

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 109,2033 (2008)	15-Jun-2008

Q(β⁻)=-5.37×10³ 4; S(n)=9.97×10³ 4; S(p)=2.22×10³ 4; Q(α)=3.73×10³ 4 [2012Wa38](#)

Note: Current evaluation has used the following Q record -5370 30 9970 40 2220 40 3730 40 [2003Au03](#).

Identification: genetic relationship to known ¹⁶⁹Hf daughter; excitation functions for ¹⁵⁵Gd(¹⁹F,xnγ) ([1988Yu02](#)).

Other Reactions:

¹⁵⁴Gd(²⁰Ne,p4nγ): [1985Re06](#) (γ rays observed, but no data given).

¹⁶⁰Dy(¹⁴N,5nγ): [1985Re06](#) (γ rays observed, but no data given).

¹⁶⁹Ta Levels

The level structure shown here is based on the ¹²⁴Sn(⁵¹V,6nγ) reaction study by [2006Ha46](#), in which a number of interconnected bands were identified. However, the 180.1 level deexcited by the delayed 153γ and 170γ feeding the 3/2⁺ 1/2[411] and 1/2⁺ 1/2[411] levels, respectively, is assigned there as the 1/2⁻ 1/2[541] state, at variance with TDPAD measurements in (¹⁶O,5nγ) which determine Q=2.23 13 and indicate J=5/2. π=- would imply M2 multipolarity for the 170γ and that would violate RUL, thereby favoring an assignment of 5/2⁺ for this level. However, all available low-energy configurations have been assigned elsewhere. Note that the 5/2⁺ level in the 1/2[411] band has almost identical energy and is deexcited by a 152γ and a 170γ also, but those intraband transitions should Be prompt.

Cross Reference (XREF) Flags

- A ¹⁵⁵Gd(¹⁹F,5nγ), ¹²²Sn(⁵¹V,4nγ)
- B ¹⁶⁹W ε decay
- C ¹⁵⁹Tb(¹⁶O,6nγ)
- D ¹²⁴Sn(⁵¹V,6nγ)

E(level) [†]	J ^π [‡]	T _{1/2} [@]	XREF	Comments
0.0 ^g	(5/2 ⁺)	4.9 min 4	ABCD	%ε+%β ⁺ =100 T _{1/2} : weighted average of 5.0 min 5 (1969Ar22) and 4.7 min 7 (1975Re05). J ^π : band assignment consistent with 5/2[402] bandhead energy systematics in odd-A Ta isotopes (E=239, 70, 36, 94 for A=179, 177, 175, 167, respectively).
0.0+z? ^m			A	
11.4 ⁱ 4	(1/2 ⁺)		BCD	
27.5 ^j 3	(3/2 ⁺)		ABCD	
96.54 ^h 13	(7/2 ⁺)		BCD	J ^π : M1 97γ to (5/2 ⁺) g.s.; band assignment.
135.72 ^c 13	(7/2 ⁺)		ABCD	J ^π : M1 135γ to (5/2 ⁺) g.s.; band assignment.
147.9+z? ^m 10			A	
179.9 ⁱ 3	(5/2 ⁺)		A D	
180.1 3	(5/2 ⁺)	17 ns 4	ABCD	Q=2.23 13 (2005Ku40) Q: Time differential perturbed angular distribution method in (¹⁶ O,6nγ). J ^π : 5/2 from TDPAD (2005Ku40) in (¹⁶ O,6nγ); 169γ to 1/2 ⁺ 11 not M2 from RUL. However, state is assigned as 1/2 ⁻ 1/2[541] in (⁵¹ V,6nγ). Further experimental work is essential in order to resolve this contradiction. Level differs from 179.9 level because that level's intraband transitions are not expected to Be delayed. T _{1/2} : other value: 44 ns 5 (2005Ku40 in (¹⁶ O,6nγ)) from fit to time spectrum gated by 153γ+170γ, but statistical accuracy not good and presence of impurities cannot Be ruled out.

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Adopted Levels, Gammas (continued)

^{169}Ta Levels (continued)				
E(level) [†]	J^{π} [‡]	$T_{1/2}$ [@]	XREF	Comments
191.9& 3	(5/2 ⁻)		B D	J^{π} : D, $\Delta J=1$ 164 γ to (3/2 ⁺) 27. J=5/2 member of 1/2[541] orbital expected at low energy based on odd-A Ta systematics (E(level)=628 (^{179}Ta), 186 (^{177}Ta), 51 (^{175}Ta), g.s. (^{173}Ta and ^{171}Ta)); decoupling parameter $\approx +4$ for $\alpha=+1/2$ band members matches that expected for 1/2[541] band.
219.72 ^d 19	(9/2 ⁻)	28 ns 5	ABCD	Q=2.28 13 (2005Ku40) Q: Time differential perturbed angular distribution method in ($^{16}\text{O},6\text{n}\gamma$). J^{π} : E1 123 γ to (7/2 ⁺) 97 level; band assignment. $T_{1/2}$: other value: 54 ns 6 (2005Ku40 in ($^{16}\text{O},6\text{n}\gamma$)) from fit to time spectrum gated by 123 γ , but statistical accuracy is not good and presence of impurities cannot be ruled out.
233.4 ^j 3	(7/2 ⁺)		A D	
244.77 ^g 12	(9/2 ⁺)		ABCD	
298.04 ^b 12	(9/2 ⁺)		B D	
299.49& 25	(9/2 ⁻)		ABCD	
301.2+z? ^m 15			A	
336.61 ^e 22	(11/2 ⁻)		A CD	
348.3 ^a 4	(3/2 ⁻)		D	
358.48 19	(5/2 ⁻ , 7/2, 9/2 ⁺) [#]		B	
420.14 ^h 14	(11/2 ⁺)		A CD	
466.1 ⁱ 3	(9/2 ⁺)		A D	
468.6 ^a 3	(7/2 ⁻)		B D	
487.69 ^c 14	(11/2 ⁺)		D	
506.74 ^d 22	(13/2 ⁻)		A CD	
514.1+z? ^m 18			A	
522.28& 24	(13/2 ⁻)		A CD	
555.8 3			B	
568.5 ^j 3	(11/2 ⁺)		A D	
616.95 ^g 15	(13/2 ⁺)		A D	
692.41 ^e 25	(15/2 ⁻)		A CD	
695.98 ^b 15	(13/2 ⁺)		D	
723.49 ^a 23	(11/2 ⁻)		D	
744.6+z? ^m 20			A	
795.5 4			B	
835.94 ^h 16	(15/2 ⁺)		A D	
848.9 ⁱ 3	(13/2 ⁺)		A D	
858.65& 23	(17/2 ⁻)		A CD	
924.9 ^d 3	(17/2 ⁻)		A D	
927.98 ^c 16	(15/2 ⁺)		D	
999.4 ^j 3	(15/2 ⁺)		A D	
1069.68 ^g 18	(17/2 ⁺)		A D	
1076.54 ^a 25	(15/2 ⁻)		D	
1081.0+z? ^m 23			A	
1150.5 ^e 3	(19/2 ⁻)		A D	
1170.58 ^b 17	(17/2 ⁺)		D	
1296.64& 25	(21/2 ⁻)		A D	
1304.34 ⁱ 25	(17/2 ⁺)		A D	
1321.20 ^h 19	(19/2 ⁺)		A D	

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Adopted Levels, Gammas (continued)

^{169}Ta Levels (continued)

E(level) [†]	J ^π [‡]	XREF	E(level) [†]	J ^π [‡]	XREF	E(level) [†]	J ^π [‡]	XREF
1430.6 ^d 3	(21/2 ⁻)	A D	3210.7 ^e 4	(35/2 ⁻)	A D	5354.7 ^j 5	(47/2 ⁺)	D
1432.90 ^c 18	(19/2 ⁺)	D	3237.5 [?] 11		A	5391.3 ^a 5	(47/2 ⁻)	D
1493.59 ^j 24	(19/2 ⁺)	A D	3241.8 ^k 3	(33/2 ⁻)	D	5450.0 ^g 4	(49/2 ⁺)	A D
1518.64 ^a 25	(19/2 ⁻)	D	3296.9 ^h 3	(35/2 ⁺)	A D	5556.7 ^{&} 5	(49/2 ⁻)	A D
1581.12 ^g 20	(21/2 ⁺)	A D	3402.3 ^c 4	(35/2 ⁺)	D	5591.8 ^l 5	(47/2 ⁺)	D
1683.1 ^e 3	(23/2 ⁻)	A D	3440.4 ^d 4	(37/2 ⁻)	A D	5627.4 ^b 5	(49/2 ⁺)	D
1697.49 ^b 19	(21/2 ⁺)	D	3461.8 ^j 4	(35/2 ⁺)	A D	5642.3 ⁱ 5	(49/2 ⁺)	D
1789.22 ⁱ 23	(21/2 ⁺)	A D	3541.2 ^g 3	(37/2 ⁺)	A D	5679.1 ^e 5	(51/2 ⁻)	A D
1820.1 ^{&} 3	(25/2 ⁻)	A D	3620.5 ^a 4	(35/2 ⁻)	D	5746.7 ^f 5	(49/2 ⁺)	D
1855.08 ^h 21	(23/2 ⁺)	A D	3622.0 ^l 3	(35/2 ⁺)	D	5834.8 ^h 4	(51/2 ⁺)	A D
1875.02 ^f 23	(21/2 ⁺)	D	3652.8 ^b 4	(37/2 ⁺)	D	5987.9 ^k 5	(49/2 ⁻)	D
1977.06 ^c 21	(23/2 ⁺)	D	3663.2 ^{&} 4	(37/2 ⁻)	A D	6003.5 ⁿ 8	(51/2 ⁺)	D
1994.6 ^d 4	(25/2 ⁻)	A D	3689.3 ⁱ 3	(37/2 ⁺)	D	6024.3 ^c 6	(51/2 ⁺)	D
2017.37 ^j 25	(23/2 ⁺)	A D	3698.6 ^e 4	(39/2 ⁻)	A D	6073.8 ^d 5	(53/2 ⁻)	A D
2035.3 ^a 3	(23/2 ⁻)	D	3741.8 ^f 3	(37/2 ⁺)	D	6104.0 ^j 6	(51/2 ⁺)	D
2129.83 ^g 21	(25/2 ⁺)	A D	3795.3 ^k 4	(37/2 ⁻)	D	6111.3 [?] a 7	(51/2 ⁻)	D
2205.73 ^f 21	(25/2 ⁺)	A D	3829.8 ^h 3	(39/2 ⁺)	A D	6195.1 ^g 4	(53/2 ⁺)	A D
2217.7 ^l 3	(23/2 ⁺)	D	3952.1 ^c 4	(39/2 ⁺)	D	6315.1 ^{&} 6	(53/2 ⁻)	D
2257.37 ^b 21	(25/2 ⁺)	D	3974.2 ^d 4	(41/2 ⁻)	A D	6351.3 ⁱ 7	(53/2 ⁺)	D
2262.1 ^e 4	(27/2 ⁻)	A D	4019.8 ^j 5	(39/2 ⁺)	A D	6391.2 ^b 6	(53/2 ⁺)	D
2335.0 ⁱ 3	(25/2 ⁺)	D	4110.1 ^g 3	(41/2 ⁺)	A D	6467.5 ^e 5	(55/2 ⁻)	A D
2405.45 ^h 21	(27/2 ⁺)	A D	4137.3 ^a 4	(39/2 ⁻)	D	6521.4 ^f 5	(53/2 ⁺)	D
2412.4 ^{&} 3	(29/2 ⁻)	A D	4225.0 ^l 4	(39/2 ⁺)	D	6599.4 ^h 5	(55/2 ⁺)	A D
2498.91 ^c 24	(27/2 ⁺)	D	4230.8 ^{&} 4	(41/2 ⁻)	A D	6742.7 ⁿ 9	(55/2 ⁺)	D
2530.5 ^j 3	(27/2 ⁺)	A D	4240.3 ^b 5	(41/2 ⁺)	D	6812.5 ^c 8	(55/2 ⁺)	D
2541.6 ^k 3	(25/2 ⁻)	D	4281.6 ^e 5	(43/2 ⁻)	A D	6887.7 ^j 8	(55/2 ⁺)	D
2571.1 ^d 4	(29/2 ⁻)	A D	4285.6 ⁱ 4	(41/2 ⁺)	D	6901.1 ^d 5	(57/2 ⁻)	A D
2602.9 ^a 3	(27/2 ⁻)	D	4360.9 ^f 4	(41/2 ⁺)	D	6978.4 ^g 5	(57/2 ⁺)	A D
2623.4 ^l 3	(27/2 ⁺)	D	4438.8 ^h 4	(43/2 ⁺)	A D	7128.7 ^{&} 6	(57/2 ⁻)	D
2634.80 ^g 22	(29/2 ⁺)	A D	4503.6 ^k 4	(41/2 ⁻)	D	7194.9 ^b 8	(57/2 ⁺)	D
2667.51 ^f 22	(29/2 ⁺)	A D	4582.1 ^c 5	(43/2 ⁺)	D	7309.8 ^e 6	(59/2 ⁻)	A D
2711.53 ^b 24	(29/2 ⁺)	D	4601.5 ^d 5	(45/2 ⁻)	A D	7327.7 ^f 7	(57/2 ⁺)	D
2745.5 ⁱ 4	(29/2 ⁺)	D	4651.4 ^j 5	(43/2 ⁺)	D	7409.4 ^h 5	(59/2 ⁺)	D
2795.5 ^e 4	(31/2 ⁻)	A D	4728.8 ^a 5	(43/2 ⁻)	D	7789.7 ^d 6	(61/2 ⁻)	D
2845.01 ^h 24	(31/2 ⁺)	A D	4750.7 ^g 4	(45/2 ⁺)	A D	7810.0 ^g 5	(61/2 ⁺)	D
2851.4 ^k 3	(29/2 ⁻)	D	4860.6 ^{&} 5	(45/2 ⁻)	A D	7993.5 ^{&} 6	(61/2 ⁻)	D
2940.6 ^c 3	(31/2 ⁺)	D	4883.5 ^l 4	(43/2 ⁺)	D	8182.3 ^f 9	(61/2 ⁺)	D
2986.5 ^j 4	(31/2 ⁺)	A D	4903.1 ^b 5	(45/2 ⁺)	D	8207.0 ^e 6	(63/2 ⁻)	D
3003.6 ^d 4	(33/2 ⁻)	A D	4946.8 ^e 5	(47/2 ⁻)	A D	8279.4 [?] h 7	(63/2 ⁺)	D
3053.77 ^g 24	(33/2 ⁺)	A D	4948.2 ⁱ 4	(45/2 ⁺)	D	8695.0 ^g 6	(65/2 ⁺)	D
3053.8 ^{&} 3	(33/2 ⁻)	A D	5031.0 ^f 4	(45/2 ⁺)	D	8745.3 ^d 8	(65/2 ⁻)	D
3074.6 ^l 3	(31/2 ⁺)	D	5111.4 ^h 4	(47/2 ⁺)	A D	8913.1 ^{&} 8	(65/2 ⁻)	D
3150.1 ^b 4	(33/2 ⁺)	D	5245.2 ^k 5	(45/2 ⁻)	D	9085.3 ^f 10	(65/2 ⁺)	D
3152.4 ^a 3	(31/2 ⁻)	D	5279.0 ^c 5	(47/2 ⁺)	D	9158.1 ^e 8	(67/2 ⁻)	D
3173.4 ⁱ 3	(33/2 ⁺)	D	5305.6 ^d 5	(49/2 ⁻)	A D	9635.0 ^g 8	(69/2 ⁺)	D
3176.7 ^f 3	(33/2 ⁺)	D	5316.8 ⁿ 5	(47/2 ⁺)	D	9886.7 ^{&} 10	(69/2 ⁻)	D

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Adopted Levels, Gammas (continued) ^{169}Ta Levels (continued)

E(level) [†]	J ^π [‡]	XREF
10154.7 ^e 9	(71/2 ⁻)	D
10916.5 ^{&} 11	(73/2 ⁻)	D
11992.5 ^{?&} 12	(77/2 ⁻)	D

[†] From least-squares fit to adopted E_γ, assigning ΔE_γ=1 keV for all data to which authors have not assigned an uncertainty.

[‡] Values given without comment come from (⁵¹V,6n_γ) data; they are based on transition multiplicities, on deduced band structure and on systematics of band structures in neighboring odd-A, odd-Z nuclides. The 9/2[514] and 5/2[402] configuration assignments are also supported by measured B(M1)(ΔJ=1 transition)/B(E2)(ΔJ=2 transition) for intraband transitions deexciting individual band members (1993Li15). Band parameters for the 1/2[541], α=+1/2 band are close to those for known 1/2[541] bands in this mass region.

359_γ to (5/2⁺) g.s.; 139_γ to (9/2⁻) 220 level.

@ From delayed γγ coin in (¹⁶O,6n_γ) (1998Zh03), except as noted.

& Band(A): 1/2[541], α=+1/2 band (2006Ha46). Band parameters: A=14.4, a=+4.3 (5/2, 9/2, 13/2, 17/2 levels). Band crossing at ħω=0.30 MeV due to alignment of first pair of i_{13/2} neutrons. Steady gain in alignment suggests subsequent crossing by structure with a second pair of aligned i_{13/2} neutrons. The location of the J=1/2 band member is unclear; it is expected to lie very close to the J=5/2 member (at 192 here and in (⁵¹V,6n_γ), but at 180 in (¹⁶O,6n_γ) and (¹⁹F,5n_γ)) but the J=1/2 level has not been observed in neighboring nuclides. 2006Ha46 assign a 180.1 level as the J=1/2 bandhead but, although the energy is reasonable, this is not adopted here because of a conflicting assignment of J=5/2 for that level from TDPAD (2005Ku40). Further experimental work is required to resolve this discrepancy.

^a Band(a): π 1/2[541], α=-1/2 band (2006Ha46). Band crossing at ħω=0.26 MeV due to configuration with first pair of aligned i_{13/2} neutrons. Steady gain in alignment suggests subsequent crossing by a configuration with a second pair of aligned i_{13/2} neutrons. Band parameters could not be extracted for this band; no reasonable fit to energy sequence was possible.

^b Band(B): π 7/2[404], α=+1/2 band (2006Ha46). Bandhead expected at low energy, based on systematics; ¹⁷⁹Ta, ¹⁷⁷Ta and ¹⁷⁵Ta have 7/2[404] ground states, and this bandhead lies at 52 keV in ¹⁷¹Ta. First crossing occurs at ħω=0.238 MeV due to structure with first pair of aligned i_{13/2} neutrons, second crossing at ħω=0.37 MeV due to structure with second pair of aligned i_{13/2} neutrons. Above the first crossing there is mixing of 5/2[402] and 7/2[404] configurations.

^c Band(b): π 7/2[404], α=-1/2 band (2006Ha46). See comment on signature partner band.

^d Band(C): π 9/2[514], α=+1/2 band (2006Ha46). Band crossing at ħω=0.24 MeV due to alignment of first pair of i_{13/2} neutrons. Steady gain in alignment suggests crossing by configuration with a second pair of aligned i_{13/2} neutrons.

^e Band(c): π 9/2[514], α=-1/2 band (2006Ha46). See comment on signature partner band.

^f Band(D): π 1/2[660], α=+1/2 band (2006Ha46). Decoupled band. No evidence of a wobbling mode of excitation is suggested, although the population intensity of this band is weak.

^g Band(E): π 5/2[402], α=+1/2 band (2006Ha46). First crossing at ħω=0.242 MeV due to alignment of first pair of i_{13/2} neutrons, second crossing at ħω=0.37 MeV due to alignment of second pair of i_{13/2} neutrons. Above the first crossing there is mixing of 5/2[402] and 7/2[404] configurations.

^h Band(e): π 5/2[402], α=-1/2 band (2006Ha46). See comment on signature partner band.

ⁱ Band(F): π 1/2[411], α=+1/2 band (2006Ha46). Band parameters: A=18.6, B=-33, a=-0.66 (J=1/2 through 13/2 levels). First crossing at ħω=0.24 MeV due to alignment of first pair of i_{13/2} neutrons, second crossing at ħω=0.37 MeV due to structure with second pair of aligned i_{13/2} neutrons.

^j Band(f): 1/2[411], α=-1/2 band (2006Ha46). Apparent K=1/2 decoupled band; 1/2[411] is only low-energy K=1/2 orbital available. See comment on signature partner band.

^k Band(G): Band based on (25/2⁻), α=+1/2 (2006Ha46). This band interacts strongly with 1/2[541] band. At low-spins, the configuration may be (π h_{9/2})⊗(first pair of i_{13/2} neutrons). At higher spins (J>35/2), it seems to be a continuation of 1/2[541] band. Band crossing at ħω≈0.37 MeV due to second pair of i_{13/2} neutrons.

^l Band(H): π h_{9/2} v_{13/2} vp_{3/2}? band (2006Ha46). J^π values are from figure 1 (proposed level scheme) of 2006Ha46 and reflect the authors' preference for 23/2⁺ over 21/2⁻ for the lowest-energy level observed in this band, as discussed in their text. The different values appearing in the summary of transition properties in table I of the original publication were based on the less-favored 21/2⁻ option; these were erroneous and were subsequently corrected in an erratum. Strong feeding to 1/2[541] band.

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Adopted Levels, Gammas (continued) **${}^{169}\text{Ta}$ Levels (continued)**

- ^m Band(I): Possible band fragment ([1993Li15](#)). [1993Li15](#) make no configuration assignment for this band. Levels are shown as uncertain here because band is observed only in (${}^{19}\text{F},5n\gamma$). Subsequent detailed (HI,xn γ) studies should have observed it, but did not. Possibly it does not belong to ${}^{169}\text{Ta}$.
- ⁿ Band(J): Band fragment ([2006Ha46](#)). This band is built as a side band above the $43/2^+$ state in $1/2[411]$ band.

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$

$E_i(\text{level})$	J_i^π	E_γ^{\ddagger}	I_γ^{\ddagger}	E_f	J_f^π	Mult. [†]	δ	$\alpha^{\&}$	Comments
11.4	(1/2 ⁺)	(11.4 4)		0.0	(5/2 ⁺)				E_γ : from level energy difference; transition not observed.
27.5	(3/2 ⁺)	(16.1 5)		11.4	(1/2 ⁺)	[M1]		156 16	E_γ : from level energy difference; transition not observed.
96.54	(7/2 ⁺)	96.6 @ 2	100 @	0.0	(5/2 ⁺)	M1		4.82	Mult.: M1,E2 from $\alpha(\text{exp})$ in ^{169}W ε decay; D from $\gamma(\theta)$ in ($^{51}\text{V},6n\gamma$).
135.72	(7/2 ⁺)	135.7 2	100	0.0	(5/2 ⁺)	M1(+E2)	<0.68	1.71 11	Other E_γ : 136.0 3 in ε decay. Mult., δ : from $\alpha(\text{exp})$ in ^{169}W ε decay.
147.9+z?		147.9#a	100#	0.0+z?					
179.9	(5/2 ⁺)	152.4 2	≈ 100	27.5	(3/2 ⁺)	(M1+E2)		1.0 3	
		168.5 2	≈ 19	11.4	(1/2 ⁺)	(E2)		0.535	
180.1	(5/2 ⁺)	152.6 2	≈ 97	27.5	(3/2 ⁺)	[M1+E2]		1.0 3	B(M1)(W.u.) $\approx 5.1 \times 10^{-5}$ 17; B(E2)(W.u.) ≈ 1.0 4 Additional information 1.
		168.7 2	≈ 100	11.4	(1/2 ⁺)	[E2]		0.530	B(E2)(W.u.) ≈ 1.3 4 Additional information 2.
									Mult.: D ($\Delta J=0$) or Q ($\Delta J=2$) to (1/2 ⁺) 11 level from ($^{51}\text{V},6n\gamma$); not M2 from RUL.
191.9	(5/2 ⁻)	11.8 ^a	<2.4	180.1	(5/2 ⁺)				
		164.4 2	≈ 100	27.5	(3/2 ⁺)	D			
219.72	(9/2 ⁻)	123.0 2	100	96.54	(7/2 ⁺)	E1		0.214	B(E1)(W.u.) $= 3.5 \times 10^{-6}$ 7 Mult.: from $\alpha(\text{exp})$ in ^{169}W ε decay.
233.4	(7/2 ⁺)	53.0 ^a 5		179.9	(5/2 ⁺)				
		205.8 2	100	27.5	(3/2 ⁺)				
244.77	(9/2 ⁺)	109.0 2	17.5 8	135.72	(7/2 ⁺)	D			
		148.3 2	100 3	96.54	(7/2 ⁺)	(M1+E2)		1.1 3	Mult.: D+Q from ($^{19}\text{F},4n\gamma$) for intraband γ .
		244.7 2	19.2 14	0.0	(5/2 ⁺)				
298.04	(9/2 ⁺)	162.3 2	≈ 100	135.72	(7/2 ⁺)	(M1)		1.099	
		201.5 2	≈ 22	96.54	(7/2 ⁺)	D			
		298.0 2	≈ 37	0.0	(5/2 ⁺)	(E2)		0.0837	
299.49	(9/2 ⁻)	107.6 2	100	191.9	(5/2 ⁻)	[E2]		2.78 5	
301.2+z?		153.3#a	100#	147.9+z?					
336.61	(11/2 ⁻)	116.9 2	100	219.72	(9/2 ⁻)	(M1)		2.79	
348.3	(3/2 ⁻)	168.2 5	100	180.1	(5/2 ⁺)	[E1]		0.0947 15	
358.48	(5/2 ⁻ ,7/2,9/2 ⁺)	138.5 @ 3	40 @ 8	219.72	(9/2 ⁻)				
		222.8 @ 3	15 @ 5	135.72	(7/2 ⁺)				
		262.0 @ 4	100 @ 40	96.54	(7/2 ⁺)				
		358.8 @ 4	15 @ 8	0.0	(5/2 ⁺)				
420.14	(11/2 ⁺)	122.1 2	7.7 8	298.04	(9/2 ⁺)				
		175.3 2	100.0 16	244.77	(9/2 ⁺)	(M1+E2)		0.68 21	
		323.7 2	44 3	96.54	(7/2 ⁺)	(E2)		0.0655	Other I_γ : 115 6 in ($^{19}\text{F},5n\gamma$). Mult.: from $\gamma(\theta)$ for intraband γ in ($^{19}\text{F},5n\gamma$).

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^{\ddagger}	I_γ^{\ddagger}	E_f	J_f^π	Mult. \ddagger	$\alpha\&$	Comments
466.1	(9/2 ⁺)	232.6 2	96 8	233.4	(7/2 ⁺)	(M1)	0.404	
		286.3 2	100 8	179.9	(5/2 ⁺)			
468.6	(7/2 ⁻)	120.3 2	37 5	348.3	(3/2 ⁻)	[E2]	1.82	Other I_γ : 28 10 in ε decay.
		169.1 2	45 5	299.49	(9/2 ⁻)	[M1]	0.979	Other I_γ : \approx 66 in ε decay.
		276.7 2	100 8	191.9	(5/2 ⁻)	[M1]	0.251	Mult.: Q(+D) from ($^{51}\text{V},6n\gamma$).
487.69	(11/2 ⁺)	189.6 2	100 4	298.04	(9/2 ⁺)	(M1)	0.711	
		242.9 2	24.8 26	244.77	(9/2 ⁺)			
		352.0 2	73 4	135.72	(7/2 ⁺)	(E2)	0.0515	
506.74	(13/2 ⁻)	170.2 2	100 3	336.61	(11/2 ⁻)	(M1+E2)	0.74 23	
		287.0 2	29.5 18	219.72	(9/2 ⁻)	(E2)	0.0938	I_γ : from ($^{19}\text{F},5n\gamma$). $I(170\gamma):I(287\gamma)=100\ 4:25.5\ 21$ in ($^{51}\text{V},6n\gamma$).
514.1+z?		212.9 ^{#a}	100 [#]	301.2+z?				
522.28	(13/2 ⁻)	185.5 2	2.7 3	336.61	(11/2 ⁻)			
		222.8 2	100 4	299.49	(9/2 ⁻)	(E2)	0.208	Mult.: from $\gamma(\theta)$ for intraband γ in ($^{19}\text{F},5n\gamma$).
555.8		197.3 ^{@ 3}	100 ^{@ 38}	358.48	(5/2 ⁻ ,7/2,9/2 ⁺)			
		420.1 ^{@ 4}	38 ^{@ 25}	135.72	(7/2 ⁺)			
568.5	(11/2 ⁺)	335.1 2	100	233.4	(7/2 ⁺)			
616.95	(13/2 ⁺)	129.2 2	6.9 5	487.69	(11/2 ⁺)	(M1)	0.641	Other I_γ : $I(372\gamma):I(197\gamma)=100\ 4:76\ 6$ in ($^{19}\text{F},5n\gamma$).
		196.8 2	62.7 17	420.14	(11/2 ⁺)			
		372.2 2	100 3	244.77	(9/2 ⁺)			
692.41	(15/2 ⁻)	185.6 2	100 4	506.74	(13/2 ⁻)	(M1)	0.755	
		355.9 2	55.4 24	336.61	(11/2 ⁻)	(E2)	0.0499	Other I_γ : $I(186\gamma):I(356\gamma)=100\ 5:68\ 3$ in ($^{19}\text{F},5n\gamma$).
695.98	(13/2 ⁺)	208.4 2	53.8 27	487.69	(11/2 ⁺)	(M1+E2)	0.40 15	
		275.8 2	13.8 15	420.14	(11/2 ⁺)	D+Q		
		397.9 2	100 8	298.04	(9/2 ⁺)	(E2)	0.0366	
723.49	(11/2 ⁻)	201.0 5	<10	522.28	(13/2 ⁻)			
		216.7 2	13.7 10	506.74	(13/2 ⁻)			
		254.9 2	100 7	468.6	(7/2 ⁻)			
		386.9 2	14.7 20	336.61	(11/2 ⁻)			
		424.0 2	85 6	299.49	(9/2 ⁻)			
744.6+z?		230.5 ^{#a}	100 [#]	514.1+z?				
795.5		575.6 ^{@ 4}	100 ^{@ 23}	219.72	(9/2 ⁻)			
		699.3 ^{@ 5}	<15 [@]	96.54	(7/2 ⁺)			
835.94	(15/2 ⁺)	140.0 2	3.1 7	695.98	(13/2 ⁺)			
		218.9 2	46.3 19	616.95	(13/2 ⁺)	(M1+E2)	0.35 13	
		415.9 2	100 4	420.14	(11/2 ⁺)	(E2)	0.0325	Other I_γ : $I(416\gamma):I(219\gamma)=100\ 7:116\ 5$ in ($^{19}\text{F},5n\gamma$).
848.9	(13/2 ⁺)	280.4 2	30.9 24	568.5	(11/2 ⁺)	(M1)	0.242	
		382.7 2	100 9	466.1	(9/2 ⁺)	(E2)	0.0407	
858.65	(17/2 ⁻)	336.4 2	100 4	522.28	(13/2 ⁻)	(E2)	0.0586	Mult.: from $\gamma(\theta)$ for intraband γ in ($^{19}\text{F},5n\gamma$).
		352.1 2	1.82 20	506.74	(13/2 ⁻)			

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Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π	Mult. [†]	$\alpha\&$	Comments
924.9	(17/2 ⁻)	232.4 2	100 3	692.41	(15/2 ⁻)	(M1+E2)	0.29 12	Other E γ : 233.5 in (¹⁹ F,5n γ). I γ : from (¹⁹ F,5n γ). I γ : from (¹⁹ F,5n γ); 84 4 in (⁵¹ V,6n γ).
927.98	(15/2 ⁺)	418.1 2	89 4	506.74	(13/2 ⁻)	(E2)	0.0320	
		232.0 2	43 3	695.98	(13/2 ⁺)	(M1+E2)	0.29 12	
		311.0 2	25.2 21	616.95	(13/2 ⁺)	D+Q		
999.4	(15/2 ⁺)	440.2 2	100 7	487.69	(11/2 ⁺)			
		431.0 2	100	568.5	(11/2 ⁺)	(E2)	0.0295	
		1069.68	(17/2 ⁺)	233.8 2	29.4 13	835.94	(15/2 ⁺)	
1076.54	(15/2 ⁻)	452.8 2	100 4	616.95	(13/2 ⁺)	(E2)	0.0259	
		353.0 2	100 5	723.49	(11/2 ⁻)	(E2)	0.0510	
		554.1 2	50 4	522.28	(13/2 ⁻)	D		I γ : from (¹⁹ F,5n γ). I(225 γ):I(458 γ)=64 4:100 3 in (⁵¹ V,6n γ). Mult.: from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
1081.0+z?		336.4 ^{#a}	100 [#]	744.6+z?				
1150.5	(19/2 ⁻)	225.6 2	64.2 21	924.9	(17/2 ⁻)	(M1)	0.439	
1170.58	(17/2 ⁺)	458.2 2	100.0 20	692.41	(15/2 ⁻)	(E2)	0.0252	I γ : from (¹⁹ F,5n γ).
		242.5 2	35.2 21	927.98	(15/2 ⁺)			
		334.7 2	13.4 14	835.94	(15/2 ⁺)			
1296.64	(21/2 ⁻)	474.6 2	100 10	695.98	(13/2 ⁺)			γ anisotropy in (⁵¹ V,6n γ) is too low for $\Delta J=2$ required by level scheme.
1304.34	(17/2 ⁺)	438.1 2	100	858.65	(17/2 ⁻)	(E2)	0.0283	
1321.20	(19/2 ⁺)	304.8 2	10.0 8	999.4	(15/2 ⁺)			
		455.4 2	100 8	848.9	(13/2 ⁺)	(E2)	0.0256	
		251.5 2	28.1 15	1069.68	(17/2 ⁺)	(M1+E2)	0.23 10	
1430.6	(21/2 ⁻)	485.2 2	100 4	835.94	(15/2 ⁺)	(E2)	0.0217	
		280.1 2	83 3	1150.5	(19/2 ⁻)	(M1+E2)	0.17 8	
1432.90	(19/2 ⁺)	505.7 2	100 4	924.9	(17/2 ⁻)			Other E γ : 505.8 in (¹⁹ F,5n γ).
		262.2 2	31.3 25	1170.58	(17/2 ⁺)			
		363.3 2	17.1 21	1069.68	(17/2 ⁺)			
1493.59	(19/2 ⁺)	504.9 2	100 8	927.98	(15/2 ⁺)	(E2)	0.0197	
		494.3 2	100 9	999.4	(15/2 ⁺)			
		635.0 5	<3	858.65	(17/2 ⁻)			
1518.64	(19/2 ⁻)	441.9 2	100 6	1076.54	(15/2 ⁻)	(E2)	0.0276	
		660.1 2	35.3 24	858.65	(17/2 ⁻)	D		
1581.12	(21/2 ⁺)	259.8 2	28.2 13	1321.20	(19/2 ⁺)	(M1+E2)	0.21 9	Other I γ : I(260 γ):I(512 γ)=51.2 22:100 5 in (¹⁹ F,5n γ).
		511.5 2	100 4	1069.68	(17/2 ⁺)	(E2)	0.0190	
1683.1	(23/2 ⁻)	252.4 2	56.1 24	1430.6	(21/2 ⁻)	(M1+E2)	0.23 10	Other I γ : I(252 γ):I(533 γ)=47 3:100 4 in (¹⁹ F,5n γ). Mult.: from $\gamma(\theta)$ in (¹⁹ F,5n γ).
		532.6 2	100 6	1150.5	(19/2 ⁻)	(E2)	0.01724	
1697.49	(21/2 ⁺)	264.6 2	20.7 23	1432.90	(19/2 ⁺)			
		376.4 2	12.0 13	1321.20	(19/2 ⁺)			
1789.22	(21/2 ⁺)	527.0 2	100 7	1170.58	(17/2 ⁺)	(E2)	0.01769	
		295.7 2	10.0 10	1493.59	(19/2 ⁺)			

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π	Mult. \dagger	$\alpha\&$	Comments
1789.22	(21/2 ⁺)	485.0 2	100 10	1304.34	(17/2 ⁺)	(E2)	0.0218	
1820.1	(25/2 ⁻)	523.4 2	100	1296.64	(21/2 ⁻)	(E2)	0.0180	
1855.08	(23/2 ⁺)	274.0 2	30.9 18	1581.12	(21/2 ⁺)	(M1)	0.258	Other I γ : I(274 γ):I(534 γ)=48 3:100 5 in (¹⁹ F,5n γ). Mult.: from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
1875.02	(21/2 ⁺)	533.8 2	100 9	1321.20	(19/2 ⁺)			
		381.4 2	40 5	1493.59	(19/2 ⁺)			
		570.4 2	100 7	1304.34	(17/2 ⁺)	Q		
1977.06	(23/2 ⁺)	279.5 2	27 3	1697.49	(21/2 ⁺)			
		544.1 2	100 6	1432.90	(19/2 ⁺)			
1994.6	(25/2 ⁻)	311.5 2	68 3	1683.1	(23/2 ⁻)	(M1+E2)	0.13 6	
		564.1 2	100 3	1430.6	(21/2 ⁻)	(E2)	0.01500	
2017.37	(23/2 ⁺)	523.9 2	100 10	1493.59	(19/2 ⁺)	(E2)	0.0179	
		720.8 2	10.0 7	1296.64	(21/2 ⁻)			
2035.3	(23/2 ⁻)	516.6 2	100 14	1518.64	(19/2 ⁻)			
		738.8 2	31 4	1296.64	(21/2 ⁻)			
2129.83	(25/2 ⁺)	274.7 2	27.0 9	1855.08	(23/2 ⁺)			Other I γ : I(275 γ):I(549 γ)=42 3:100 5 in (¹⁹ F,5n γ).
		548.7 2	100 5	1581.12	(21/2 ⁺)			
2205.73	(25/2 ⁺)	330.5 2	18.5 20	1875.02	(21/2 ⁺)			
		416.5 2	100 6	1789.22	(21/2 ⁺)	Q		
		508.4 2	72 5	1697.49	(21/2 ⁺)			
		624.0 5	<6.6	1581.12	(21/2 ⁺)			
2217.7	(23/2 ⁺)	921.0 2	100	1296.64	(21/2 ⁻)			
2257.37	(25/2 ⁺)	280.2 2	45 4	1977.06	(23/2 ⁺)			
		560.0 2	100 6	1697.49	(21/2 ⁺)	(E2)	0.01526	
2262.1	(27/2 ⁻)	267.4 2	41.3 27	1994.6	(25/2 ⁻)	(M1(+E2))	0.20 8	Other I γ : I(267 γ):I(579 γ)=70 3:100 7 in (¹⁹ F,5n γ).
		579.0 2	100 4	1683.1	(23/2 ⁻)	(E2)	0.01409	
2335.0	(25/2 ⁺)	459.9 2	66 6	1875.02	(21/2 ⁺)			
		546.0 2	100 8	1789.22	(21/2 ⁺)	(E2)	0.01622	
2405.45	(27/2 ⁺)	275.5 2	25.1 22	2129.83	(25/2 ⁺)			Other I γ : I(276 γ):I(550 γ)=42 4:100 5 in (¹⁹ F,5n γ).
		550.4 2	100 5	1855.08	(23/2 ⁺)			
2412.4	(29/2 ⁻)	592.3 2	100	1820.1	(25/2 ⁻)	(E2)	0.01336	
2498.91	(27/2 ⁺)	241.6 2	35 4	2257.37	(25/2 ⁺)			
		521.8 2	100 6	1977.06	(23/2 ⁺)	(E2)	0.0181	
2530.5	(27/2 ⁺)	513.3 2	100 9	2017.37	(23/2 ⁺)			
		710.2 2	16.4 14	1820.1	(25/2 ⁻)			
2541.6	(25/2 ⁻)	721.5 2	100	1820.1	(25/2 ⁻)			
2571.1	(29/2 ⁻)	309.0 2	60 4	2262.1	(27/2 ⁻)	(M1+E2)	0.13 6	
		576.5 2	100 4	1994.6	(25/2 ⁻)	(E2)	0.01424	
2602.9	(27/2 ⁻)	567.5 2	100 6	2035.3	(23/2 ⁻)	(E2)	0.01478	
		782.9 2	28.7 25	1820.1	(25/2 ⁻)			
2623.4	(27/2 ⁺)	405.7 2	86 14	2217.7	(23/2 ⁺)			

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π	Mult. [†]	$\alpha\&$	Comments
2623.4	(27/2 ⁺)	803.4 2	100 14	1820.1	(25/2 ⁻)			
2634.80	(29/2 ⁺)	229.3 2	45.4 20	2405.45	(27/2 ⁺)	(M1)	0.420	
		429.0 2	10.0 14	2205.73	(25/2 ⁺)			
		504.9 2	100 6	2129.83	(25/2 ⁺)	(E2)	0.0197	
2667.51	(29/2 ⁺)	262.2 2	14.4 12	2405.45	(27/2 ⁺)			
		410.1 2	13.2 12	2257.37	(25/2 ⁺)			
		461.7 2	100 8	2205.73	(25/2 ⁺)	(E2)	0.0247	
2711.53	(29/2 ⁺)	305.9 2	16 2	2405.45	(27/2 ⁺)			
		377.0 5	<10	2335.0	(25/2 ⁺)			
		454.0 ^a 5	<10	2257.37	(25/2 ⁺)			
		581.8 2	100 8	2129.83	(25/2 ⁺)	Q		
2745.5	(29/2 ⁺)	410.5 2	100 8	2335.0	(25/2 ⁺)			
		488.0 ^a 5	<38	2257.37	(25/2 ⁺)			
2795.5	(31/2 ⁻)	224.6 2	65 5	2571.1	(29/2 ⁻)	(M1)	0.445	I_γ : from (¹⁹ F,5n γ). Other I_γ : I(225 γ):I(533 γ)=55 7:100 7 in (⁵¹ V,6n γ).
		533.3 2	100 5	2262.1	(27/2 ⁻)	(E2)	0.01718	Mult.: (Q) for intraband γ from $\gamma(\theta)$ in (¹⁹ F,5n γ).
2845.01	(31/2 ⁺)	178		2667.51	(29/2 ⁺)			
		210.2 2	86 4	2634.80	(29/2 ⁺)	(M1)	0.534	Other I_γ : I(210 γ):I(439 γ)=110 10:100 4 in (¹⁹ F,5n γ).
		439.6 2	100 5	2405.45	(27/2 ⁺)	(E2)	0.0280	Mult.: (D) from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
2851.4	(29/2 ⁻)	309.9 2	57 9	2541.6	(25/2 ⁻)			Mult.: (Q) from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
		438.9 2	100 13	2412.4	(29/2 ⁻)			
		1031.3 2	83 13	1820.1	(25/2 ⁻)			
2940.6	(31/2 ⁺)	441.7 2	100 8	2498.91	(27/2 ⁺)			
		535.0 5	<13	2405.45	(27/2 ⁺)			
2986.5	(31/2 ⁺)	456.0 2	100 5	2530.5	(27/2 ⁺)	(E2)	0.0255	
		574.3 5	<6	2412.4	(29/2 ⁻)			
3003.6	(33/2 ⁻)	207.9 2	100 10	2795.5	(31/2 ⁻)			
		432.6 2	45.2 24	2571.1	(29/2 ⁻)	(E2)	0.0292	Other I_γ : I(433 γ):I(208 γ)=164 8:100 15 in (¹⁹ F,5n γ).
3053.77	(33/2 ⁺)	208.8 2	75 11	2845.01	(31/2 ⁺)			I_γ : weighted average of 66 10 from (¹⁹ F,5n γ) and 88 12 from (⁵¹ V,6n γ).
		418.8 2	100 6	2634.80	(29/2 ⁺)	(E2)	0.0319	
3053.8	(33/2 ⁻)	641.4 2	100	2412.4	(29/2 ⁻)	(E2)	0.01110	
3074.6	(31/2 ⁺)	451.3 2	59 8	2623.4	(27/2 ⁺)			
		544.2 2	36 5	2530.5	(27/2 ⁺)			
		662.2 2	100 11	2412.4	(29/2 ⁻)			
3150.1	(33/2 ⁺)	438.6 2	100	2711.53	(29/2 ⁺)			
3152.4	(31/2 ⁻)	549.7 2	100 7	2602.9	(27/2 ⁻)	(E2)	0.01596	
		739.9 2	20 4	2412.4	(29/2 ⁻)			
3173.4	(33/2 ⁺)	428.0 ^a 5	<10	2745.5	(29/2 ⁺)	(E2)	0.0301	
		505.8 2	100 9	2667.51	(29/2 ⁺)			
3176.7	(33/2 ⁺)	431.0 ^a 5	<7	2745.5	(29/2 ⁺)			
		509.3 2	100 14	2667.51	(29/2 ⁺)	(E2)	0.0192	

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π	Mult.†	$\alpha\&$	Comments
3176.7	(33/2 ⁺)	542.0 ^a 5	<7	2634.80	(29/2 ⁺)			
3210.7	(35/2 ⁻)	206.9 2	100 13	3003.6	(33/2 ⁻)	(M1)	0.558	Mult.: from $\gamma(\theta)$ in (¹⁹ F,5n γ).
		415.3 2	60.0 25	2795.5	(31/2 ⁻)	(E2)	0.0326	Other I γ : I(415 γ):I(207 γ)=132 I2:100 9 in (¹⁹ F,5n γ).
3237.5?		570 ^{#a}	100 [#]	2667.51	(29/2 ⁺)			
3241.8	(33/2 ⁻)	390.3 2	63 8	2851.4	(29/2 ⁻)			
		829.4 2	100 10	2412.4	(29/2 ⁻)	Q		
3296.9	(35/2 ⁺)	243.1 2	97 4	3053.77	(33/2 ⁺)	(M1)	0.358	Other I γ : I(243 γ):I(452 γ)=115 7:100 I4 in (¹⁹ F,5n γ).
		451.9 2	100 4	2845.01	(31/2 ⁺)	(E2)	0.0261	Mult.: D from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
3402.3	(35/2 ⁺)	461.7 2	100	2940.6	(31/2 ⁺)	(E2)	0.0247	Mult.: (Q) from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
3440.4	(37/2 ⁻)	229.6 2	100 6	3210.7	(35/2 ⁻)	(M1+E2)	0.30 I2	
		436.7 2	52 3	3003.6	(33/2 ⁻)	(E2)	0.0285	Other E γ : 437.7 in (¹⁹ F,5n γ).
								Other I γ : I(437 γ):I(230 γ)=130 8:100 I2 in (¹⁹ F,5n γ).
3461.8	(35/2 ⁺)	475.3 2	100	2986.5	(31/2 ⁺)	(E2)	0.0229	
3541.2	(37/2 ⁺)	244.3 2	59 6	3296.9	(35/2 ⁺)			Other I γ : I(244 γ):I(487 γ)=123 I2:100 I2 in (¹⁹ F,5n γ).
		487.4 2	100 7	3053.77	(33/2 ⁺)	(E2)	0.0215	Mult.: from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
3620.5	(35/2 ⁻)	468.0 2	100	3152.4	(31/2 ⁻)	(E2)	0.0238	
3622.0	(35/2 ⁺)	547.5 2	100 13	3074.6	(31/2 ⁺)			
		568.1 2	31 5	3053.77	(33/2 ⁺)			
3652.8	(37/2 ⁺)	502.7 2	100	3150.1	(33/2 ⁺)			
3663.2	(37/2 ⁻)	421.4 2	8.6 5	3241.8	(33/2 ⁻)			
		609.4 2	100 8	3053.8	(33/2 ⁻)	(E2)	0.01250	
3689.3	(37/2 ⁺)	512.6 2	55 7	3176.7	(33/2 ⁺)			
		515.9 2	100 11	3173.4	(33/2 ⁺)			
3698.6	(39/2 ⁻)	258.0 2	100 7	3440.4	(37/2 ⁻)	(M1+E2)	0.22 9	
		488.0 2	70 4	3210.7	(35/2 ⁻)	(E2)	0.0214	
3741.8	(37/2 ⁺)	565.2 2	100 7	3176.7	(33/2 ⁺)			
		568.3 2	55 6	3173.4	(33/2 ⁺)	Q		
3795.3	(37/2 ⁻)	553.4 2	77 7	3241.8	(33/2 ⁻)			
		741.6 2	100 11	3053.8	(33/2 ⁻)			
3829.8	(39/2 ⁺)	288.6 2	53 6	3541.2	(37/2 ⁺)	(M1+E2)	0.16 7	Other I γ : I(289 γ):I(533 γ)=133 8:100 I3 in (¹⁹ F,5n γ).
		532.9 2	100 4	3296.9	(35/2 ⁺)	(E2)	0.01721	Mult.: (Q) from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
3952.1	(39/2 ⁺)	549.8 2	100	3402.3	(35/2 ⁺)	(E2)	0.01595	
3974.2	(41/2 ⁻)	275.4 2	100 6	3698.6	(39/2 ⁻)	(M1+E2)	0.18 8	Other E γ : 276.4 in (¹⁹ F,5n γ).
		534.0 2	56 6	3440.4	(37/2 ⁻)	(E2)	0.01713	I γ : from (¹⁹ F,5n γ). 65 I0 in (⁵¹ V,6n γ).
								Mult.: (Q) from $\gamma(\theta)$ for intraband γ in (¹⁹ F,5n γ).
4019.8	(39/2 ⁺)	558.0 2	100	3461.8	(35/2 ⁺)			
4110.1	(41/2 ⁺)	280.4 2	35 5	3829.8	(39/2 ⁺)	(M1)	0.242	Other I γ : I(280 γ):I(569 γ)=81 I2:100 I2 in (¹⁹ F,5n γ).
		569.0 2	100 7	3541.2	(37/2 ⁺)	(E2)	0.01469	
4137.3	(39/2 ⁻)	516.8 2	100	3620.5	(35/2 ⁻)			

Adopted Levels, Gammas (continued)

γ(¹⁶⁹Ta) (continued)

<u>E_i(level)</u>	<u>J^π_i</u>	<u>E_γ[‡]</u>	<u>I_γ[‡]</u>	<u>E_f</u>	<u>J^π_f</u>	<u>Mult.[†]</u>	<u>α&</u>	<u>Comments</u>
4225.0	(39/2 ⁺)	603.0 2	100	3622.0	(35/2 ⁺)			
4230.8	(41/2 ⁻)	567.6 2	100	3663.2	(37/2 ⁻)	(E2)	0.01478	
4240.3	(41/2 ⁺)	587.5 2	100	3652.8	(37/2 ⁺)			
4281.6	(43/2 ⁻)	307.4 2	87 4	3974.2	(41/2 ⁻)	(M1+E2)	0.13 6	Other Iγ: I(307γ):I(583γ)=175 12:100 12 in (¹⁹ F,5nγ).
		583.0 2	100 13	3698.6	(39/2 ⁻)	(E2)	0.01387	
4285.6	(41/2 ⁺)	596.3 2	100	3689.3	(37/2 ⁺)			
4360.9	(41/2 ⁺)	619.1 2	100	3741.8	(37/2 ⁺)			
4438.8	(43/2 ⁺)	328.8 2	42 5	4110.1	(41/2 ⁺)	(M1)	0.1577	Other Iγ: I(329γ):I(609γ)=67 13:100 13 in (¹⁹ F,5nγ).
		608.9 2	100 4	3829.8	(39/2 ⁺)	(E2)	0.01252	
4503.6	(41/2 ⁻)	708.3 2	100 11	3795.3	(37/2 ⁻)	(E2)	0.00888	
		840.0 ^a 5	<16	3663.2	(37/2 ⁻)			
4582.1	(43/2 ⁺)	630.0 2	100	3952.1	(39/2 ⁺)			
4601.5	(45/2 ⁻)	319.8 2	91 5	4281.6	(43/2 ⁻)	(M1)	0.1699	Other Iγ: I(320γ):I(627γ)=154 18:100 18 in (¹⁹ F,5nγ).
		627.4 2	100 6	3974.2	(41/2 ⁻)	(E2)	0.01168	
4651.4	(43/2 ⁺)	631.6 2	100	4019.8	(39/2 ⁺)			
4728.8	(43/2 ⁻)	591.5 2	100	4137.3	(39/2 ⁻)			
4750.7	(45/2 ⁺)	311.8 2	38 7	4438.8	(43/2 ⁺)			Other Iγ: I(312γ):I(641γ)=67 21:100 13 in (¹⁹ F,5nγ).
		640.6 2	100 8	4110.1	(41/2 ⁺)	(E2)	0.01114	
4860.6	(45/2 ⁻)	629.8 2	100	4230.8	(41/2 ⁻)	(E2)	0.01158	
4883.5	(43/2 ⁺)	658.5 2	100	4225.0	(39/2 ⁺)			
4903.1	(45/2 ⁺)	662.8 2	100	4240.3	(41/2 ⁺)			
4946.8	(47/2 ⁻)	345.4 2	96 6	4601.5	(45/2 ⁻)	(M1)	0.1382	
		665.1 2	100 6	4281.6	(43/2 ⁻)	(E2)	0.01022	
4948.2	(45/2 ⁺)	662.6 2	100	4285.6	(41/2 ⁺)			
5031.0	(45/2 ⁺)	670.1 2	100	4360.9	(41/2 ⁺)			
5111.4	(47/2 ⁺)	360.6 2	29 5	4750.7	(45/2 ⁺)	(M1+E2)	0.09 4	Other Iγ: I(361γ):I(673γ)=70 9:100 17 in (¹⁹ F,5nγ).
		672.5 2	100 5	4438.8	(43/2 ⁺)	(E2)	0.00997	
5245.2	(45/2 ⁻)	741.6 2	100	4503.6	(41/2 ⁻)			
5279.0	(47/2 ⁺)	696.9 2	100	4582.1	(43/2 ⁺)			
5305.6	(49/2 ⁻)	358.8 2	81 4	4946.8	(47/2 ⁻)	(M1)	0.1248	Other Eγ: 360.0 in (¹⁹ F,5nγ).
		704.1 2	100 5	4601.5	(45/2 ⁻)	(E2)	0.00900	Other Eγ: 705.9 in (¹⁹ F,5nγ).
5316.8	(47/2 ⁺)	665.4 2	100	4651.4	(43/2 ⁺)			
5354.7	(47/2 ⁺)	703.3 2	100	4651.4	(43/2 ⁺)			
5391.3	(47/2 ⁻)	662.5 2	100	4728.8	(43/2 ⁻)			
5450.0	(49/2 ⁺)	338.6 2	26 6	5111.4	(47/2 ⁺)			Other Iγ: I(339γ):I(699γ)=60 8:100 12 in (¹⁹ F,5nγ).
		699.4 2	100 7	4750.7	(45/2 ⁺)			
5556.7	(49/2 ⁻)	696.1 2	100	4860.6	(45/2 ⁻)	(E2)	0.00923	Other Eγ: 697.5 in (¹⁹ F,5nγ).
5591.8	(47/2 ⁺)	708.3 2	100	4883.5	(43/2 ⁺)			
5627.4	(49/2 ⁺)	724.3 2	100	4903.1	(45/2 ⁺)			
5642.3	(49/2 ⁺)	694.1 2	100	4948.2	(45/2 ⁺)			

Adopted Levels, Gammas (continued)

γ(¹⁶⁹Ta) (continued)

<u>E_i(level)</u>	<u>J^π_i</u>	<u>E_γ[‡]</u>	<u>I_γ[‡]</u>	<u>E_f</u>	<u>J^π_f</u>	<u>Mult.[†]</u>	<u>α^{&}</u>	<u>Comments</u>
5679.1	(51/2 ⁻)	373.4 2	55 4	5305.6	(49/2 ⁻)			Other E _γ : 372.3 in (¹⁹ F,5n _γ).
		732.4 2	100 5	4946.8	(47/2 ⁻)			
5746.7	(49/2 ⁺)	715.7 2	100	5031.0	(45/2 ⁺)			
5834.8	(51/2 ⁺)	384.8 2	31 4	5450.0	(49/2 ⁺)	(M1)	0.1036	Other I _γ : I(385 _γ):I(723 _γ)=81 10:100 14 in (¹⁹ F,5n _γ).
		723.4 2	100 8	5111.4	(47/2 ⁺)	(E2)	0.00848	
5987.9	(49/2 ⁻)	742.7 2	100	5245.2	(45/2 ⁻)			
6003.5	(51/2 ⁺)	686.7 5	100	5316.8	(47/2 ⁺)			
6024.3	(51/2 ⁺)	745.3 2	100	5279.0	(47/2 ⁺)			
6073.8	(53/2 ⁻)	394.6 2	66 5	5679.1	(51/2 ⁻)			Other I _γ : I(395 _γ):I(768 _γ)=139 10:100 21 in (¹⁹ F,5n _γ).
		768.2 2	100 5	5305.6	(49/2 ⁻)			
6104.0	(51/2 ⁺)	749.3 2	100	5354.7	(47/2 ⁺)			
6111.3?	(51/2 ⁻)	720.0 ^a 5	100	5391.3	(47/2 ⁻)			
6195.1	(53/2 ⁺)	360.3 2	32 5	5834.8	(51/2 ⁺)			Other I _γ : I(360 _γ):I(745 _γ)=71 10:100 14 in (¹⁹ F,5n _γ).
		745.1 2	100 14	5450.0	(49/2 ⁺)			
6315.1	(53/2 ⁻)	758.4 2	100	5556.7	(49/2 ⁻)	(E2)	0.00765	
6351.3	(53/2 ⁺)	709.0 5	100	5642.3	(49/2 ⁺)			
6391.2	(53/2 ⁺)	763.8 2	100	5627.4	(49/2 ⁺)			
6467.5	(55/2 ⁻)	392.0 ^{#a}	86 [#] 43	6073.8	(53/2 ⁻)			I _γ : (from (¹⁹ F,5n _γ)).
		788.4 2	100 43	5679.1	(51/2 ⁻)			
6521.4	(53/2 ⁺)	774.7 2	100	5746.7	(49/2 ⁺)			
6599.4	(55/2 ⁺)	404.0 ^a 5	<28	6195.1	(53/2 ⁺)			Other E _γ : 405.2 in (¹⁹ F,5n _γ).
		764.6 2	100 14	5834.8	(51/2 ⁺)			Other I _γ : I(404 _γ):I(765 _γ)=222 24:100 42 in (¹⁹ F,5n _γ).
6742.7	(55/2 ⁺)	739.2 5	100	6003.5	(51/2 ⁺)			
6812.5	(55/2 ⁺)	788.2 5	100	6024.3	(51/2 ⁺)			
6887.7	(55/2 ⁺)	783.7 5	100	6104.0	(51/2 ⁺)			
6901.1	(57/2 ⁻)	435 ^{#a}	75 [#] 38	6467.5	(55/2 ⁻)			
		827.3 2	100 50	6073.8	(53/2 ⁻)			I _γ : from (¹⁹ F,5n _γ).
6978.4	(57/2 ⁺)	378.0 ^{#a}	100 [#] 15	6599.4	(55/2 ⁺)			
		783.3 2	53 23	6195.1	(53/2 ⁺)			I _γ : from (¹⁹ F,5n _γ).
7128.7	(57/2 ⁻)	813.6 2	100	6315.1	(53/2 ⁻)			
7194.9	(57/2 ⁺)	803.7 5	100	6391.2	(53/2 ⁺)			
7309.8	(59/2 ⁻)	407 ^{#a}	#	6901.1	(57/2 ⁻)			
		842.3 2	100 6	6467.5	(55/2 ⁻)			
7327.7	(57/2 ⁺)	806.3 5	100	6521.4	(53/2 ⁺)			
7409.4	(59/2 ⁺)	810.0 2	100	6599.4	(55/2 ⁺)			
7789.7	(61/2 ⁻)	888.6 2	100	6901.1	(57/2 ⁻)			
7810.0	(61/2 ⁺)	831.6 2	100	6978.4	(57/2 ⁺)			
7993.5	(61/2 ⁻)	864.8 2	100	7128.7	(57/2 ⁻)			

Adopted Levels, Gammas (continued)

$\gamma(^{169}\text{Ta})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π	$E_i(\text{level})$	J_i^π	E_γ^\ddagger	I_γ^\ddagger	E_f	J_f^π
8182.3	(61/2 ⁺)	854.6 5	100	7327.7	(57/2 ⁺)	9158.1	(67/2 ⁻)	951.1 5	100	8207.0	(63/2 ⁻)
8207.0	(63/2 ⁻)	897.2 2	100	7309.8	(59/2 ⁻)	9635.0	(69/2 ⁺)	940.0 5	100	8695.0	(65/2 ⁺)
8279.4?	(63/2 ⁺)	870.0 ^a 5	100	7409.4	(59/2 ⁺)	9886.7	(69/2 ⁻)	973.6 5	100	8913.1	(65/2 ⁻)
8695.0	(65/2 ⁺)	885.0 2	100	7810.0	(61/2 ⁺)	10154.7	(71/2 ⁻)	996.6 5	100	9158.1	(67/2 ⁻)
8745.3	(65/2 ⁻)	955.6 5	100	7789.7	(61/2 ⁻)	10916.5	(73/2 ⁻)	1029.8 5	100	9886.7	(69/2 ⁻)
8913.1	(65/2 ⁻)	919.6 5	100	7993.5	(61/2 ⁻)	11992.5?	(77/2 ⁻)	1076.0 ^a 5	100	10916.5	(73/2 ⁻)
9085.3	(65/2 ⁺)	903.0 5	100	8182.3	(61/2 ⁺)						

† From γ asymmetry in (⁵¹V,6n γ), except as noted, assigning $\Delta\pi=(\text{no})$ for intraband transitions.

‡ From ¹²⁴Sn(⁵¹V,6n γ), except as noted.

From ¹⁵⁵Gd(¹⁹F,5n γ), except as noted; uncertainty unstated by authors.

@ From ¹⁶⁹W 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.

^a Placement of transition in the level scheme is uncertain.

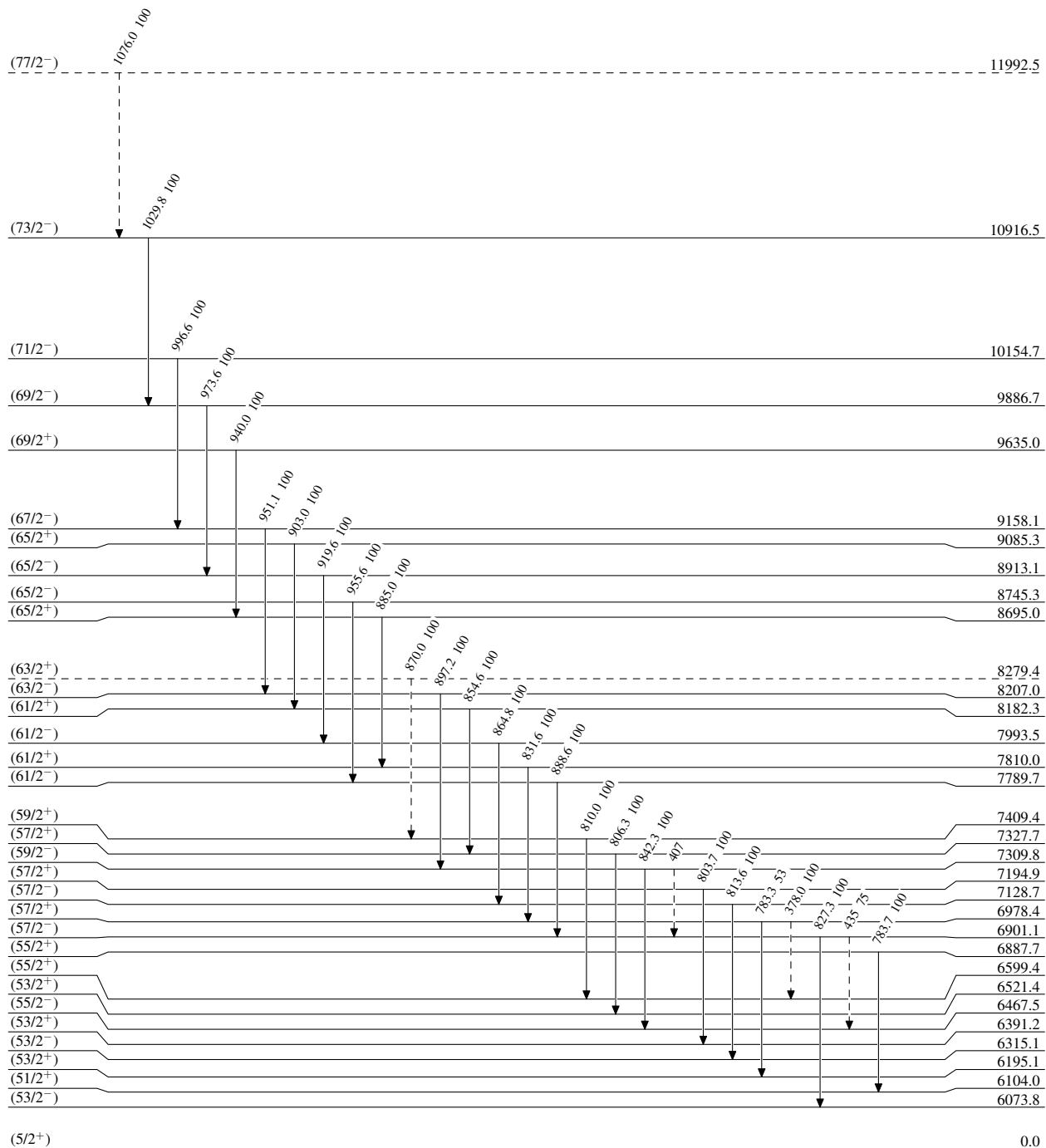
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



4.9 min 4

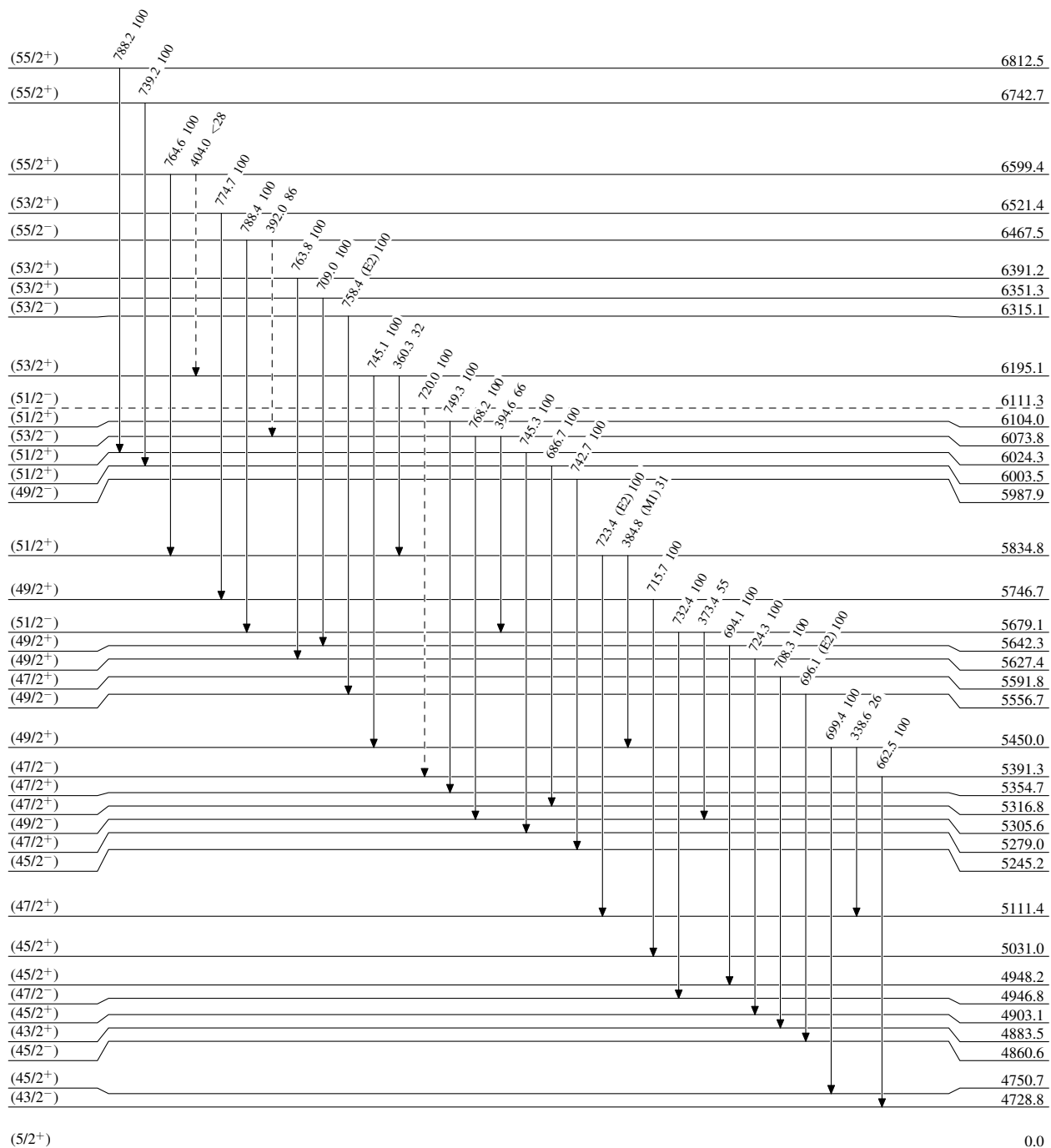
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



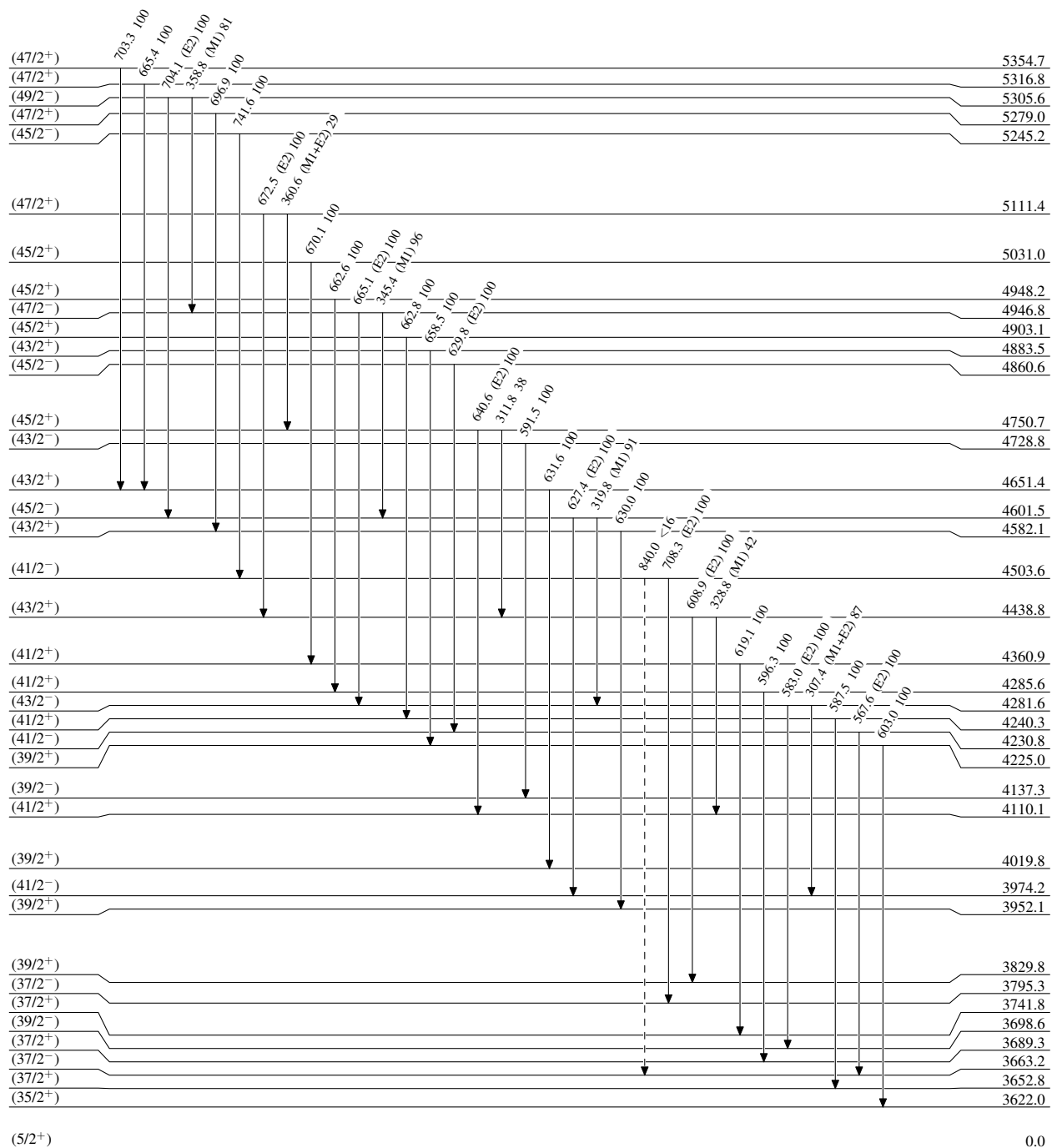
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Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

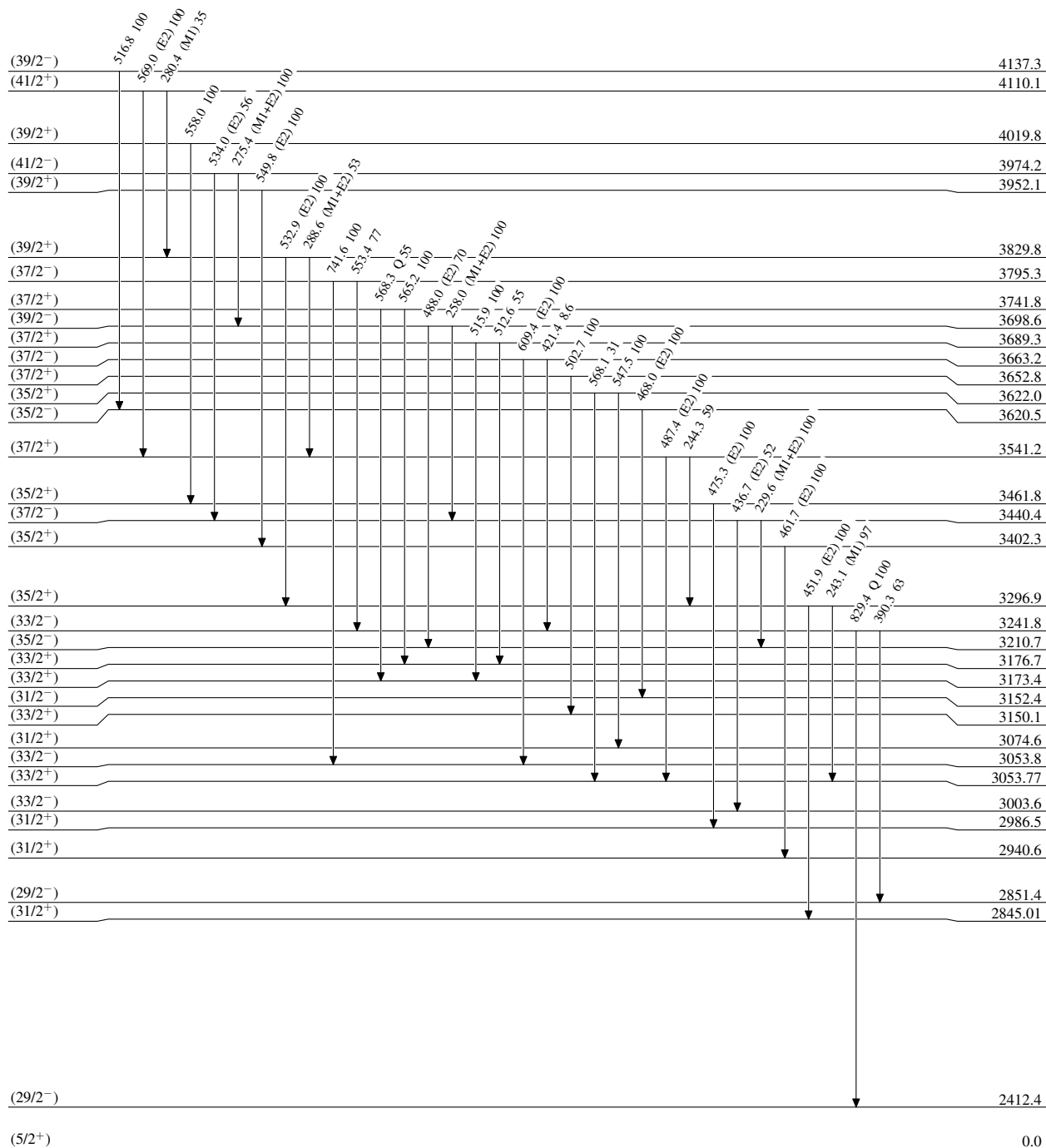
-----▶ γ Decay (Uncertain)

4.9 min 4

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



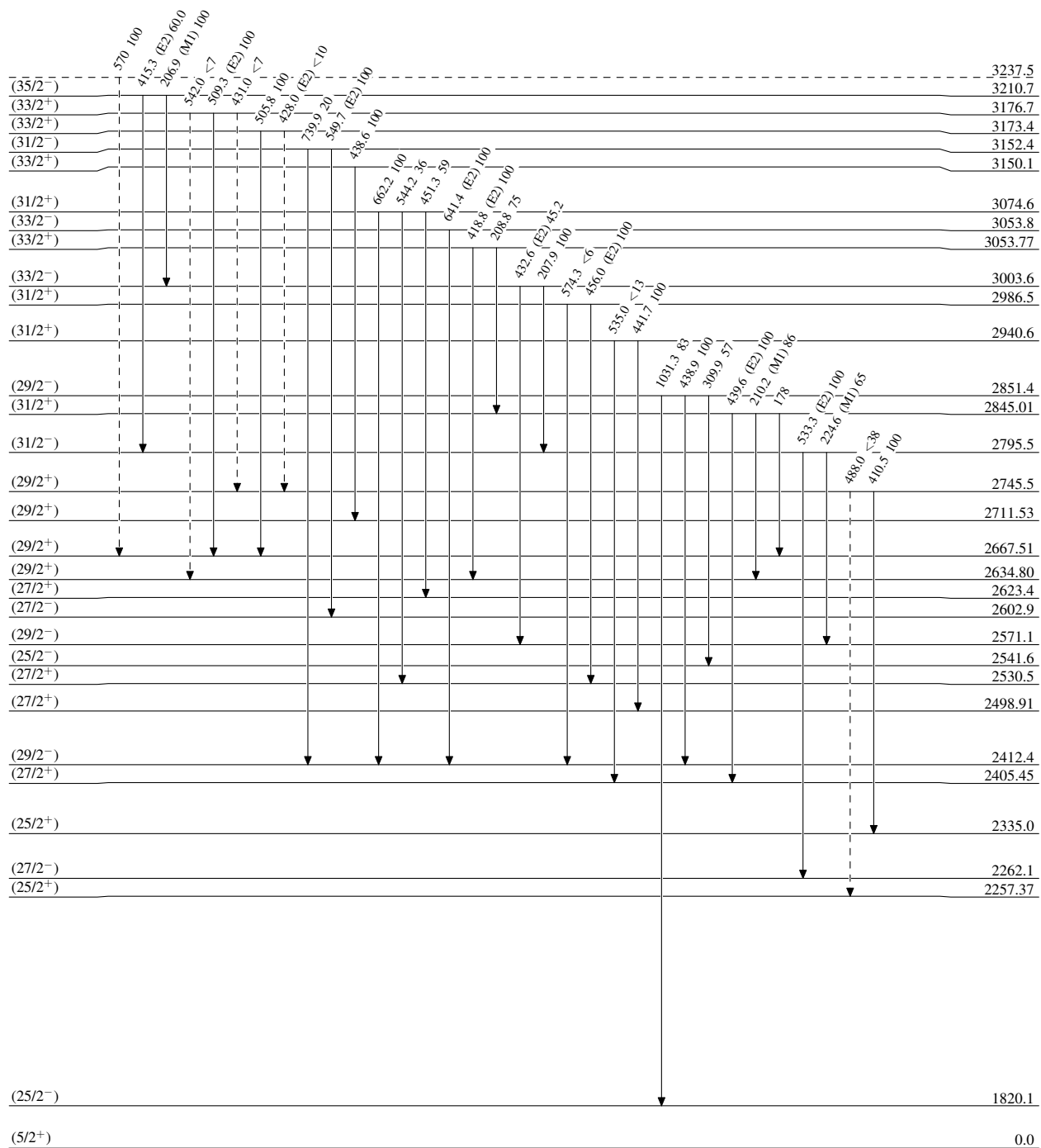
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)

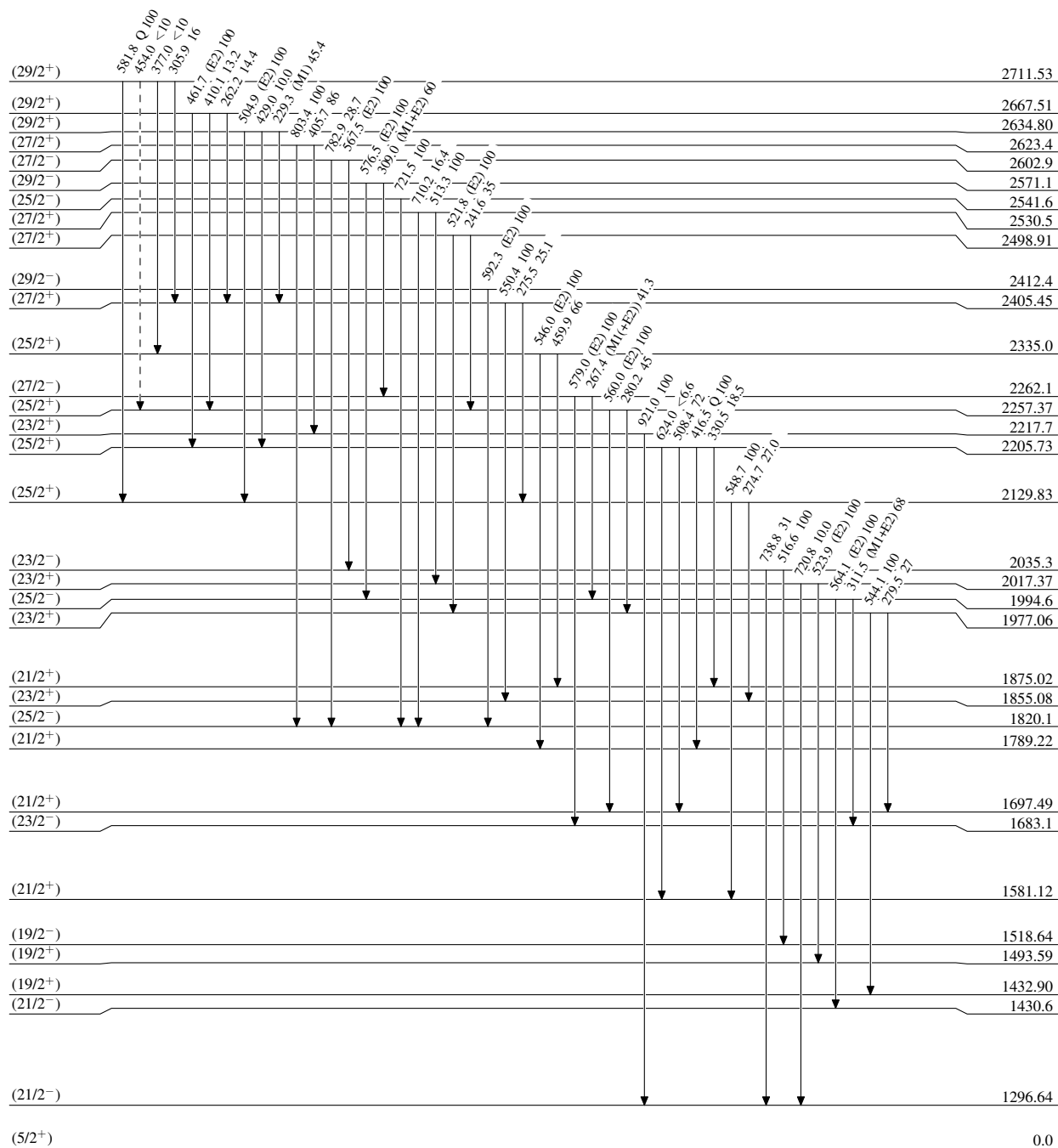


Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)

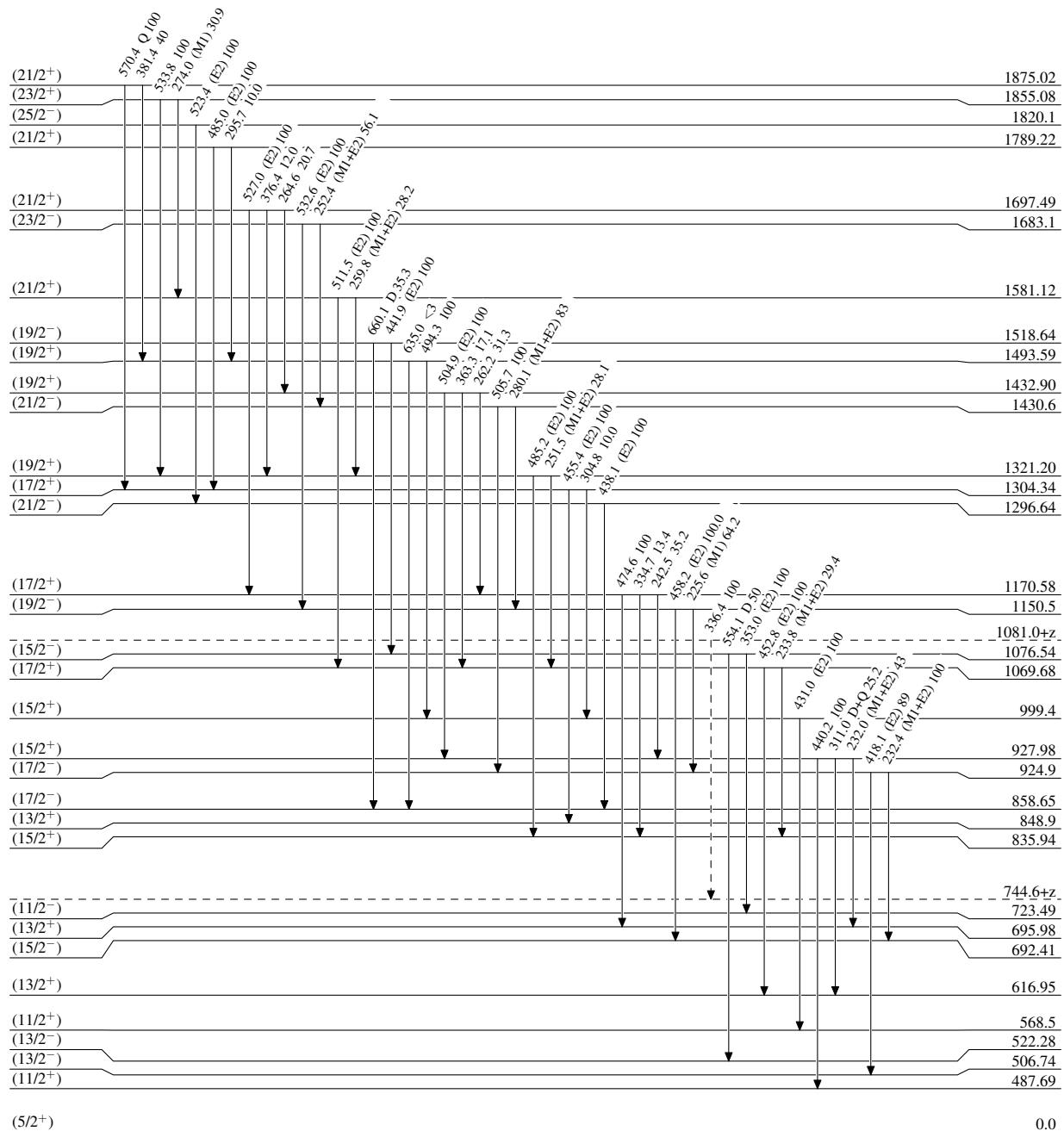
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



4.9 min 4

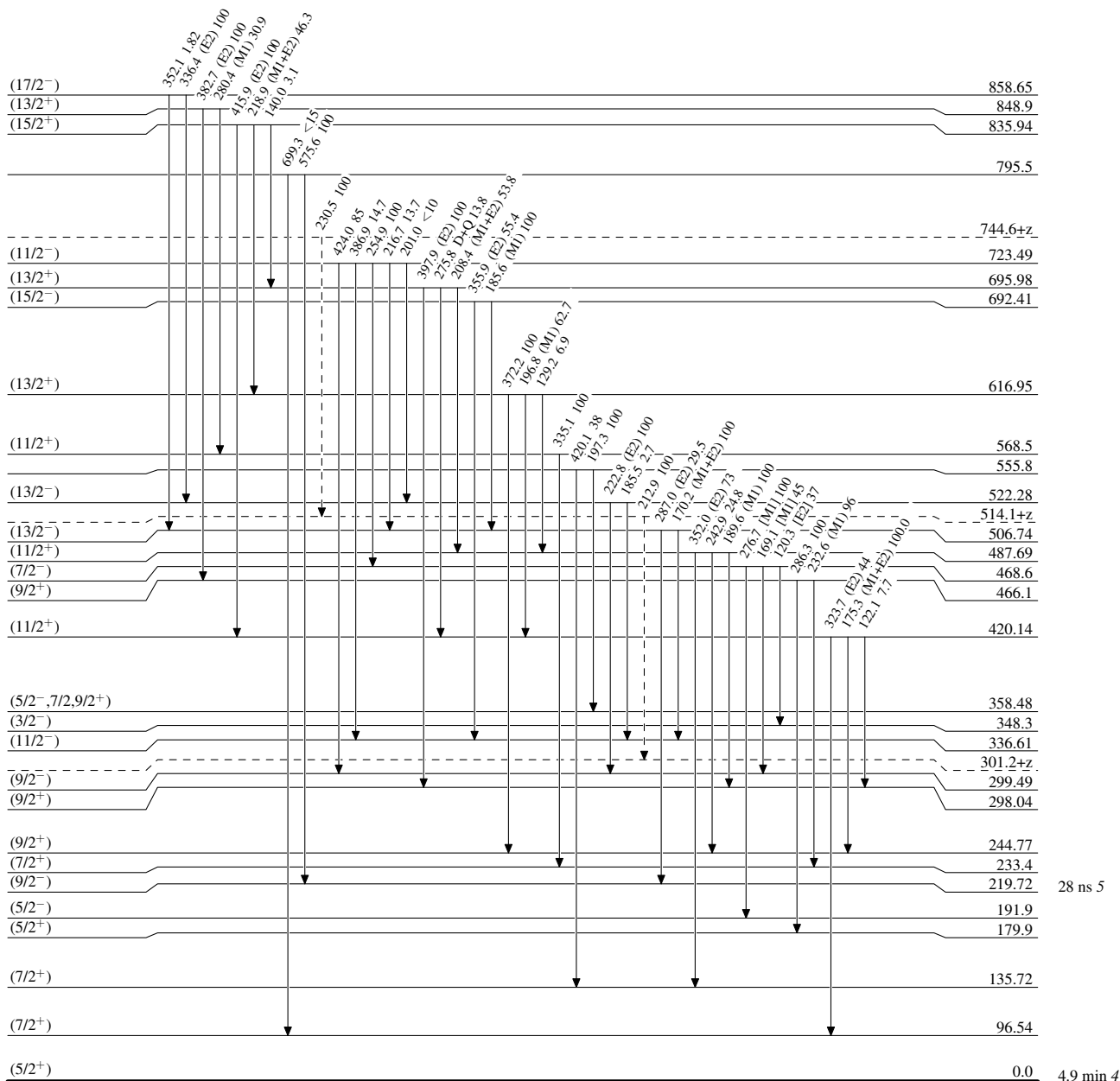
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



$^{169}_{73}\text{Ta}_{96}$

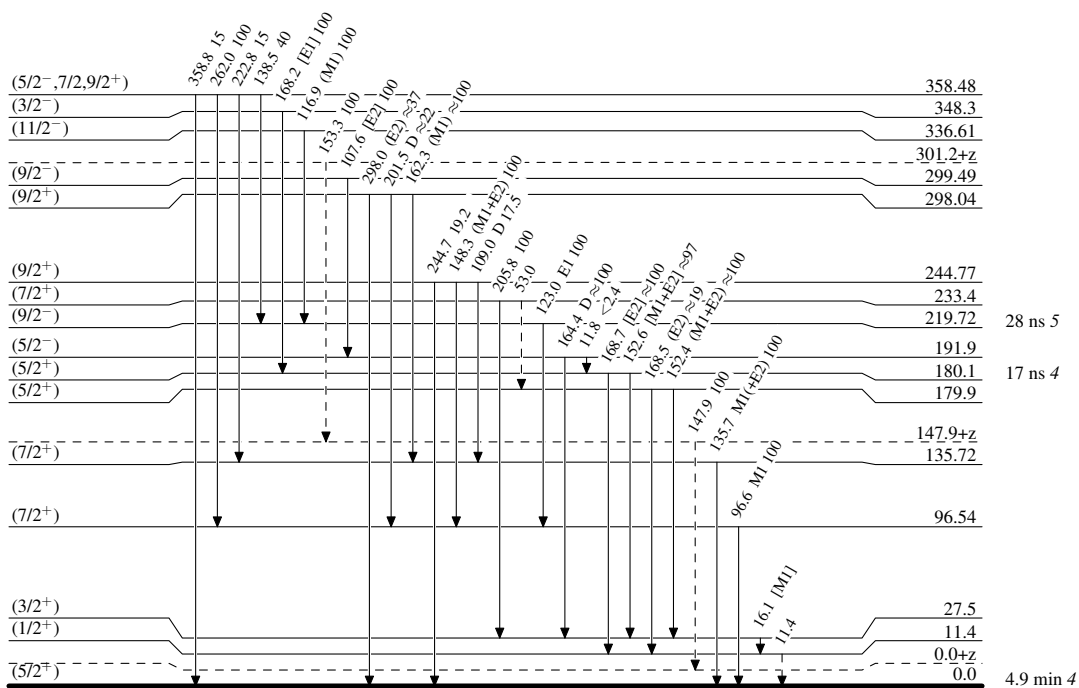
Adopted Levels, Gammas

Legend

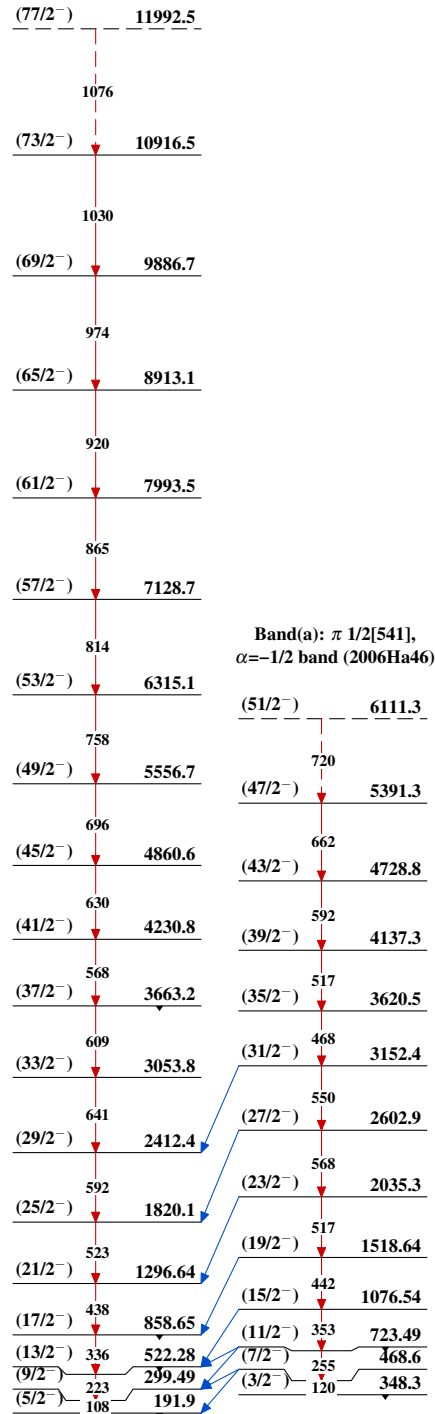
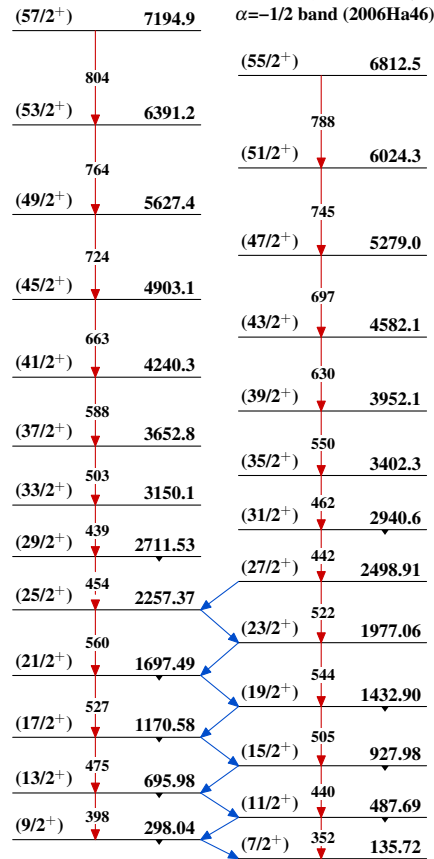
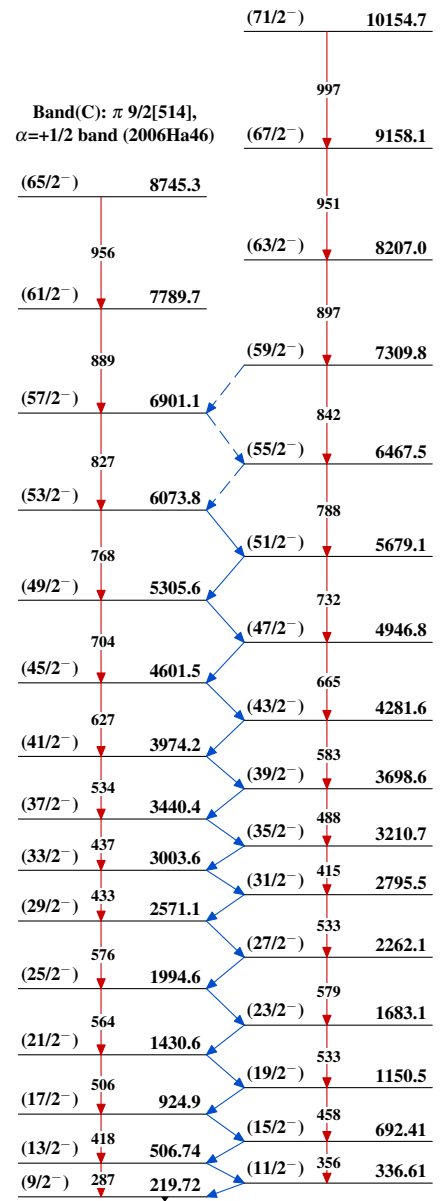
Level Scheme (continued)

Intensities: Relative photon branching from each level

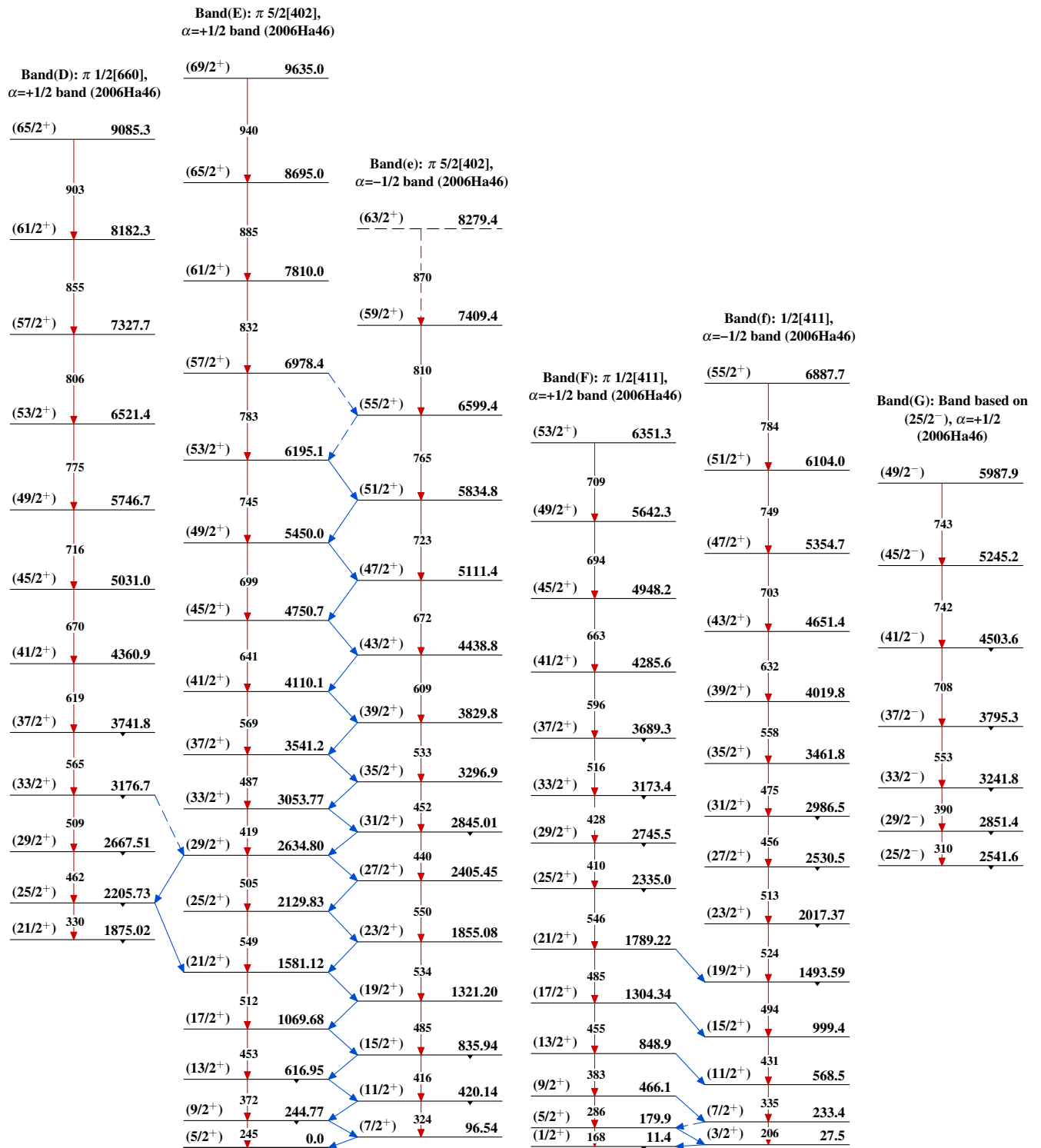
-----► γ Decay (Uncertain)

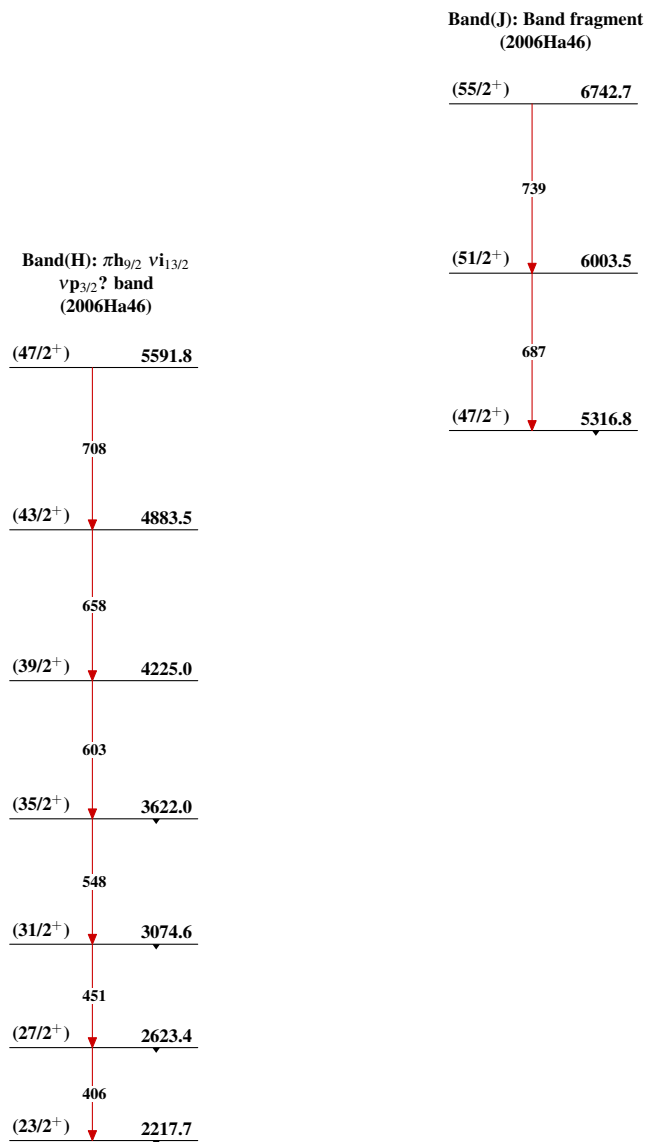
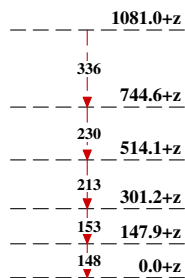


$^{169}_{73}\text{Ta}_{96}$

Adopted Levels, Gammas**Band(A): 1/2[541],
 $\alpha=+1/2$ band (2006Ha46)****Band(B): π 7/2[404],
 $\alpha=+1/2$ band (2006Ha46)****Band(c): π 9/2[514],
 $\alpha=-1/2$ band (2006Ha46)**

Adopted Levels, Gammas (continued)



Adopted Levels, Gammas (continued)**Band(I): Possible band
fragment (1993Li15)** $^{169}_{73}\text{Ta}_{96}$