Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 176, 1 (2021)	1-May-2021

Q(β^-)=−2140 *30*; S(n)=7800 *40*; S(p)=3030 *30*; Q(α)=2810 *50* 2021Wa16
S(2n)=17740 *40*, S(2p)=8690 *40* (2021Wa16).
Additional information 1.
For a discussion of the systematic features of signature inversion in the (π $h_{11/2}$)(ν $i_{13/2}$) bands in nuclides in the mass region A≈160, see 2001Ri19 and 2011Ku12. For other discussions, including theoretical calculations, see 1995Li40, 1997Zh13, 2000Xu01, 2001Kv02, 2001Zh16, 2003Ya19, and 2010Zh14.

^{160}Tm Levels

Cross Reference (XREF) Flags

A	^{160}Tm IT decay (74.5 s)
B	^{160}Yb ε decay (4.8 min)
C	(HI,xnγ)
D	^{128}Te(^{37}Cl,5nγ):tsd

E(level)[†]	J$^\pi$	T$_{1/2}$	XREF	Comments
0.0[f]	1⁻	9.4 min *3*	AB	%ε+%β⁺=100 μ=+0.156 *18*; Q=+0.582 *44* J$^\pi$: atomic beam (1971Ek01). π=− from E1 γ from 1⁺ level at 215.84 keV. T$_{1/2}$: average of 9.2 min *4* (1970De13) and 9.5 min 4 (1975St12). μ: from 1989Al27, resonance ionization mass spectroscopy. 2014StZZ report μ=+0.16 *2*. Q: from 1989Al27, resonance ionization mass spectroscopy. 2016St14 list Q=+0.58 *4*. Δ<r²>(^{160}Tm−^{169}Tm)=−0.783 fm² *4* (adopted by 2013An02), −0.741 fm² *4* (1987Mi31,1988Al04). Earlier work (1986Al32) by this collaboration reported −0.726 fm² *4* for the value of this quantity. Both studies employed resonant photoionization, via lasers, of a beam of mass-separated atoms. In an evaluation of nuclear rms charge radii, 2013An02 report <r²>$^{1/2}$=5.1504 fm *55*.
42.11[f] *5*	2⁻	1.6 ns *3*	ABC	T$_{1/2}$: from delayed γce in ε decay (1978Ad03). J$^\pi$: 42γ to g.s. is M1+E2. Level energy and large B(E2) of this γ transition suggest that this level is the 2⁻ member of the g.s. band.
70 *20*	5	74.5 s *15*	A C	%ε+%β⁺=15 *5*; %IT=85 *5* Additional information 2. The values for %ε+%β⁺ and %IT are those of 1983Si20, from analysis of the decay of the 264.1 γ in ^{160}Er (emitted following the decays of both this level and the ^{160}Tm g.s.). E(level): 70.9 *15* (HI dataset) if presumably measured 28.85γ to 42 level would be confirmed. E(level): 70 *20* estimated by 2005Re18 from the absence of K x rays and of a ce transition with E(ce)<35 keV that suggests that Eγ<50 keV for any transition in the IT decay. The isomer must lie above the 42 level since, if it were to lie below this level, the decay would have to take place to the g.s., and the implied B(E4)(W.u.) or B(M4)(W.u.) value would greatly exceed RUL. The most probable mode for the IT decay is to the 42 level. With the energy of the deexciting γ restricted to between ≈8 keV (L x rays are observed) and ≈50 keV, the energy of the isomer is estimated to lie somewhere between ≈50 and ≈90 keV. 1983Si20 conclude that the isomeric state is located within 100 keV above the g.s. 70.9 *15* if the presumably measured 28.85γ to 42 level in the HI dataset would be confirmed. J$^\pi$: log *ft*=6.4 (log $f^{1u}t$=8.2) to 4⁺ and log *ft*=6.5 (log $f^{1u}t$=8.2) to 6⁺. Since the side band populated in the heavy-ion reactions probably has K^π=5⁺, it is tempting to identify this state as the head of this band. If this is correct, then J^π would be 5⁺ for this state, with configuration=(π 7/2[523] + ν 3/2[521]). Note that, from in-beam γ studies,

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Adopted Levels, Gammas (continued)

^{160}Tm Levels (continued)

E(level)[†]	J^π	$T_{1/2}$	XREF	Comments
				1990TeZX show a 161.8 level having $J^\pi=5^+$ on their proposed level scheme which could be this bandhead, but no information is given to support either the energy or the J^π assignment of this level. Note also that, if the $\varepsilon+\beta^+$ branching to the 3^+, 987 level in ^{160}Er is nonzero, a 5^+ assignment to this level is ruled out. $T_{1/2}$: γ(t), from IT decay (1983Si20).
99.43 *4*	$1^{(-)}$		B	J^π: log *ft*=5.8 for the $\varepsilon+\beta^+$ transition from 0^+ implies J=1 with $\Delta\pi$=no more likely (but $\Delta\pi$=yes not excluded). (E1) γ from 1^+ implies $\pi=(-)$ and J=0,1,2. If $\pi=+$ is adopted then 99.5γ would be E1 that would give negative $\varepsilon+\beta^+$ feeding to 99.4 level; therefore the evaluator has adopted $\pi=(-)$ the argument from log *ft*.
123.5 *8*	$(6^-,7)$		C	J^π: γ from (8^-) and γ to (5).
140.33 *4*	$0^+,1^+,2^+$		B	J^π: E1 transition to g.s. Configuration=(π 1/2[411] $-$ ν 5/2[642]) seems reasonable, based on expected systematics of odd-neutron states. If this is correct, then J^π is most probably 2^+.
149.9 *7*	$(6^-,7)$		C	J^π: γ from (8^-) and γ to (5).
156.3 *8*	(6)		C	J^π: ΔJ=1 γ to J=5 in (HI,xnγ).
168.4 *8*	(6)		C	J^π: ΔJ=1, γ to J=5 in (HI,xnγ).
174.38 *6*	1^+	17 ns *1*	B	J^π: log *ft*=5.3 from 0^+. E1 transitions to 1^- and 2^- states. $T_{1/2}$: from delayed γce (1978Ad03) in ε decay.
215.84 *4*	1^+	0.65 ns *15*	B	J^π: log *ft*=4.2 indicates allowed unhindered $\varepsilon+\beta^+$ transition from 0^+ parent, giving uniquely $J^\pi=1^+$. This also establishes configuration=(π 7/2[523] $-$ ν 5/2[523]) for this state. $T_{1/2}$: from centroid shift in delayed $\gamma\gamma$ in ε decay (1978Ad03).
244.0[b] *13*	(7^+)[#]		C	A level previously adopted by 2005Re18 (from 1989An08) of energy 76.0+Y (with Y undetermined), with J=7^+, and decaying by a 76.0γ could tentatively be associated with this level, which is also decaying by a close-lying 76.0γ. J^π: (7,8) from γ to J=(6); (7^+) postulated by 2008Su08 in (HI,xnγ) dataset.
244.4 *8*	$(6^-,7)$		C	J^π: γ from (8^-) and γ to (5).
261.2 *7*	(7)		C	J^π: ΔJ=2, (Q) γ to J=(5).
341.9[a] *16*	(8^+)[#]		C	A level previously adopted by 2005Re18 (from 1989An08) of energy 98.2+X (with X undetermined), with J=(8), $T_{1/2}\approx 200$ ns (from $\gamma\gamma$(t) in 1986Dr06)), and decaying by a 98.2γ could tentatively be associated with this level, which is also decaying by a close-lying 97.9γ (however the feeding patterns of 98.2+X and this level are different). J^π: (8,9) from γ to J=(7^+); (8^+) postulated by 2008Su08 in (HI,xnγ) dataset.
390.0 *6*	(8^-)		C	J^π: ΔJ=2, (Q) γ to J=(6); $\pi=(-)$ postulated by 2008Su08 in (HI,xnγ) dataset from nuclear structure arguments.
443.4[&] *10*	(9^-)[‡]		C	J^π: (9,10) from γ to J=(8^-); (9^-) postulated by 2008Su08 in (HI,xnγ) dataset.
483.9[b] *18*	(9^+)[#]		C	J^π: (9,10) from γ to J=(8^+); (9^+) postulated by 2008Su08 in (HI,xnγ).
494.49 *15*	1^+		B	J^π: log *ft*=5.7 from 0^+ parent.
522.7[@] *10*	(10^-)[‡]		C	J^π: γ's to (8^-) and (9^-) and band structure.
543.35 *13*	$(1,2,3)^+$		B	J^π: (M1,E2) γ to 1^+.
547.38 *12*	1^+		B	J^π: log *ft*=5.3 from 0^+ parent.
605.37 *13*	1^+		B	J^π: log *ft*=5.2 from 0^+ parent.
605.9[&] *11*	(11^-)[‡]		C	J^π: γ's to (9^-) and (10^-) and band structure.
654.6[a] *18*	(10^+)[#]		C	J^π: γ's to (8^+) and (9^+) and band structure.
782.6[@] *12*	(12^-)[‡]		C	J^π: ΔJ=2, (Q) γ to (10^-) and band structure.
797.96 *21*	1^+		B	J^π: log *ft*=5.7 from 0^+ parent.
864.8[b] *19*	(11^+)[#]		C	J^π: γ's to (9^+) and (10^+) and band structure.
935.5[&] *13*	(13^-)[‡]		C	J^π: γ's to (11^-) and (12^-) and band structure.
1093.7[a] *19*	(12^+)[#]		C	J^π: γ's to (10^+) and (11^+) and band structure.
1181.1[@] *14*	(14^-)[‡]		C	J^π: γ's to (12^-) and (13^-) and band structure.

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Adopted Levels, Gammas (continued)

^{160}Tm Levels (continued)

E(level)[†]	J^π	XREF	Comments
1358.2[b] 20	(13+)[#]	C	J^π: γ's to (11+) and (12+) and band structure.
1405.0[&] 15	(15−)[‡]	C	J^π: γ's to (13−) and (14−) and band structure.
1631.6[a] 21	(14+)[#]	C	J^π: γ's to (12+) and (13+) and band structure.
1695.1[@] 15	(16−)[‡]	C	J^π: γ's to (14−) and (15−) and band structure.
1796.1 22	(14+)	C	J^π: γ to (13+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
1938.0[b] 21	(15+)[#]	C	J^π: γ's to (13+) and (14+) and band structure.
1984.4[&] 16	(17−)[‡]	C	J^π: γ's to (15−) and (16−) and band structure.
2054.4 22	(15+)	C	J^π: γ to (13+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
2242.3[a] 21	(16+)[#]	C	J^π: γ's to (14+) and (15+) and band structure.
2301.6[@] 16	(18−)[‡]	C	J^π: γ's to (16−) and (17−) and band structure.
2320.1 22	(16+)	C	J^π: γ to (14+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
2497.9[d] 17	(18−)	C	J^π: γ to (16−); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
2570.1[b] 22	(17+)[#]	C	J^π: γ's to (15+) and (16+) and band structure.
2616.2 22	(17+)	C	J^π: γ to (15+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
2646.0[&] 17	(19−)[‡]	C	J^π: γ's to (17−) and (18−) and band structure.
2688.5[c] 17	(19−)	C	J^π: γ to (17−); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
2813.8[a] 22	(18+)[#]	C	J^π: γ's to (16+) and (17+) and band structure.
2908.2[d] 17	(20−)	C	J^π: γ's to (18−) and (19−) and band structure.
2909.4 22	(18+)	C	J^π: γ's to (16+) and (17+) and band structure.
2976.2[@] 17	(20−)[‡]	C	J^π: γ's to (18−) and (19−) and band structure.
3051.1[b] 22	(19+)[#]	C	J^π: γ's to (17+) and (18+) and band structure.
3159.5[c] 17	(21−)	C	J^π: γ's to (19−) and (20−) and band structure.
3313.7[a] 23	(20+)[#]	C	J^π: γ's to (18+) and (19+) and band structure.
3357.0[&] 18	(21−)[‡]	C	J^π: γ's to (19−) and (20−) and band structure.
3412.6[d] 18	(22−)	C	J^π: γ's to (20−) and (21−) and band structure.
3596.4[b] 23	(21+)[#]	C	J^π: γ's to (19+) and (20+) and band structure.
3687.2[@] 18	(22−)[‡]	C	J^π: γ's to (20−) and (21−) and band structure.
3722.0[c] 18	(23−)	C	J^π: γ's to (21−) and (22−) and band structure.
3910.9[a] 24	(22+)[#]	C	J^π: γ's to (20+) and (21+) and band structure.
4027.8[d] 19	(24−)	C	J^π: γ's to (22−) and (23−) and band structure.
4080.4[&] 19	(23−)[‡]	C	J^π: γ's to (21−) and (22−) and band structure.
4249.2[b] 24	(23+)[#]	C	J^π: γ's to (21+) and (22+) and band structure.
4381.1[c] 19	(25−)	C	J^π: γ's to (23−) and (24−) and band structure.
4410.2[@] 20	(24−)[‡]	C	J^π: γ's to (22−) and (23−) and band structure.
4610.2[a] 25	(24+)[#]	C	J^π: γ's to (22+) and (23+) and band structure.
4748.6[d] 20	(26−)	C	J^π: γ's to (24−) and (25−) and band structure.
4811.3[&] 20	(25−)[‡]	C	J^π: γ's to (23−) and (23−) and band structure.
4823.3 22	(25−)	C	J^π: (Q) γ to (23−) and band structure.
5005[b] 3	(25+)[#]	C	J^π: γ to (23+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
5137.0[c] 22	(27−)	C	J^π: γ to (25−); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
5154.2[@] 21	(26−)[‡]	C	J^π: γ's to (24−) and (25−) and band structure.
5410[a] 3	(26+)[#]	C	J^π: γ to (24+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
5580.3[&] 21	(27−)[‡]	C	J^π: γ's to (25−) and (26−) and band structure.
5847[b] 3	(27+)[#]	C	J^π: γ to (25+); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
5945.3[@] 22	(28−)[‡]	C	J^π: γ's to (26−) and (27−) and band structure.
6408.7[&] 23	(29−)[‡]	C	J^π: γ to (27−); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).

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Adopted Levels, Gammas (continued)

^{160}Tm Levels (continued)

E(level)[†]	J$^{\pi}$	XREF	Comments
6797.1[@] *24*	(30$^-$)[‡]	C	J$^{\pi}$: γ to (28$^-$); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
7302[&] *3*	(31$^-$)[‡]	C	J$^{\pi}$: γ to (29$^-$); postulated by 2008Su08 in (HI,xnγ) dataset (based on level scheme arguments).
x[e]	(8$^+$)	C	Additional information 3.
234.4+x[e] *10*	(10$^+$)	C	
599.0+x[e] *15*	(12$^+$)	C	
1067.8+x[e] *18*	(14$^+$)	C	
1624.4+x[e] *20*	(16$^+$)	C	
2268.7+x[e] *23*	(18$^+$)	C	
2973.4+x[e] *25*	(20$^+$)	C	
y[g]	J	C	Additional information 4.
680.0+y[g] *10*	J+2	D	
1412.0+y[g] *15*	J+4	D	
2196.0+y[g] *18*	J+6	D	
3032.0+y[g] *20*	J+8	D	
3916.0+y[g] *23*	J+10	D	
4856.0+y[g] *25*	J+12	D	
5847+y[g] *3*	J+14	D	
6896+y[g] *3*	J+16	D	

† From a least-squares fit of the γ-ray energies. Where no uncertainties are available for the Eγ values, a value of 1 keV was assigned for this calculation.

‡ Spin assignment based on considerations of band structure, theoretical predictions and studies of yrast bands in other doubly-odd deformed nuclei.

\# Spin assignment based on band-structure and nuclear-model considerations. Measured g-factors for some of the intraband transitions provide evidence for the listed configuration and, hence, that π=+.

@ Band(A): Yrast band, signature=0. Configuration=(π 7/2[523] + ν 5/2[642]). By analogy with the situation in ^{162}Tm, this is the most likely Nilsson-orbital composition. At higher spins, the classification according to spherical shell-model structure, namely $\pi h_{11/2}\otimes\nu i_{13/2}$, as given by the authors, might be more appropriate.

& Band(a): Yrast band, signature=1. Configuration=(π 7/2[523] + ν 5/2[642]). See comment on the signature-0 portion of this band.

a Band(B): Side band 1, signature=0. Configuration=(π 7/2[523] + ν 3/2[521]). In the spherical shell-model notation, the band can be described as $\pi h_{11/2}\otimes\nu h_{9/2}$.

b Band(b): Side band 1, signature=1. Configuration=(π 7/2[523] + ν 3/2[521]). See comment on the signature-0 portion of this band.

c Band(c): Side band 2, signature=1. $\pi g_{7/2}\otimes\nu h_{9/2}\otimes\nu i^2_{13/2}$.

d Band(C): Side band 2, signature=0. $\pi g_{7/2}\otimes\nu h_{9/2}\otimes\nu i^2_{13/2}$.

e Band(D): Side band 3, signature=0. $\pi d_{3/2}\otimes\nu i_{13/2}$. 10% of the intensity of band A. Tentative J^{π} values assigned by 2008Su08 in (HI,xnγ) dataset based on theory arguments and systematics.

f Band(E): K$^{\pi}$=1$^-$ band. Configuration=(π 1/2[411] − ν 3/2[521]). No band parameters are listed, since only two members of the band are known and a sizeable A_2 term may be present.

g Band(F): Triaxial SD band. Population intensity ≈ 1% of the channel populating ^{160}Tm. Comparisons with model calculations gives deformation parameters: $\varepsilon_2\approx0.39$ and $\gamma\approx20°$. Proposed configuration=[π6(21),ν(22)5], implying $\pi[h^6_{11/2},(h_{9/2}f_{7/2})^2,(i_{13/2})^1]$; and $\nu[(N_{osc}=4)^2,(h_{11/2})^2,(i_{13/2})^5]$.

$\gamma(^{160}Tm)$

The adopted γ-ray properties, where more than simply an Eγ value is given, have been taken from the ^{160}Yb ε decay. Other Eγ values are from the heavy-ion-induced reaction studies.

The (Q) values adopted in the table based on DCO (2008Su08) can be considered (E2) for fast transitions from (HI,xnγ) reactions. However because no evidence of the DCO measurements was provided by authors the evaluator conservatively kept the (Q) assignment.

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	α[&]	Comments
42.11	2⁻	42.02[@] *10*	100	0.0	1⁻	M1+E2	0.31 *3*	17.1 *20*	α(L)=13.2 *16*; α(M)=3.1 *4* α(N)=0.71 *9*; α(O)=0.088 *10*; α(P)=0.00185 *4* B(M1)(W.u.)=0.0094 *21*; B(E2)(W.u.)=2.5×10^{2} *8*
70	5	28.85[a]	100	42.11	2⁻				Eγ: value given with two decimals but with no unc in (HI,xnγ) dataset (2008Lu17 and 2008Su08). Because of missing information it is not clear how this transition was measured, reason for which its existence is questioned by evaluator.
99.43	1$^{(-)}$	99.46[@] *5*	100	0.0	1⁻	[M1]		3.15	α(K)=2.64 *4*; α(L)=0.400 *6*; α(M)=0.0891 *13* α(N)=0.0208 *3*; α(O)=0.00300 *5*; α(P)=0.0001620 *23*
123.5	(6⁻,7)	53.7	100	70	5				
140.33	0⁺,1⁺,2⁺	98.24[@] *5*	12.6 *9*	42.11	2⁻	[E1]		0.350	α(K)=0.289 *4*; α(L)=0.0470 *7*; α(M)=0.01048 *15* α(N)=0.00240 *4*; α(O)=0.000318 *5*; α(P)=1.287×10^{-5} *18*
		140.35[@] *5*	100 *5*	0.0	1⁻	E1		0.1360	α(K)=0.1135 *16*; α(L)=0.01759 *25*; α(M)=0.00391 *6* α(N)=0.000901 *13*; α(O)=0.0001219 *18*; α(P)=5.31×10^{-6} *8*
149.9	(6⁻,7)	79.8	100	70	5				
156.3	(6)	86.3		70	5	(D)			Mult.: ΔJ=1, (D) transition in (HI,xnγ) (2008Su08, DCO).
168.4	(6)	97.8	100	70	5	(D)			Mult.: ΔJ=1, (D) transition in (HI,xnγ) (2008Su08, DCO).
174.38	1⁺	34.18[@] *10*	22 *4*	140.33	0⁺,1⁺,2⁺	M1		11.69 *20*	B(M1)(W.u.)=0.0014 *4* α(L)=9.11 *15*; α(M)=2.03 *4* α(N)=0.475 *8*; α(O)=0.0682 *12*; α(P)=0.00368 *6*
		132.23[@] *5*	100 *5*	42.11	2⁻	E1		0.1593	α(K)=0.1328 *19*; α(L)=0.0207 *3*; α(M)=0.00461 *7* α(N)=0.001061 *15*; α(O)=0.0001430 *20*; α(P)=6.16×10^{-6} *9* B(E1)(W.u.)=1.18×10^{-6} *16*
		174.40[@] *10*	94 *11*	0.0	1⁻	E1		0.0767	α(K)=0.0643 *9*; α(L)=0.00975 *14*; α(M)=0.00217 *3* α(N)=0.000500 *7*; α(O)=6.84×10^{-5} *10*; α(P)=3.09×10^{-6} *5* B(E1)(W.u.)=4.8×10^{-7} *9*
215.84	1⁺	(41.46)	≈0.4	174.38	1⁺	(M1+E2)	≥0.65	92 *46*	B(M1)(W.u.)≤0.0014; B(E2)(W.u.)≤540 α(L)=70 *36*; α(M)=17.1 *87* α(N)=3.9 *20*; α(O)=0.44 *22*; α(P)=9.4×10^{-4} *62* B(E2)(W.u.): upper limit calculated if pure E2 γ (α=137.5 *20*); ≥ 23 if calculated with δ ≥ 0.65.
		116.44[@] *5*	1.96 *16*	99.43	1$^{(-)}$	(E1)		0.223	B(E1)(W.u.)=2.2×10^{-6} *6*

γ(^{160}Tm) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[&]	Comments
								α(K)=0.185 *3*; α(L)=0.0294 *5*; α(M)=0.00654 *10* α(N)=0.001504 *22*; α(O)=0.000201 *3*; α(P)=8.45×10^{-6} *12*
215.84	1^+	173.74[@] *6*	100 *4*	42.11	2^-	E1	0.0775	B(E1)(W.u.)=3.4×10^{-5} *9* α(K)=0.0649 *10*; α(L)=0.00985 *14*; α(M)=0.00219 *3* α(N)=0.000505 *7*; α(O)=6.90×10^{-5} *10*; α(P)=3.12×10^{-6} *5*
		215.78[@] *6*	48.0 *20*	0.0	1^-	E1	0.0441	B(E1)(W.u.)=8.5×10^{-6} *22* α(K)=0.0370 *6*; α(L)=0.00553 *8*; α(M)=0.001226 *18* α(N)=0.000284 *4*; α(O)=3.91×10^{-5} *6*; α(P)=1.83×10^{-6} *3*
244.0	(7^+)	75.6	100	168.4	(6)			
244.4	$(6^-,7)$	174.3	100	70	5			
261.2	(7)	110.8		149.9	$(6^-,7)$			
		191.8		70	5	(Q)		Mult.: ΔJ=2, (Q) transition in (HI,xnγ) (2008Su08, DCO).
341.9	(8^+)	97.9	100	244.0	(7^+)			
390.0	(8^-)	128.9		261.2	(7)	(D)		Mult.: ΔJ=1, (D) transition in (HI,xnγ) (2008Su08, DCO).
		145.5		244.4	$(6^-,7)$			
		221.1		168.4	(6)	(Q)		Mult.: ΔJ=2, (Q) transition in (HI,xnγ) (2008Su08, DCO).
		233.7		156.3	(6)	(Q)		Mult.: ΔJ=2, (Q) transition in (HI,xnγ) (2008Su08, DCO).
		240.5		149.9	$(6^-,7)$			
		266.6		123.5	$(6^-,7)$			
443.4	(9^-)	53.7	100	390.0	(8^-)			
483.9	(9^+)	142.0	100	341.9	(8^+)			
494.49	1^+	320.00[@] *15*	100 *9*	174.38	1^+			
		354.6[@] *3*	32 *6*	140.33	$0^+,1^+,2^+$			
522.7	(10^-)	79.3		443.4	(9^-)			
		132.4		390.0	(8^-)			
543.35	$(1,2,3)^+$	327.60[@] *15*	100	215.84	1^+			
547.38	1^+	373.00[@] *10*	100	174.38	1^+			
605.37	1^+	62.05[@] *10*	9 *3*	543.35	$(1,2,3)^+$	(M1,E2)	16.6 *45*	α(K)=6.0 *42*; α(L)=8.2 *66*; α(M)=2.0 *17* α(N)=0.45 *37*; α(O)=0.053 *41*; α(P)=3.8×10^{-4} *26* Mult.: based on intensity balance at 543 level.
		389.45[@] *15*	100	215.84	1^+			
605.9	(11^-)	83.3		522.7	(10^-)			
		162.7		443.4	(9^-)			
654.6	(10^+)	170.6		483.9	(9^+)			
		312.8		341.9	(8^+)			
782.6	(12^-)	176.6		605.9	(11^-)			
		259.6		522.7	(10^-)	(Q)		Mult.: ΔJ=2, (Q) transition in (HI,xnγ) (2008Su08, DCO).
797.96	1^+	582.12[@] *20*	100	215.84	1^+			
864.8	(11^+)	210.3		654.6	(10^+)			
		380.8		483.9	(9^+)			
935.5	(13^-)	152.6		782.6	(12^-)			

Adopted Levels, Gammas (continued)

$\gamma(^{160}Tm)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f
935.5	(13^-)	330.0		605.9	(11^-)
1093.7	(12^+)	228.6		864.8	(11^+)
		439.2		654.6	(10^+)
1181.1	(14^-)	245.7		935.5	(13^-)
		398.4		782.6	(12^-)
1358.2	(13^+)	264.3		1093.7	(12^+)
		493.5		864.8	(11^+)
1405.0	(15^-)	223.8		1181.1	(14^-)
		469.6		935.5	(13^-)
1631.6	(14^+)	273.2		1358.2	(13^+)
		538.1		1093.7	(12^+)
1695.1	(16^-)	289.8		1405.0	(15^-)
		513.9		1181.1	(14^-)
1796.1	(14^+)	437.9	100	1358.2	(13^+)
1938.0	(15^+)	306.3		1631.6	(14^+)
		579.9		1358.2	(13^+)
1984.4	(17^-)	289.8		1695.1	(16^-)
		579.8		1405.0	(15^-)
2054.4	(15^+)	696.2	100	1358.2	(13^+)
2242.3	(16^+)	304.6		1938.0	(15^+)
		610.7		1631.6	(14^+)
2301.6	(18^-)	316.8		1984.4	(17^-)
		606.7		1695.1	(16^-)
2320.1	(16^+)	688.5	100	1631.6	(14^+)
2497.9	(18^-)	801.9	100	1695.1	(16^-)
2570.1	(17^+)	327.7		2242.3	(16^+)
		631.4		1938.0	(15^+)
2616.2	(17^+)	678.5	100	1938.0	(15^+)
2646.0	(19^-)	344.3		2301.6	(18^-)
		662.2		1984.4	(17^-)
2688.5	(19^-)	704.5	100	1984.4	(17^-)
2813.8	(18^+)	197.4		2616.2	(17^+)
		243.6		2570.1	(17^+)
		571.7		2242.3	(16^+)
2908.2	(20^-)	220.0		2688.5	(19^-)
		263.3		2646.0	(19^-)
		409.4		2497.9	(18^-)
		606.1		2301.6	(18^-)
2909.4	(18^+)	339.2		2570.1	(17^+)
		589.3		2320.1	(16^+)
		667.2		2242.3	(16^+)
2976.2	(20^-)	329.8		2646.0	(19^-)
		675.0		2301.6	(18^-)

γ(^{160}Tm) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.[#]	Comments
3051.1	(19$^+$)	237.7		2813.8	(18$^+$)		
		435.3		2616.2	(17$^+$)		E_γ: 453.3 in figure 1 of 2008Su08 seems a type error.
		480.6		2570.1	(17$^+$)		
3159.5	(21$^-$)	251.2		2908.2	(20$^-$)		
		471.3		2688.5	(19$^-$)		
		513.5		2646.0	(19$^-$)		
3313.7	(20$^+$)	262.9		3051.1	(19$^+$)		
		499.6		2813.8	(18$^+$)		
3357.0	(21$^-$)	380.6		2976.2	(20$^-$)		
		711.0		2646.0	(19$^-$)		
3412.6	(22$^-$)	253.2		3159.5	(21$^-$)		
		504.2		2908.2	(20$^-$)		
3596.4	(21$^+$)	282.7		3313.7	(20$^+$)		
		545.4		3051.1	(19$^+$)		
3687.2	(22$^-$)	330.1		3357.0	(21$^-$)		
		711.2		2976.2	(20$^-$)		
3722.0	(23$^-$)	309.3		3412.6	(22$^-$)		
		562.4		3159.5	(21$^-$)		
3910.9	(22$^+$)	314.4		3596.4	(21$^+$)		
		597.1		3313.7	(20$^+$)		
4027.8	(24$^-$)	305.9		3722.0	(23$^-$)		
		615.4		3412.6	(22$^-$)		
4080.4	(23$^-$)	393.5		3687.2	(22$^-$)		
		723.3		3357.0	(21$^-$)		
4249.2	(23$^+$)	338.5		3910.9	(22$^+$)		
		652.8		3596.4	(21$^+$)		
4381.1	(25$^-$)	353.5		4027.8	(24$^-$)		
		658.8		3722.0	(23$^-$)		
4410.2	(24$^-$)	329.7		4080.4	(23$^-$)		
		722.8		3687.2	(22$^-$)		
4610.2	(24$^+$)	361.3		4249.2	(23$^+$)		
		699.0		3910.9	(22$^+$)		
4748.6	(26$^-$)	367.4		4381.1	(25$^-$)		
		721.0		4027.8	(24$^-$)		
4811.3	(25$^-$)	401.0		4410.2	(24$^-$)		
		731.2		4080.4	(23$^-$)		
4823.3	(25$^-$)	742.9	100	4080.4	(23$^-$)	(Q)	Mult.: ΔJ=2, (Q) transition in (HI,xnγ) (2008Su08, DCO).
5005	(25$^+$)	756.2	100	4249.2	(23$^+$)		
5137.0	(27$^-$)	755.9	100	4381.1	(25$^-$)		
5154.2	(26$^-$)	342.5		4811.3	(25$^-$)		
		743.9		4410.2	(24$^-$)		
5410	(26$^+$)	799.5	100	4610.2	(24$^+$)		
5580.3	(27$^-$)	425.0		5154.2	(26$^-$)		

Adopted Levels, Gammas (continued)

$\gamma(^{160}Tm)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ‡	E_f	J^π_f
5580.3	(27−)	769.4		4811.3	(25−)
5847	(27+)	841.8	100	5005	(25+)
5945.3	(28−)	364.4		5580.3	(27−)
		791.8		5154.2	(26−)
6408.7	(29−)	828.4	100	5580.3	(27−)
6797.1	(30−)	851.8	100	5945.3	(28−)
7302	(31−)	893.4	100	6408.7	(29−)
234.4+x	(10+)	234.4	100	x	(8+)
599.0+x	(12+)	364.6	100	234.4+x	(10+)
1067.8+x	(14+)	468.8	100	599.0+x	(12+)
1624.4+x	(16+)	556.6	100	1067.8+x	(14+)
2268.7+x	(18+)	644.3	100	1624.4+x	(16+)
2973.4+x	(20+)	704.7	100	2268.7+x	(18+)
680.0+y	J+2	680	100	y	J
1412.0+y	J+4	732	100	680.0+y	J+2
2196.0+y	J+6	784	100	1412.0+y	J+4
3032.0+y	J+8	836	100	2196.0+y	J+6
3916.0+y	J+10	884	100	3032.0+y	J+8
4856.0+y	J+12	940	100	3916.0+y	J+10
5847+y	J+14	991	100	4856.0+y	J+12
6896+y	J+16	1049	100	5847+y	J+14

† From from (HI,xnγ) dataset, unless mentioned otherwise.

‡ From ^{160}Yb ε decay, unless mentioned otherwise.

From ce data in ^{160}Yb ε decay, unless mentioned otherwise.

@ From ^{160}Yb ε decay.

& Additional information 5.

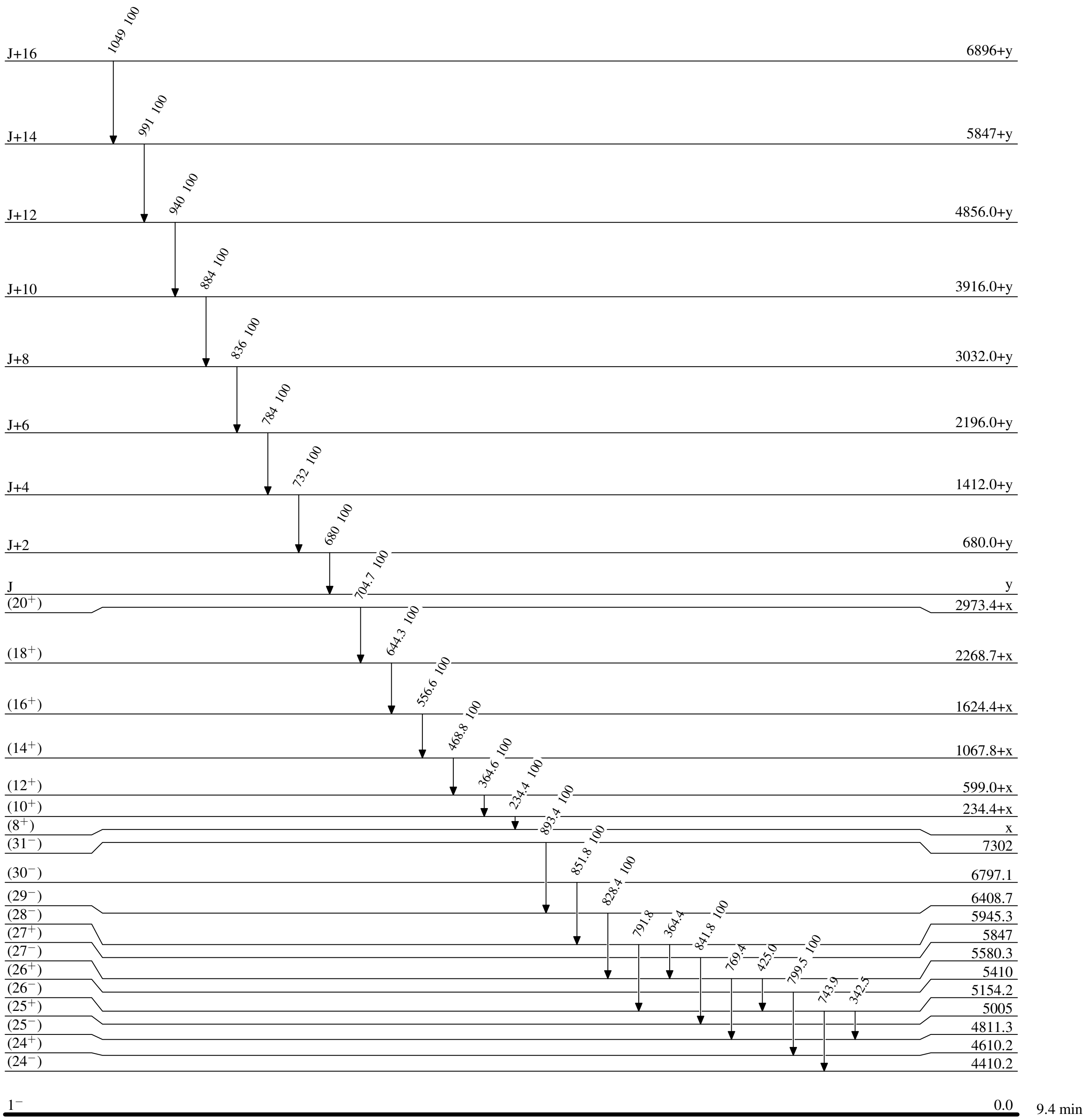
a Placement of transition in the level scheme is uncertain.

$^{160}_{69}Tm_{91}$-9

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

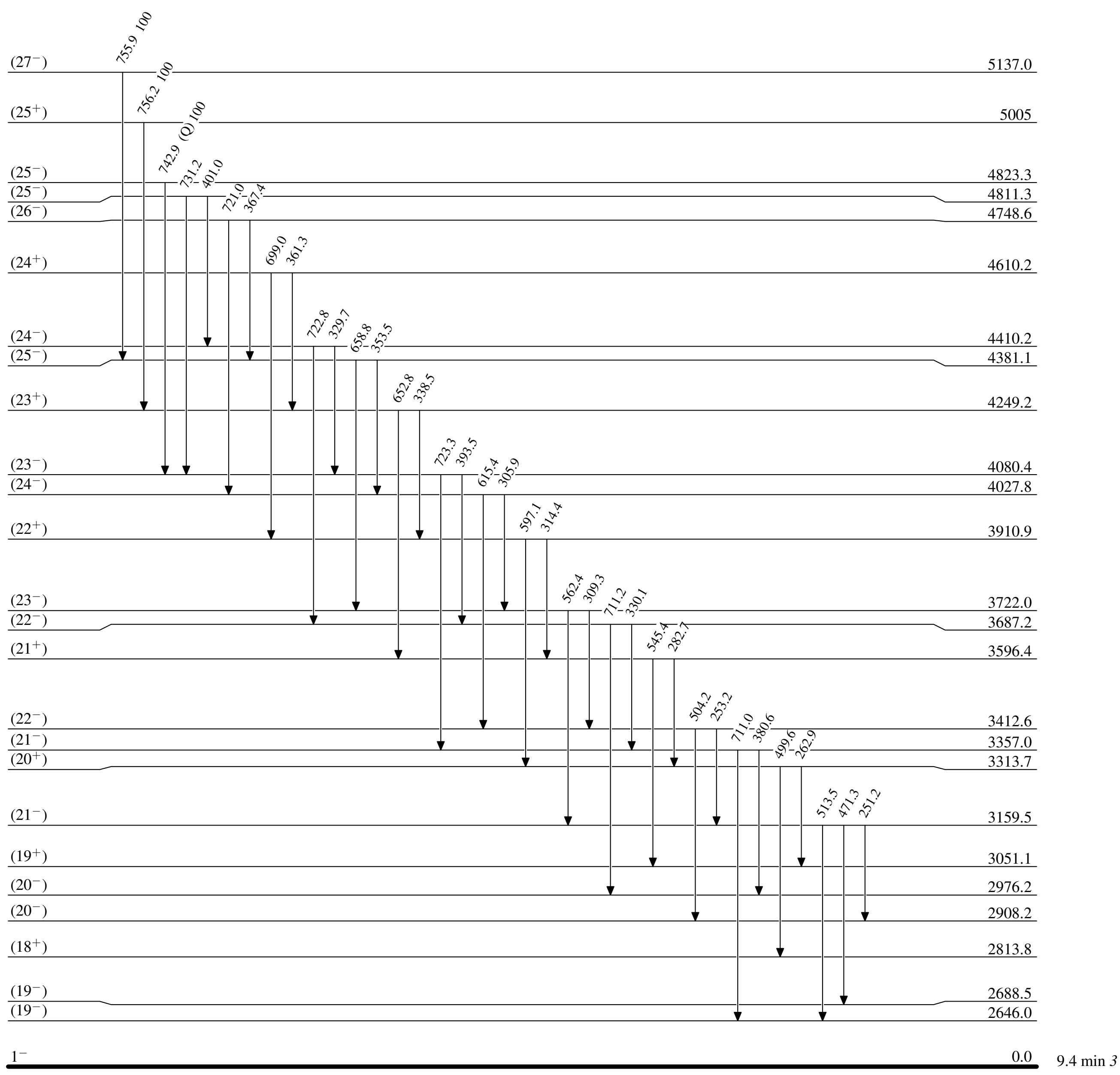


$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

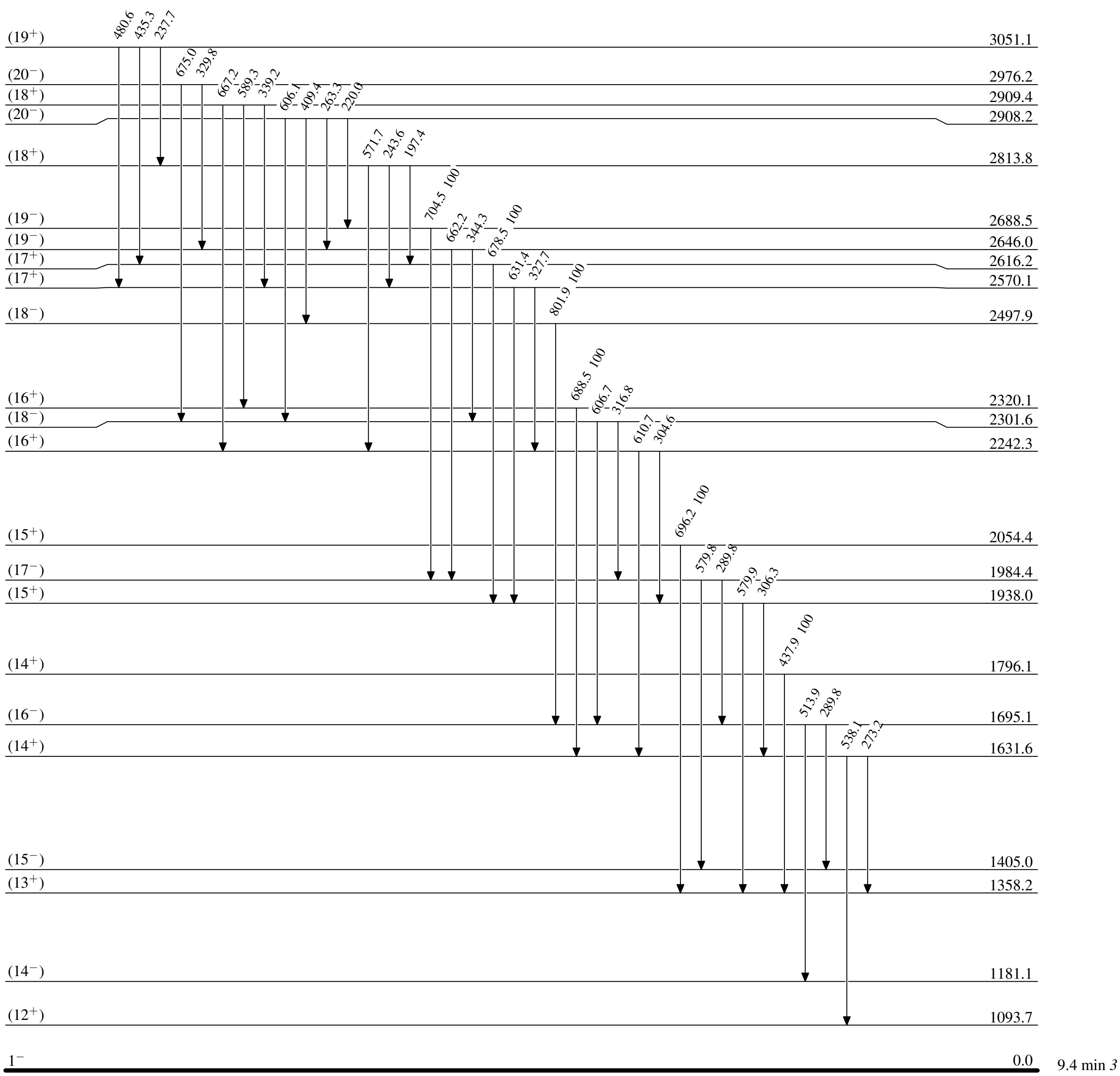


$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{160}_{69}Tm_{91}$

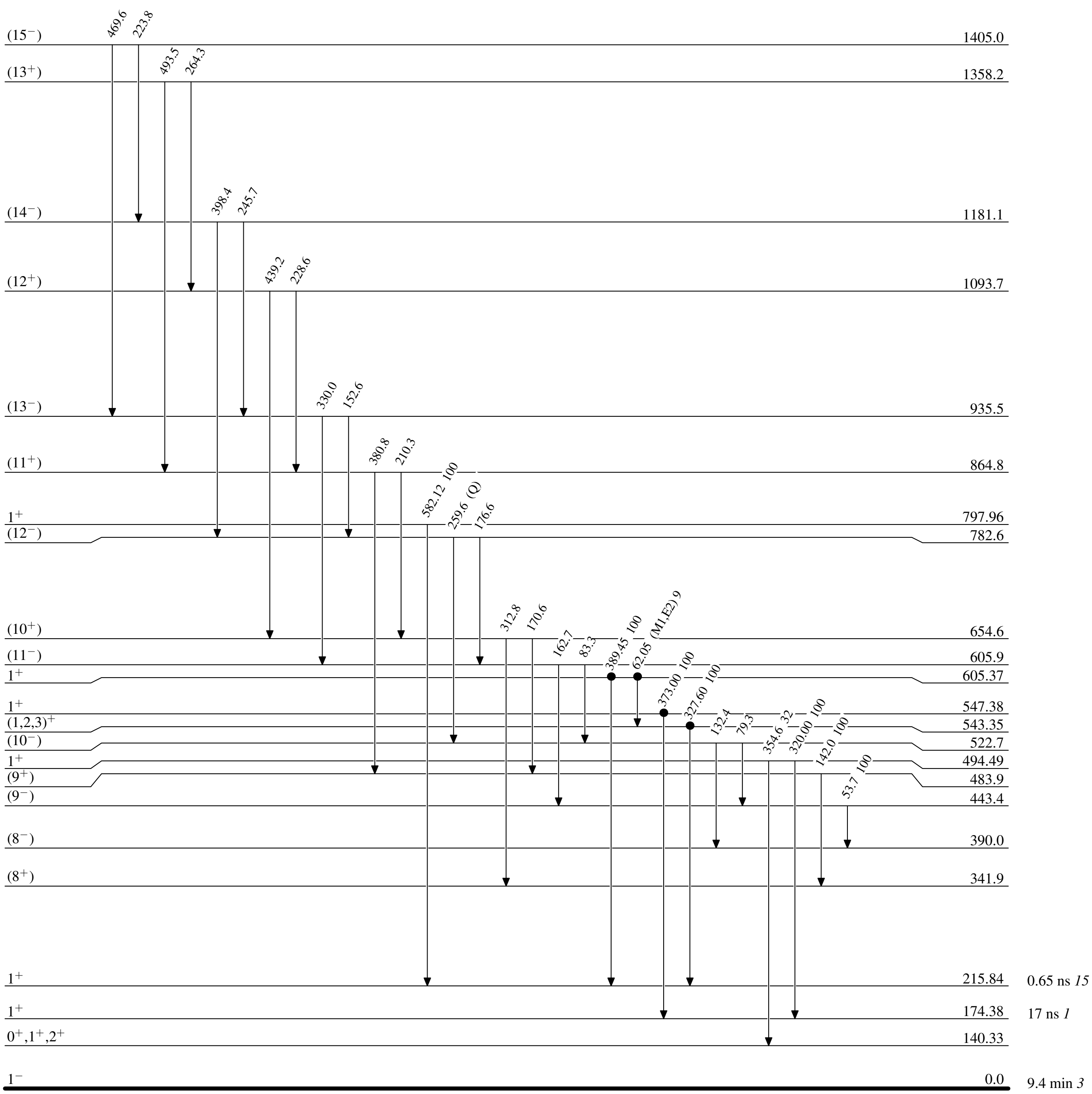
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

● Coincidence



$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas

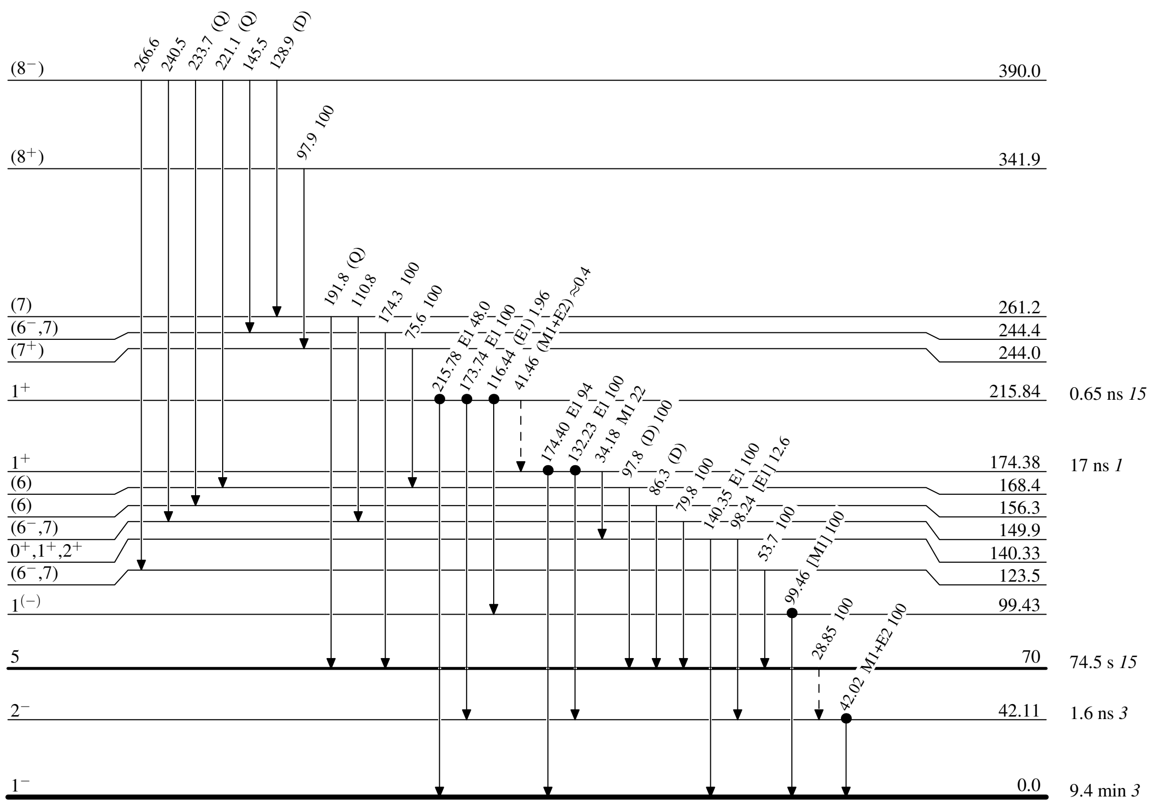
Level Scheme (continued)

Intensities: Relative photon branching from each level

Legend

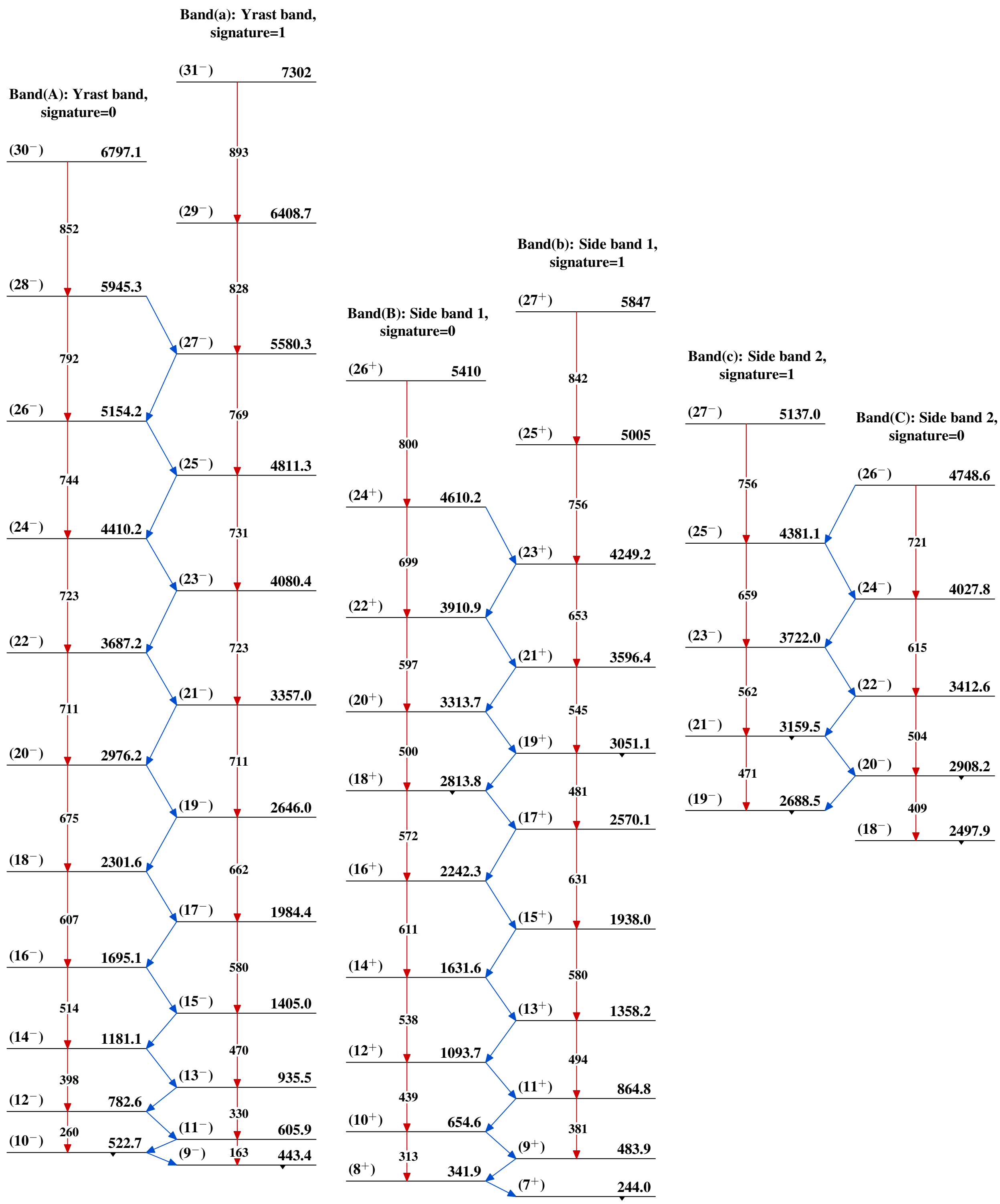
- - - - - -► γ Decay (Uncertain)

● Coincidence



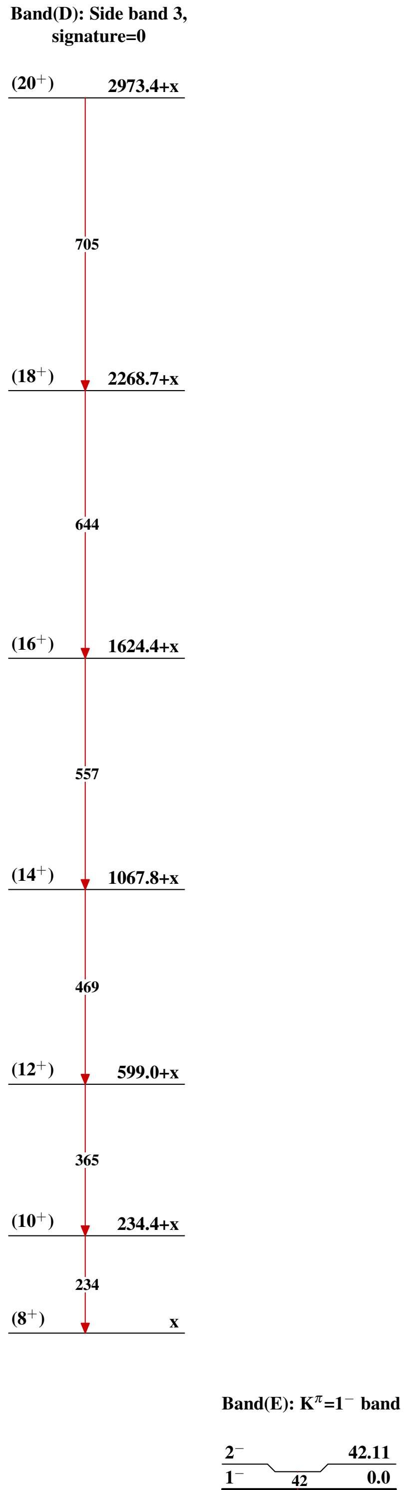
$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas



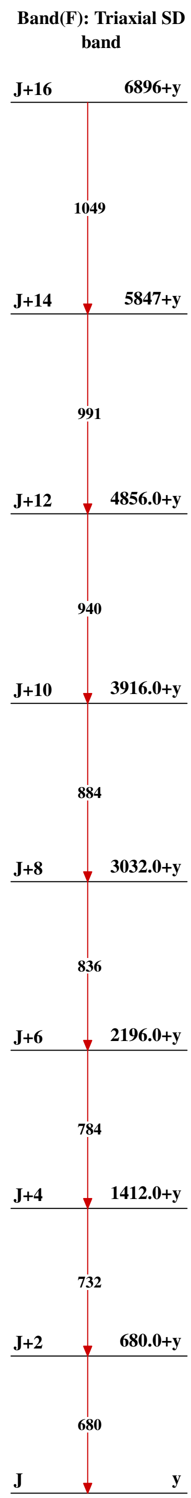
$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas (continued)



$^{160}_{69}Tm_{91}$

Adopted Levels, Gammas (continued)



$^{160}_{69}Tm_{91}$