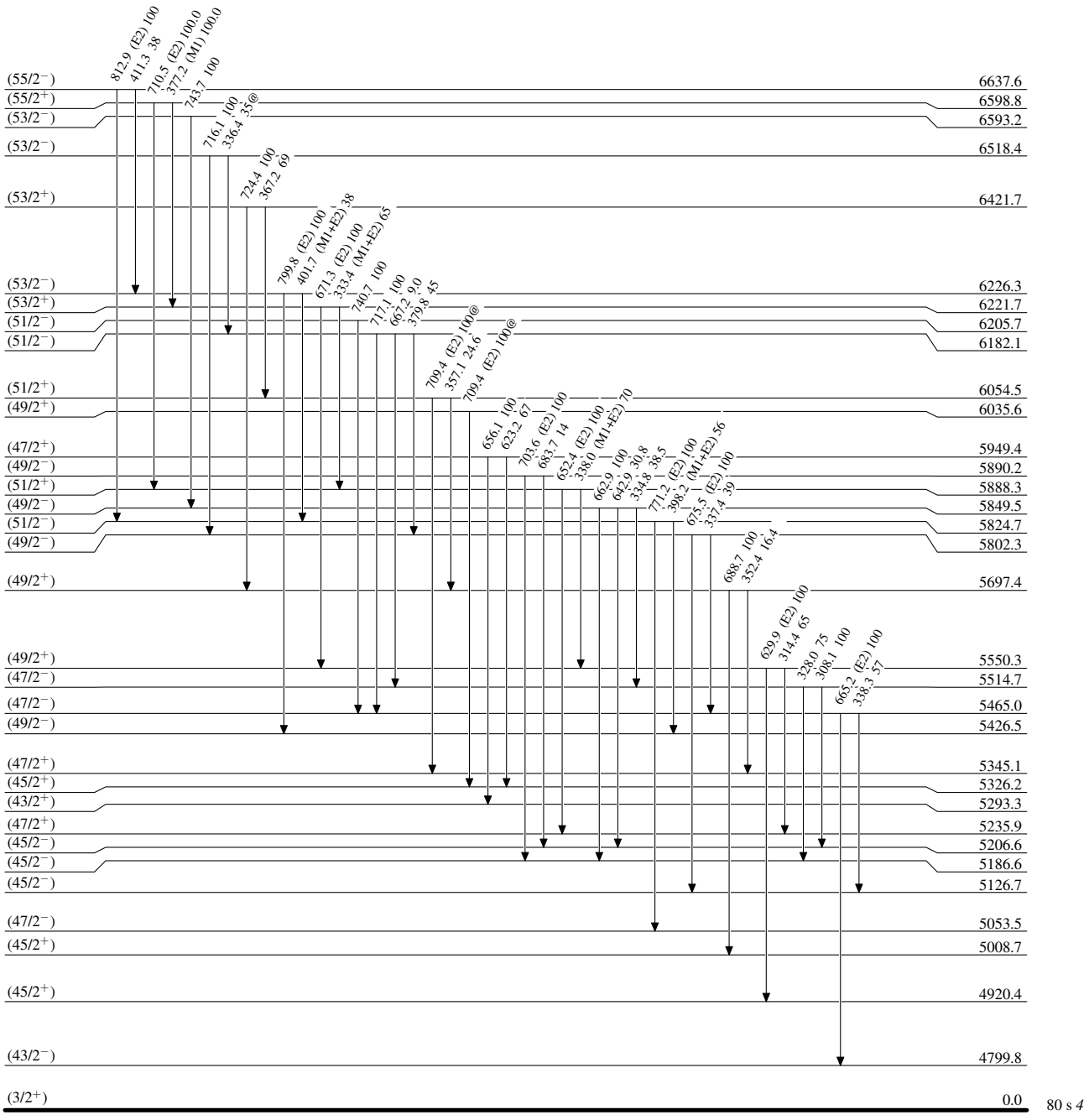
80 s *4*

$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

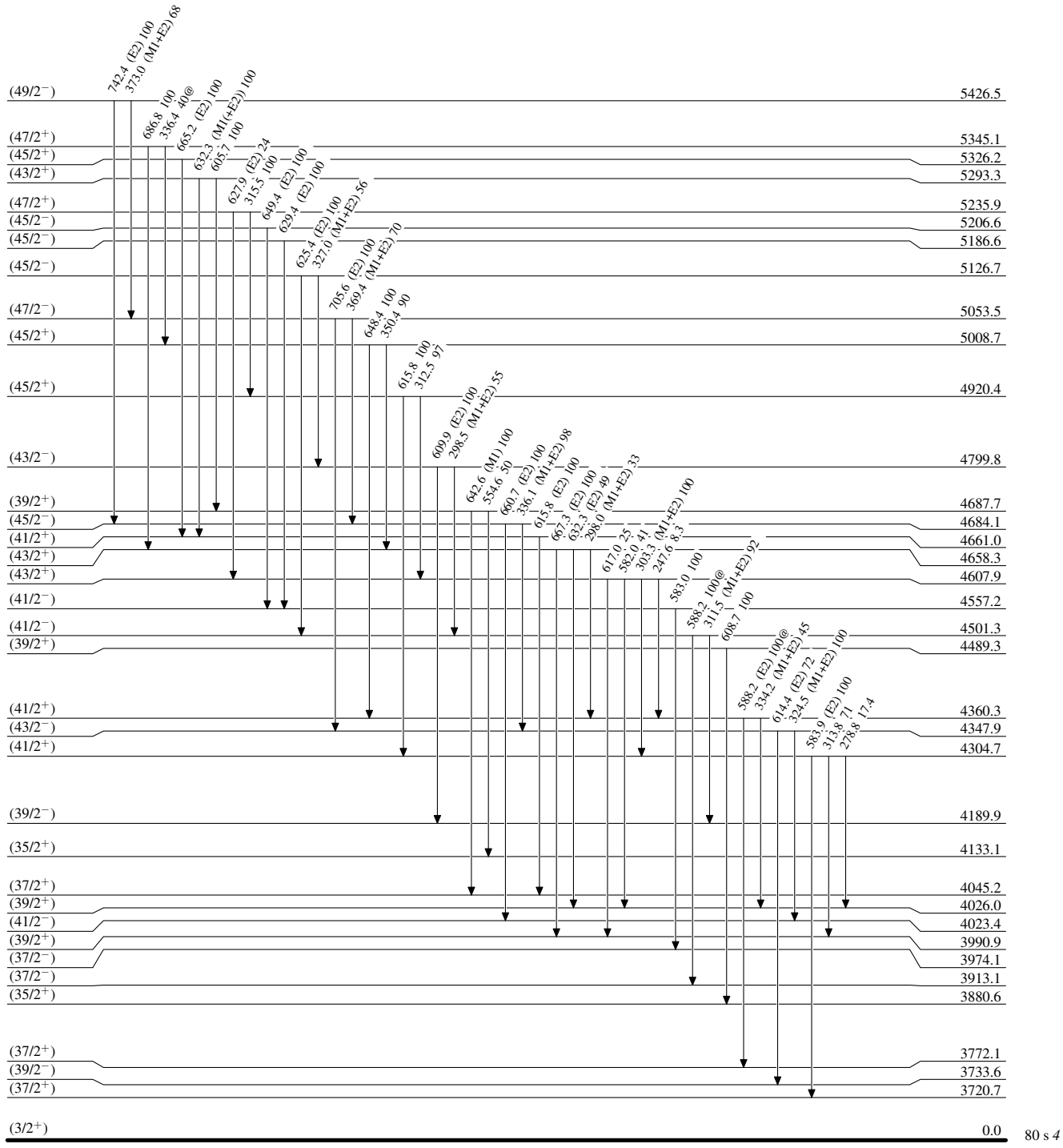


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

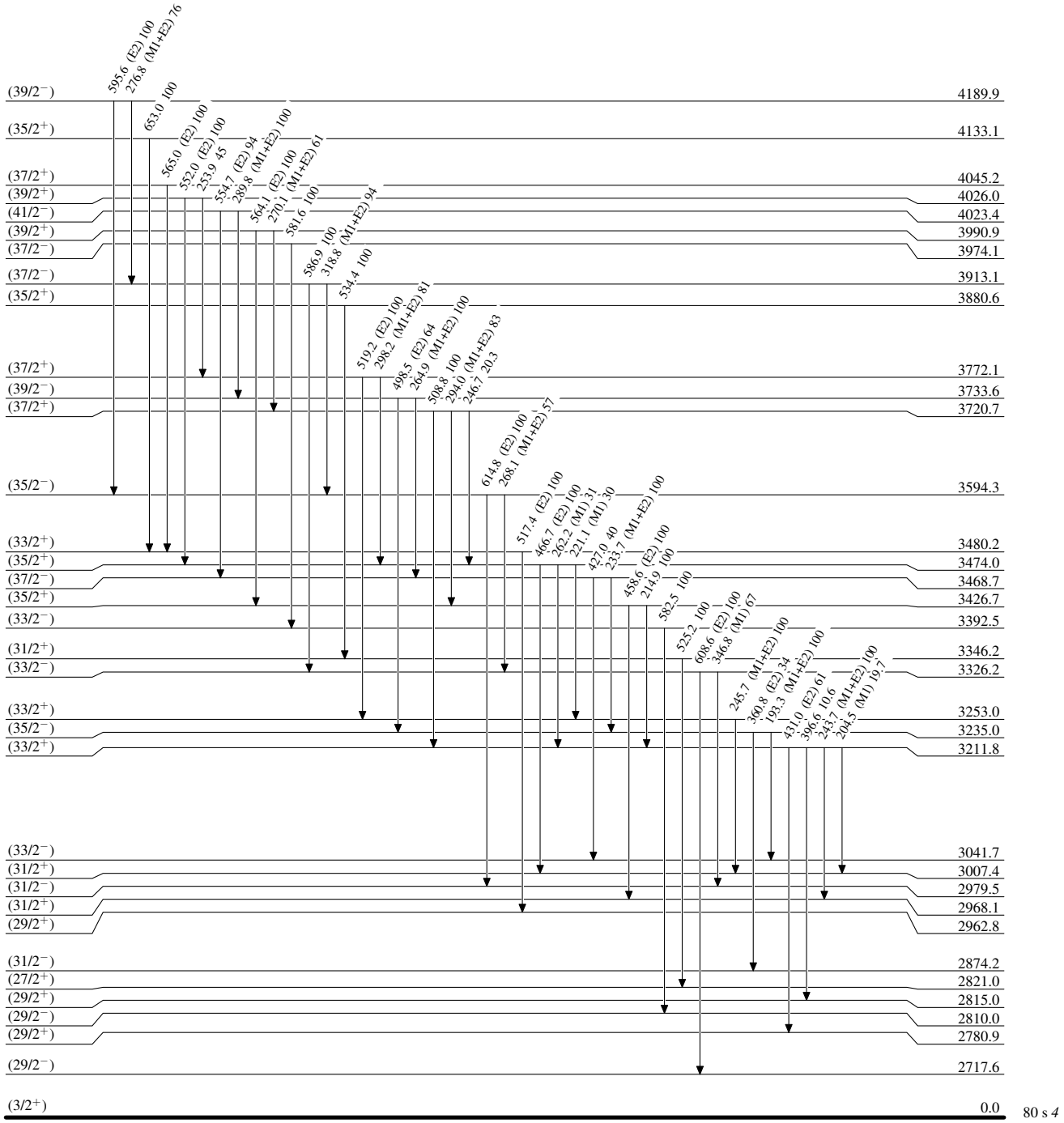


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

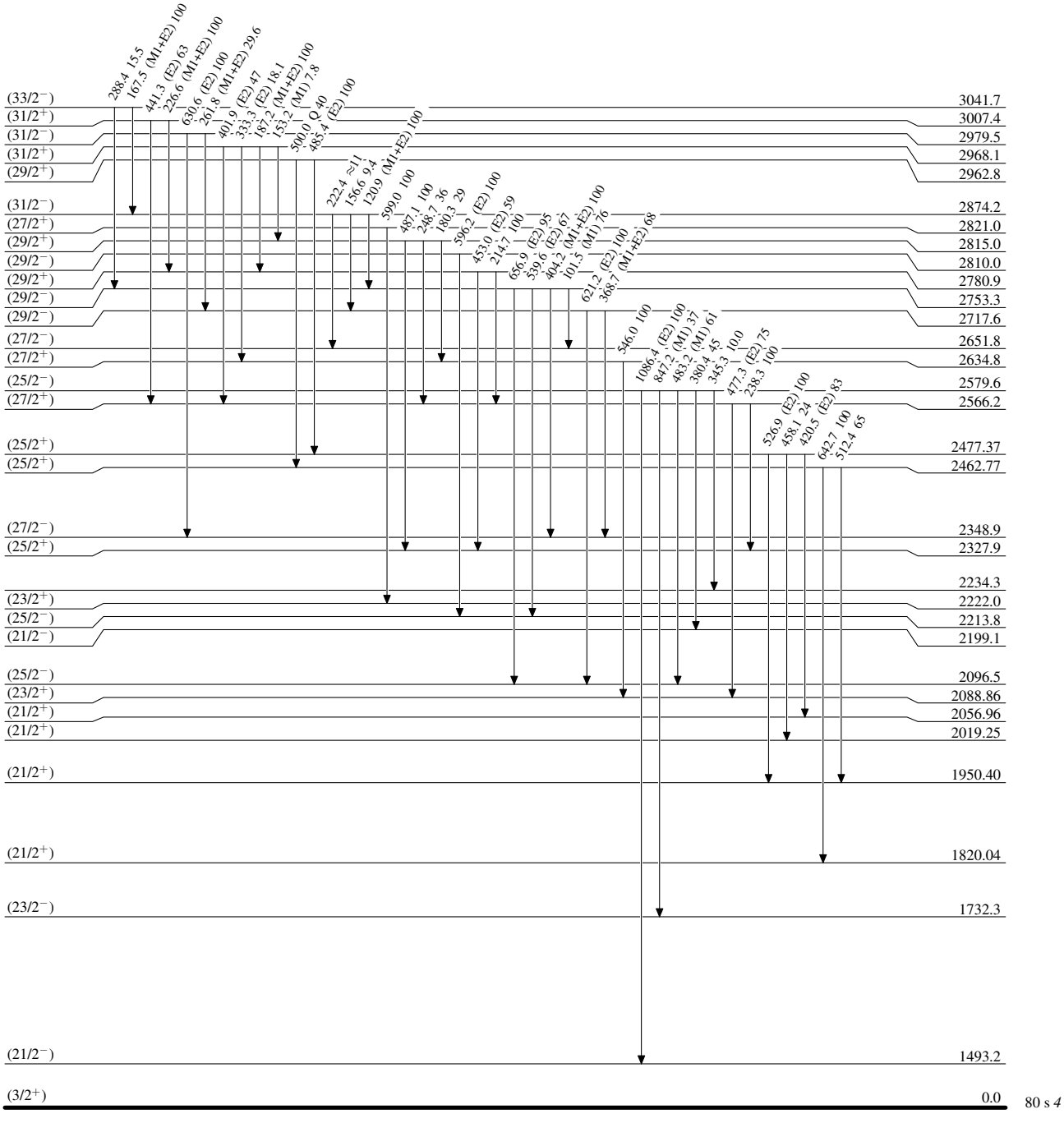


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

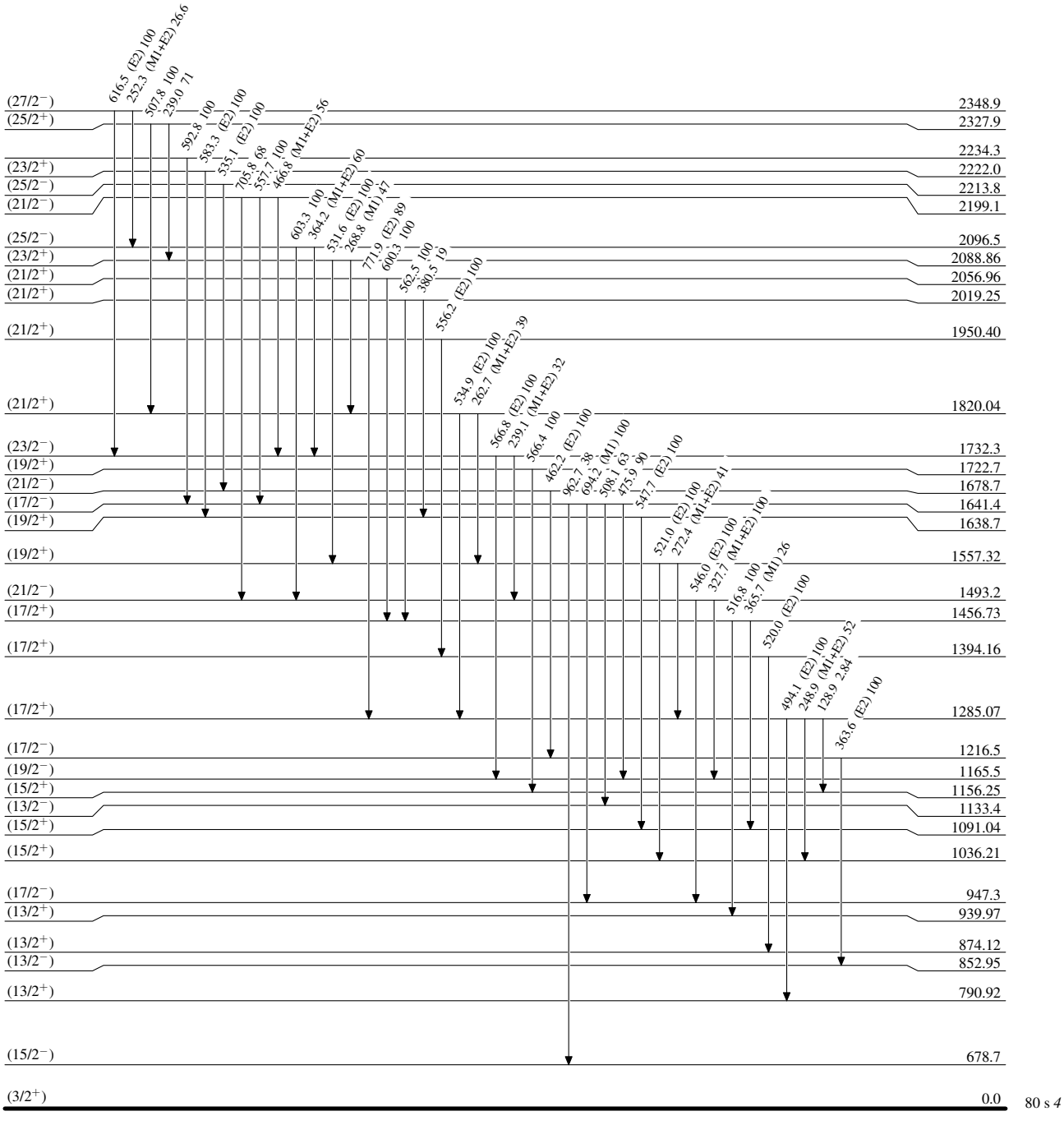


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

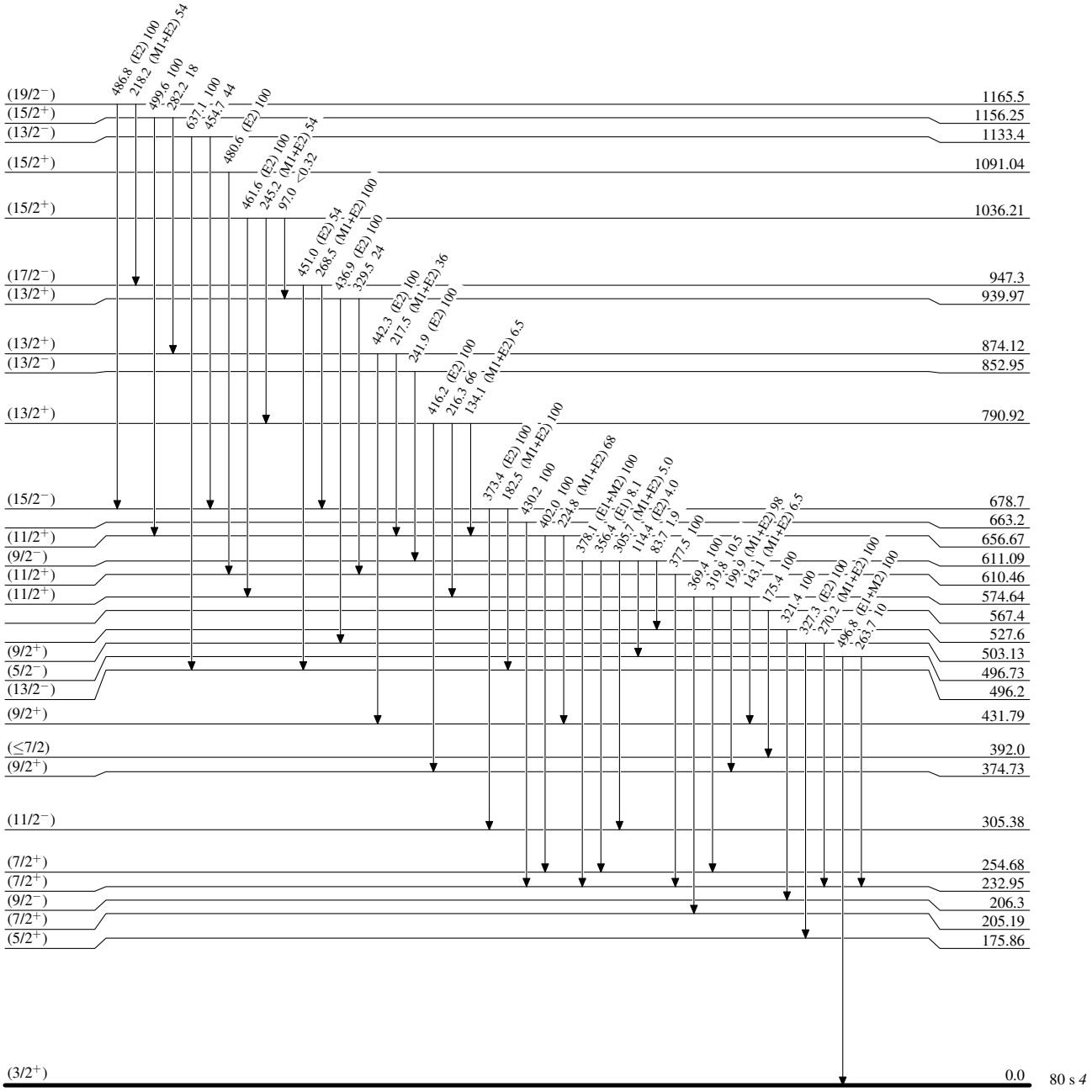


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

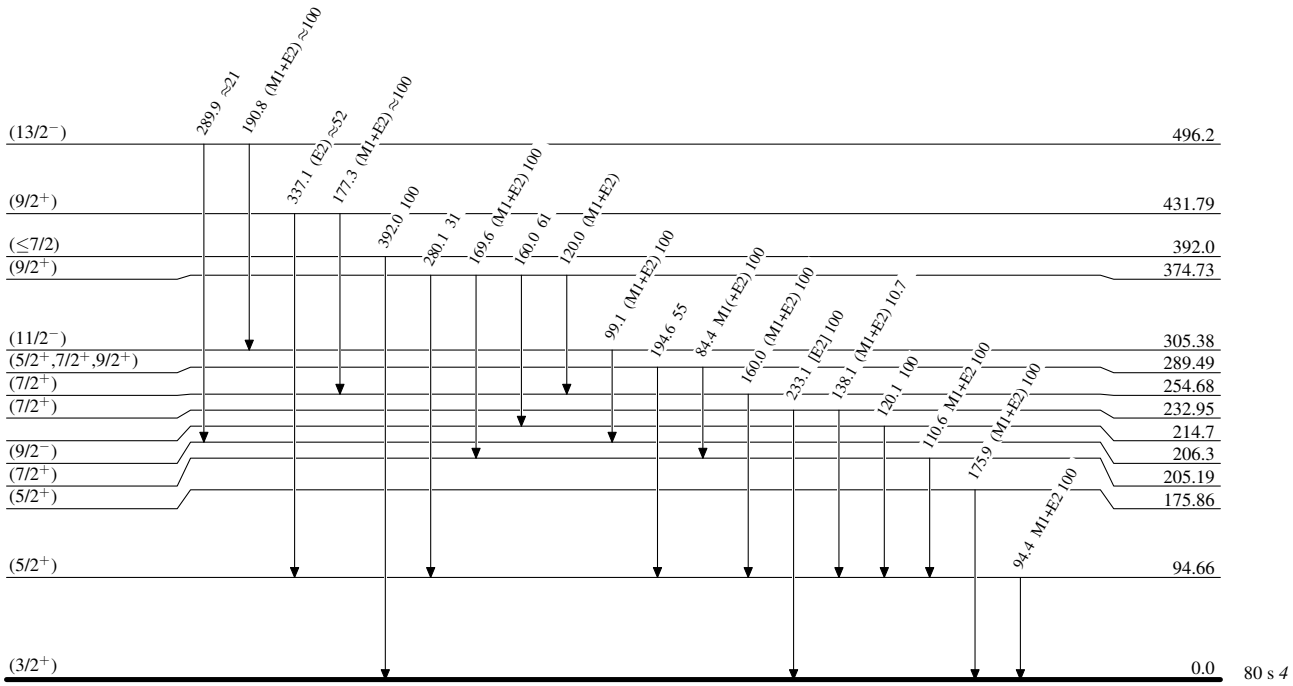


$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

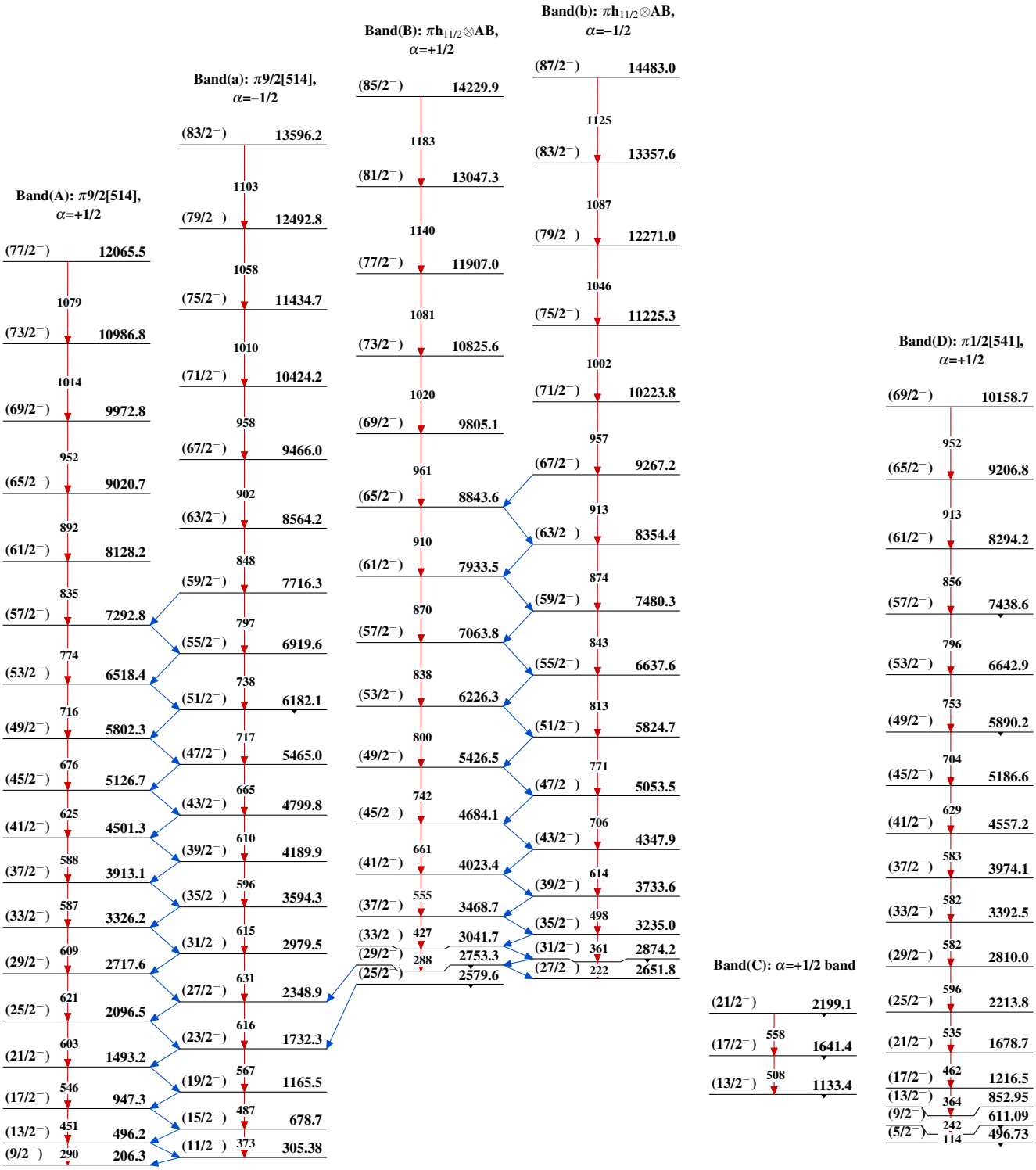
Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



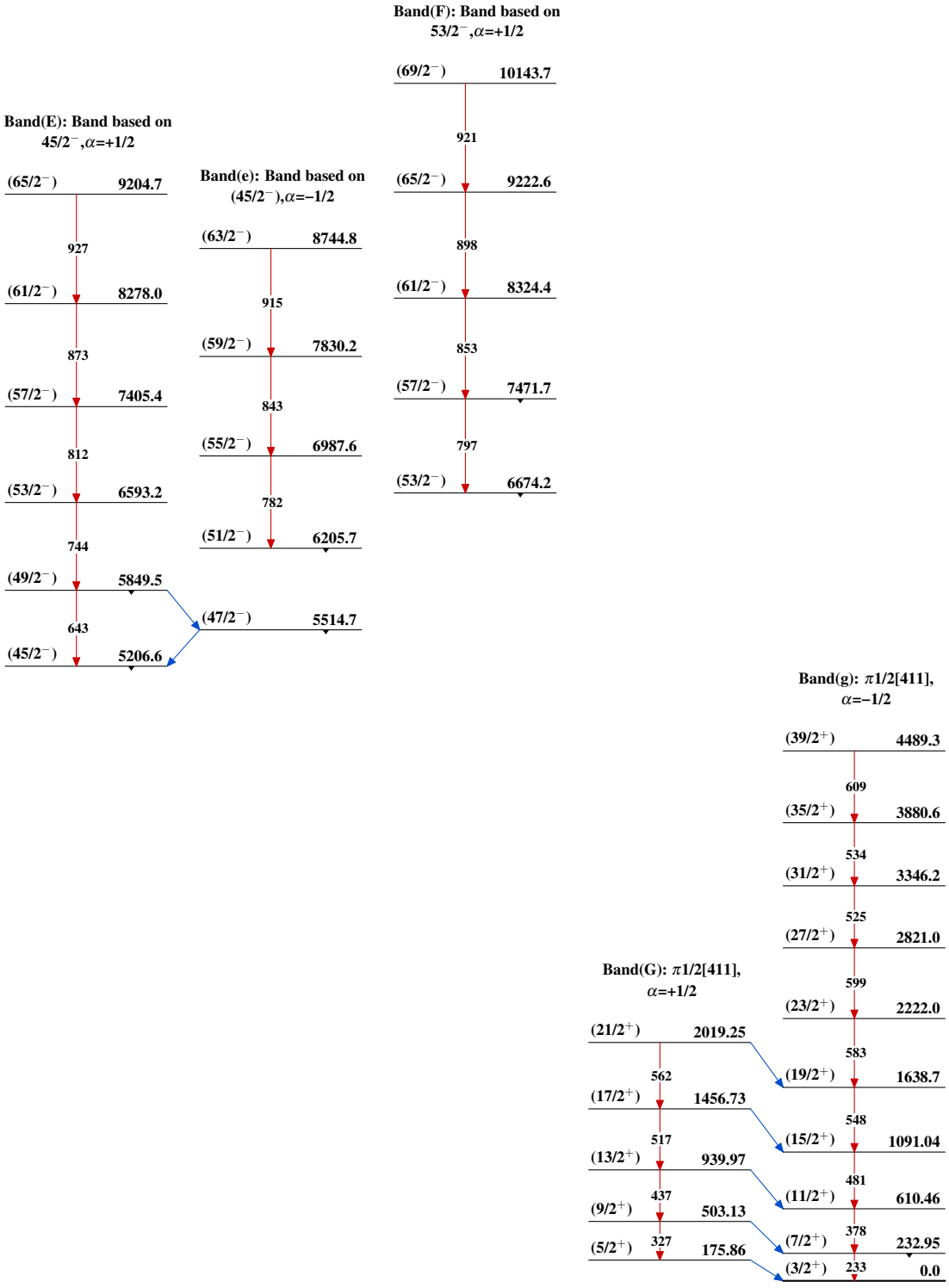
$^{167}_{73}Ta_{94}$

Adopted Levels, Gammas

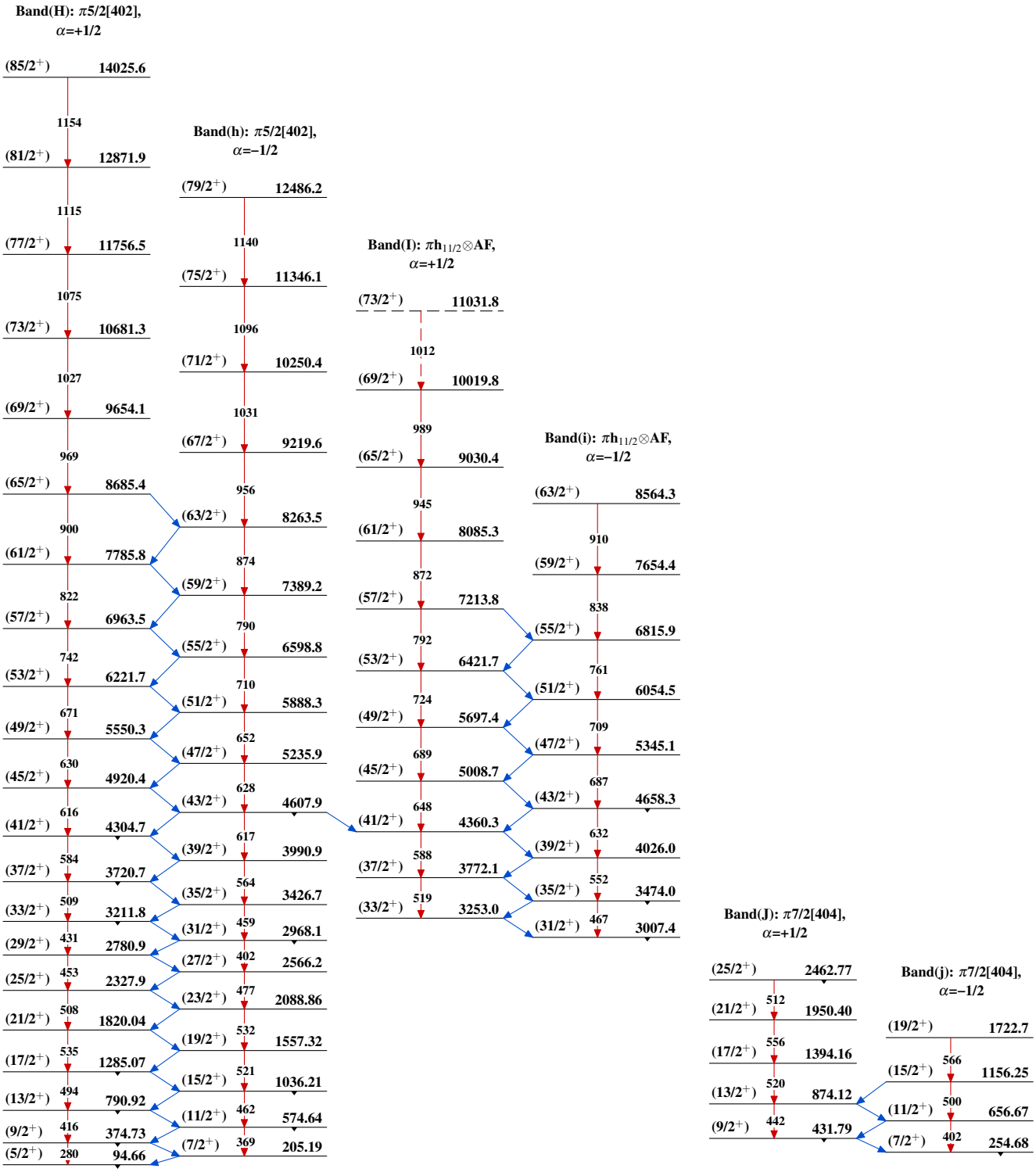


$^{167}_{73}Ta_{94}$

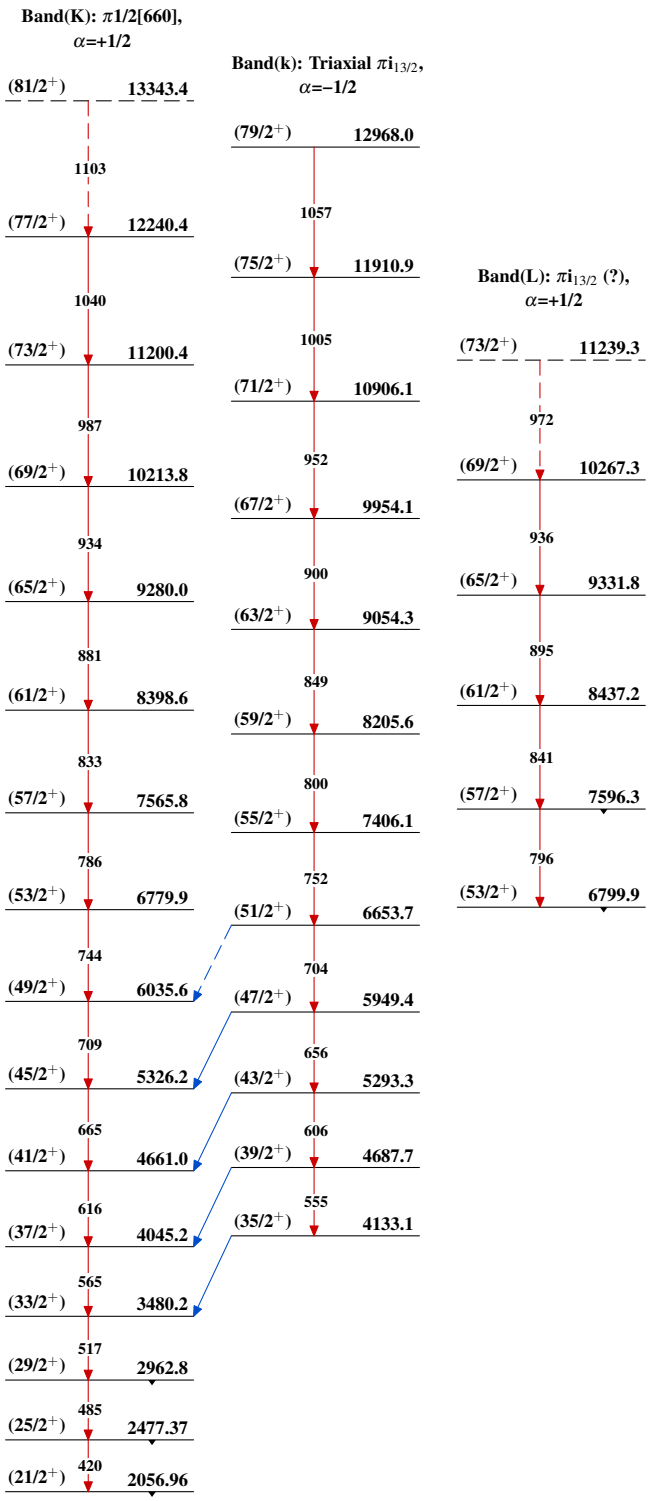
Adopted Levels, Gammas (continued)



Adopted Levels, Gammas (continued)



Adopted Levels, Gammas (continued)



$^{167}_{73}Ta_{94}$