^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX

History

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

Parent: ^{167}Yb: E=0.0; J$^{\pi}$=5/2^{-}; $T_{1/2}$=17.5 min *2*; Q(ε)=1953 *4*; %ε+%β^{+} decay=100

^{167}Yb-J$^{\pi}$,$T_{1/2}$: From ^{167}Yb Adopted Levels. Configuration=ν5/2[523].

^{167}Yb-Q(ε): From 2021Wa16.

1971Fu10 (also 1970Wi09): ^{167}Yb produced in ^{168}Yb(γ,n), E(γ)=bremsstrahlung generated by a 30-MeV electron accelerator, using 20% enriched ^{168}Yb target. ^{167}Yb was also produced in spallation reaction using E(p)=680 MeV, followed by chemical separation. Measured Eγ, Iγ using several Ge(Li) detectors, a high-resolution low-energy photon spectrometer (LEPS) for x-rays, conversion electrons using a magnetic spectrograph, prompt and delayed $\gamma\gamma$-coin using Ge(Li)-Ge(Li) and Ge(Li)-NaI(Tl) detectors. 1970Wi09 is (α,2nγ) study for levels and band structures in ^{167}Tm, but also contains a decay scheme figure for ^{167}Yb decay, nearly the same as in 1971Fu10. A Dubna report E6-4782 (1969) by A.A. Abdurazakov et al. is cited by 1971Fu10 as an earlier report of their results for ^{167}Yb decay. 1971Fu10 also cite another report of independent decay study by R. Goles, Michigan State University, Nucl. Chem. Annual report p79 (1969), related to 1971GoYX thesis.

1971GoYX (Thesis): ^{167}Yb produced in ^{169}Tm(p,3n),E(p)=23.5 MeV at the Michigan State University Sector-focused cyclotron facility. Measured Eγ, Iγ, $\gamma\gamma$-coin using Ge(Li) detector for singles and Ge(Li)-NaI(Tl) detector system for coincidences. 52 new γ rays were detected in this experiment and a detailed decay scheme proposed, with levels discussed in terms of Nilsson configurations, together with their results of ^{169}Tm(p,t) experiment. 1971GoYG is the same as 1971GoYX. Results were also reported earlier by R. Goles, in Michigan State University, Nucl. Chem. Annual report p79 (1969).

Additional information 1.

Note: 1971GoYX was not cited in the 2000 or 1976 NDS-evaluation of this decay.

Others:

1993AbZZ (also 1981AbZR): measured Eγ, ce using magnetic spectrographs. Copy of this report was not available.

1987BaZB (one author same as in 1993AbZZ): measured L1/L2 and L1/L3 ratios for 37.05 and 113.36 transitions using magnetic spectrographs.

1978Cr06: measured Eβ and branching ratio ε/β^{+}.

1967Pa04, 1966Pa17: measured Eγ, E(ce), L-subshell ratios. A total of 15 γ rays reported with ce data for seven transitions.

1965Gr20: copy of this paper was not available.

1965Ta01: ^{167}Yb from ^{168}Yb(γ,n),E(γ)=15 MeV bremsstrahlung from JAERI linear accelerator. Measured Eβ, Iβ, Eγ, Iγ, $\gamma\gamma$-coin, (x ray)γ-coin, $\beta^{+}\gamma$-coin, level half-lives by $\gamma\gamma$(t). Data for five γ rays from 62.9-1050 keV, and β^{+} decay branching of 0.2%.

1964Wa04: copy of this paper was not available.

1960Wi15: ^{167}Yb from ^{164}Er(α,n),E(α)=17,24 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, $T_{1/2}$ of ^{167}Yb decay. Three γ rays of 106, 113 and 176 keV reported. Analyzed conversion electron data from 1959Ha09.

1960Ba32: measured conversion electron spectrum. Copy of this paper was not available.

1959Ha09: measured conversion electrons for nine transitions from 25.8 to 176.2 keV at ORNL cyclotron facility.

1958Ar59: copy of this paper was not available.

1954Ha16 (from the same research group as 1959Ha09): identification of ^{167}Yb activity through parent-daughter half-lives and excitation function measurement in ^{169}Tm(p,3n)^{167}Yb,E(p)=19-23 MeV reaction. Measured half-life of 18.5 min, and Eγ=118 keV, 0.18 MeV and 0.33 MeV in a γ-ray spectrum using NaI(Tl) scintillation detector. No annihilation radiation was observed indicating small contribution from positron emission. 1954Ha16 did not confirm an earlier activity of 73 min assigned to ^{167}Yb decay by L. Michel (University of California Radiation Laboratory Report UCRL-2267) at Berkeley cyclotron facility.

Theory for decay of ^{167}Yb: 1975Fe13.

All data are from 1971Fu10, unless otherwise indicated.

^{167}Tm Levels

Following levels proposed by 1971GoYX are omitted due to lack of confirmation in 1971Fu10: 321.7, 1318.9, 1458.0 1534.7 and 1603.0, while a 1544.2 level proposed only in 1971GoYX is included in the decay scheme here as three out of four γ rays placed by 1971GoYX are also reported as unplaced γ rays in 1971Fu10, with comparable intensities in the two independent studies.

Continued on next page (footnotes at end of table)

^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX (continued)

^{167}Tm Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[‡]	Comments
0.0[#]	1/2+	9.25 d *2*	
10.412[#] *17*	3/2+	0.95 ns *5*	$T_{1/2}$: ceγ(t) and γγ(t) (1980AlZE).
116.564[#] *16*	5/2+	66 ps *7*	$T_{1/2}$: other: ≤100 ps from (ce)γ(t) and γγ(t) (1980AlZE).
142.404[#] *19*	7/2+		
171.72[@] *5*	(1/2)−		
179.464[&] *19*	7/2+	1.16 μs *6*	$T_{1/2}$: from (x ray)γ(t) (1964Lo04). Other: 1.1 μs *1* (K-x ray)γ(t) (1965Ta01).
187.622[@] *23*	5/2−		
282.20 *4*	(3/2)		3/2−, π1/2[541] assigned in 1971Fu10; however, in ^{165}Ho(α,2nγ) and ^{167}Er(p,nγ) this configuration is assigned for the 291 level.
285.864[@] *25*	9/2−		
290.87[@] *7*	(3/2−)		See comment with 282.2 level.
292.798[a] *21*	7/2−	0.9 μs *1*	$T_{1/2}$: from (K-x ray)γ(t) (1965Ta01).
296.14[&] *3*	9/2+		
326.57[#] *13*	9/2+		
383.68[a] *6*	9/2−		
470.93[b] *4*	3/2+		
496.6?[a] *3*	11/2−		
522.15[b] *5*	5/2+		
557.84[c] *5*	5/2+		
867.72? *14*	(5/2+,7/2,9/2−)		
1216.51 *6*	7/2+		
1229.82 *10*	(7/2−)		
1432.29? *10*	(5/2−,7/2)		
1527.41 *7*	(5/2−)		
1543.84 *17*			Level proposed in 1971GoYX only based on placement of 1217.1-, 1401.9-, 1427.7-, and 1533.6-keV γ rays. Note that 1401.9γ is placed from 1581 level in both 1971Fu10 and 1971GoYX. Other three γ rays are reported in 1971Fu10 but as unplaced. Jπ=5/2,7/2 proposed in 1971GoYX.
1580.95 *5*	(5/2+,7/2+)		
1597.54 *7*	(5/2−,7/2+)		
1629.17 *10*	(5/2+,7/2+)		
1654.29 *8*	(5/2+,7/2+)		Level also in 1971GoYX.

† From least squares fit to Eγ data.
‡ From the Adopted Levels.
\# Band(A): π1/2[411] band.
@ Band(B): π1/2[541] band.
& Band(C): π7/2[404] band.
a Band(D): π7/2[523] band.
b Band(E): π3/2[411] band.
c Band(F): π5/2[402] band.

^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX (continued)

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
(299 *4*)	1654.29		0.051 *6*	6.28 *5*		εK=0.7771 *13*; εL=0.1671 *8*; εM+=0.05576 *35*
(324 *4*)	1629.17		0.029 *4*	6.61 *6*		εK=0.7829 *11*; εL=0.1630 *7*; εM+=0.05415 *31*
(356 *4*)	1597.54		0.093 *9*	6.20 *5*		εK=0.7887 *10*; εL=0.1588 *6*; εM+=0.05252 *27*
(372 *4*)	1580.95		0.128 *10*	6.11 *4*		εK=0.7913 *9*; εL=0.1569 *5*; εM+=0.05179 *25*
(409 *4*)	1543.84		0.0116 *25*	7.24 *9*		εK=0.7961 *8*; εL=0.15343 *44*; εM+=0.05043 *23*
(426 *4*)	1527.41		0.185 *21*	6.08 *5*		εK=0.7980 *7*; εL=0.15210 *41*; εM+=0.04991 *22*
(521# *4*)	1432.29?		0.053 *9*	6.82 *7*		εK=0.8061 *5*; εL=0.14629 *30*; εM+=0.04766 *18*
(723 *4*)	1229.82		0.084 *12*	6.93 *6*		εK=0.81546 *39*; εL=0.13950 *19*; εM+=0.04505 *13*
(737 *4*)	1216.51		0.76 *8*	5.99 *5*		εK=0.81588 *38*; εL=0.13920 *19*; εM+=0.04492 *13*
(1085 *4*)	867.72?	1.6×10^{-9} *8*	0.023 *4*	7.87 *8*	0.023 *4*	av Eβ=36.4 *21*; εK=0.82295 *30*; εL=0.13408 *13*; εM+=0.04297 *11*
(1395 *4*)	557.84	5.04×10^{-5} *41*	0.094 *6*	7.484 *28*	0.094 *6*	av Eβ=183.4 *18*; εK=0.82567 *28*; εL=0.13172 *12*; εM+=0.04207 *11*
(1431# *4*)	522.15					Transition intensity balance gives I($\varepsilon+\beta^+$)=−0.066 *5*.
(1482 *4*)	470.93	5.4×10^{-5} *8*	0.042 *6*	7.89 *6*	0.042 *6*	av Eβ=222.2 *18*; εK=0.82569 *27*; εL=0.13116 *11*; εM+=0.04186 *10*
(1626# *4*)	326.57			1*u*		Transition intensity balance gives I($\varepsilon+\beta^+$)=0.014 *14*.
(1657# *4*)	296.14			1*u*		Transition intensity balance gives I($\varepsilon+\beta^+$)=0.00 *5*.
1661 *4*	292.798	0.453 *26*	96.5 *50*	4.628 *23*	97 *5*	av Eβ=300.8 *18*; εK=0.82397 *28*; εL=0.12993 *11*; εM+=0.04142 *10* E(decay): from Eβ+=639 *4* (1978Cr06, magnetic spectrometer). Other: 640 *20* (1965Gr20). %β^+(exp)=0.5 *1* (1978Cr06, magnetic spectrometer). Other: 0.4% *1* (1965Gr20).
(1662 *4*)	290.87	7.1×10^{-4} *14*	0.15 *3*	7.44 *9*	0.15 *3*	av Eβ=301.6 *18*; εK=0.82394 *28*; εL=0.12992 *11*; εM+=0.04142 *10*
(1671 *4*)	282.20	0.0030 *20*	0.60 *40*	6.84 *29*	0.60 *40*	av Eβ=305.4 *18*; εK=0.82378 *28*; εL=0.12985 *11*; εM+=0.04139 *10*
(1765# *4*)	187.622					Transition intensity balance gives I($\varepsilon+\beta^+$)=−0.1 *4*.
(1774# *4*)	179.464					Transition intensity balance gives I($\varepsilon+\beta^+$)=0 *12*.
(1781# *4*)	171.72					Transition intensity balance gives I($\varepsilon+\beta^+$)=−0.09 *15*.
(1811# *4*)	142.404					Transition intensity balance gives I($\varepsilon+\beta^+$)=−1.5 *23*. No feeding expected from K-forbiddenness.
(1836# *4*)	116.564					Transition intensity balance gives I($\varepsilon+\beta^+$)=3 *12*. No feeding expected from K-forbiddenness.

† $\varepsilon+\beta^+$ feedings are from intensity imbalance at each level. It is assumed that there is no direct ε feeding to the g.s. or the 10.4 level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{167}Tm)

Iγ normalization: From I(γ+ce to g.s.)+I(γ+ce to 10.4 level)=100% from levels above 10.4 level, assuming no ε feeding from 5/2$^-$ parent to 1/2$^+$, g.s. or 3/2$^+$, 10.4 level (log $f^{1u}t$>8.5 implies %(ε+β^+)<0.2 to g.s.; log ft≥5.9 implies %(ε+β^+)≤6.5 to 10.4 level). In addition, ε+β^+ feeding to the g.s., 1/2$^+$ and 10.4, 3/2$^+$ members of K^π=1/2$^+$, π1/2[411] is K-forbidden from the ^{167}Yb g.s., J^π=5/2$^-$ parent with configuration=K^π=5/2$^-$, ν5/2[523], as exemplified by no evidence of ε+β^+ feeding to the 5/2$^+$ and 7/2$^+$ members of the π1/2[411] band in ^{167}Tm. There are many unplaced γ rays, but most of the confirmed ones are weak, adding to total estimated transition intensity of about 2%, well within the 4% uncertainty for the γ-normalization factor.

Iγ(Tm K x ray)≈1220, relative to Iγ=100 for 176.2γ(1960Wi15), which can be compared with deduced Iγ(Tm K x ray)=911 from the present decay scheme.

Uncertainty in relative conversion electron intensities=20-30% (1971Fu10).

E$_\gamma$[†]	I$_\gamma$[†a]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[&]	δ[&]	α[b]	I$_{(\gamma+ce)}$[a]	Comments
(6.93)		292.798	7/2$^-$	285.864	9/2$^-$				13.3 *4*	E$_\gamma$: this transition is expected from the observed values of Iγ(143.5γ) in prompt and delayed (x ray)γ-coin data. E$_\gamma$: from energy difference between 293 and 286 levels. I$_{(\gamma+ce)}$: from intensity balance at 286 level.
10.419 *25*	0.68 *5*	10.412	3/2$^+$	0.0	1/2$^+$	M1+E2	0.043 *+4−3*	648 *38*	442 *19*	%Iγ=0.141 *12* α(L)=503 *37*; α(M)=115 *9*; α(N)=26.4 *20*; α(O)=3.47 *23*; α(P)=0.1254 *20* E$_\gamma$: weighted average of 10.45 *5* (1993AbZZ), 10.41 *3* (116.57 *2*−106.16 *2*), 10.43 *11* (171.75 *8*−161.32 *8*) 10.3 *3* (272.1 *2*−282.4 *2*), and 10.36 *21* (290.86 *7*- 280.5 *2*). Differences of the same γ-ray energies in (α,2nγ) and (p,nγ) cannot be used as for each set one γ ray is a doublet. The same value is recommended in the Adopted Gammas. Ice(M1):Ice(M2):Ice(M3)=43 *5*:14 *2*:21 *3* (1993AbZZ,1981AbZR). Mult.,δ: from M-subshell ratios. The same value is recommended in the Adopted Gammas. I$_\gamma$: from α and I(γ+ce)=442 *19* (deduced from transition intensity balance at the 10.4 level), assuming no ε+β^+ feeding to this level. Thanks to Tibor Kibedi (ANU) who provided (Aug 15, 2021) calculated total theoretical conversion coefficients for L-, M-, N-, O- and P-shells, as well as subshells using “BrIccRaine” computer code.
25.83 *2*	0.22 *7*	142.404	7/2$^+$	116.564	5/2$^+$	M1+E2	0.035	28.5 *4*		%Iγ=0.046 *15* α(L)=22.20 *32*; α(M)=4.98 *7* α(N)=1.162 *16*; α(O)=0.1643 *23*; α(P)=0.00841 *12* Eγ=25.90 *10* (1971GoYX).

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	$I_{(\gamma+ce)}$[a]	Comments
										L1:L2:L3=≈0.2:≈0.2:≈0.5 (1971Fu10). α=29.4 +*23*−*14* for a 50% uncertainty in δ. I_γ: from I(γ+ce)=6.6 *20* deduced from I(γ+ce)(132.0γ)=28.7 *8* and I(γ+ce)(25.8γ)/I(γ+ce)(132.0γ)=0.23 *7* (1971Fu10, from γγ coin), assuming α=29.4. Mult.,δ: reported in 1981AbZR with no experimental details given.
35.69[@] *3*		557.84	5/2$^+$	522.15	5/2$^+$				>0.4	Ice(L1)/Ice(M1)=0.3 *1*/≈0.1 (1993AbZZ). $I_{(\gamma+ce)}$: from Ice(L1)+Ice(M1).
37.05 *2*	0.93 *33*	179.464	7/2$^+$	142.404	7/2$^+$	M1+E2	0.326 *5*	31.3 *8*		%Iγ=0.19 *7* α(L)=24.1 *6*; α(M)=5.74 *15* α(N)=1.31 *4*; α(O)=0.159 *4*; α(P)=0.00266 *4* Eγ=37.03 *5* (1971GoYX). L1:L2:L3=1.00:1.43 6:1.64 5 (1987BaZB). L1:L2:L3:M1:M2:M3:N=2.5:3.5:4.0:1.0:1.1:1.2:0.4 (1971Fu10). L1:L2:L3=1:1.15 *10*:1.03 (1965Gr20). I_γ: I(γ+ce)(37γ)=29 *10* from I(γ+ce)(62.9γ)=317 *54* and I(γ+ce)(37.0γ)/I(γ+ce)(62.9γ)=0.09 *3* (1971Fu10, from γγ-coin). Other: Iγ(exp)=0.5 *2* (in Table 1 of 1971Fu10). δ: deduced by evaluators from L-subshell data in 1987BaZB. Others: δ=0.283 *15* from L-subshell data in 1965Gr20, assuming 25% uncertainty in L3/L1; 0.32 *8* with L-subshell ratios from 1987BaZB and 1965Gr20, but the fit is somewhat poor.
62.90 *2*	24 *4*	179.464	7/2$^+$	116.564	5/2$^+$	M1+E2	0.065 *5*	11.78 *17*		%Iγ=5.0 *9* α(K)=9.77 *14*; α(L)=1.566 *24*; α(M)=0.350 *6* α(N)=0.0819 *13*; α(O)=0.01166 *18*; α(P)=0.000610 *9* Eγ=62.88 *5*, Iγ=21.7 (1971GoYX). L1:L2:L3:M1:M2:M3:N=40:4.6:1.9:11:2.4:0.2:2.9 (1971Fu10). L1:L2:L3=26 *3*:3.6 *4*:1 (1965Gr20). δ: deduced from L-subshell ratio in 1965Gr20. Other: 0.15 from sub-shell ratios in 1971Fu10.
[x]71.30[@] *3*										Ice(L1)/Ice(M1)=1.2 *2*/0.3 *1* (1993AbZZ). All δ values possible for mult=M1+E2 or E1+M2 from L1/M1 ratio. E_γ: from 1993AbZZ. Proposed placement from 188 level by 1993AbZZ disagrees with level-energy difference of 71.05 keV *2*.

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

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	$I_{(\gamma+ce)}$[a]	Comments
^{x}87.54[@] *4*										Ice(L1)/Ice(M1)=2.0 *2*/0.5 *2* (1993AbZZ). No meaningful δ value for mult=M1+E2 or E1+M2 from L1/M1 ratio. E_γ: from 1993AbZZ. Proposed placement from 383 level by 1993AbZZ is considered incorrect as measured Ice(L1)=2.0 *3* and Ice(M1)=0.5 *2* (1993AbZZ) imply I(γ+ce)=74 *8* if mult=E1, giving %($\varepsilon+\beta^+$)=15 for a ΔJ=2, $\Delta\pi$=no β transition to the 383 level and a non-physical −15% branch for the 296 level, both of which are unlikely scenarios. Additionally, this transition was not reported in (α,2nγ) work (1980Ol05), whereas the 91γ from the 383 level is strong in this work.
90.83 *6*	0.09 *4*	383.68	9/2$^-$	292.798	7/2$^-$	M1		4.09 *6*		%Iγ=0.019 *8* α(K)exp≈2.0 (1971Fu10); α(K)exp=11 *5* (1993AbZZ) α(K)=3.42 *5*; α(L)=0.519 *7*; α(M)=0.1158 *16* α(N)=0.0271 *4*; α(O)=0.00389 *6*; α(P)=0.0002104 *30* Ice(K)≈0.2 (1971Fu10). Ice(K)=1.0 *2* (1993AbZZ).
94.53[@] *5*	0.6 *5*	282.20	(3/2)	187.622	5/2$^-$	[D,E2]		2.1 *17*	1.8 *15*	%Iγ=0.12 *10* I_γ,$I_{(\gamma+ce)}$: from Ice(K)=1.0 *2* (1993AbZZ), assuming mult=D,E2.
98.24 *3*	0.40 *4*	285.864	9/2$^-$	187.622	5/2$^-$	E2		3.28 *5*		%Iγ=0.083 *9* α(K)=1.090 *15*; α(L)=1.679 *24*; α(M)=0.411 *6* α(N)=0.0934 *13*; α(O)=0.01084 *15*; α(P)=4.58×10^{-5} *6* K:L2:L3:M3=LT 2:0.4:0.4:LT 0.1 (1971Fu10).
(103.32 *5*)	0.087 *36*	290.87	(3/2$^-$)	187.622	5/2$^-$	[M1,E2]		2.77 *7*		α(K)=1.7 *7*; α(L)=0.8 *5*; α(M)=0.20 *12* α(N)=0.046 *28*; α(O)=0.0056 *30*; α(P)=9.E−5 *5* %Iγ=0.018 *8* E_γ: from the Adopted Gammas, γ masked by neighboring intense lines in ^{167}Yb ε decay in 1971Fu10. I_γ: from Iγ(280.5γ) and adopted I(103.32γ)/I(280.5γ)=2.9 *10* taken from (α,2nγ).
105.19 *2*	2.9 *3*	292.798	7/2$^-$	187.622	5/2$^-$	M1		2.68 *4*		α(K)exp=2.8 α(K)=2.246 *31*; α(L)=0.340 *5*; α(M)=0.0758 *11* α(N)=0.01774 *25*; α(O)=0.00255 *4*; α(P)=0.0001379 *19* %Iγ=0.60 *7* K:L1:M1=8.2:0.8:0.1 (1971Fu10).

From ENSDF

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

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	$I_{(\gamma+ce)}$[a]	Comments
106.16 *2*	110 *5*	116.564	5/2⁺	10.412	3/2⁺	M1+E2	0.116 *+27−20*	2.61 *4*		%Iγ=22.9 *14* K/L=6.1 *20* α(K)=2.17 *4*; α(L)=0.342 *8*; α(M)=0.0767 *18* α(N)=0.0179 *5*; α(O)=0.00255 *5*; α(P)=0.0001330 *20* Eγ=106.14 *5*, Iγ=197 (1971GoYX). K:L1:L2:L3:M1:M2:M3:N=240:40:4.2:1.5:6.6: 0.86:0.33:0.33 (1971Fu10). L1:L2:L3=37 *7*:2.5 *5*/1 (1965Gr20). δ: deduced from L-subshell ratio in 1965Gr20. Other: 0.3 from sub-shell ratios in 1971Fu10.
110.49[@] *5*	0.36 *31*	282.20	(3/2)	171.72	(1/2)⁻	[D,E2]		1.3 *10*	0.8 *7*	%Iγ=0.08 *7* Ice(K)/Ice(L1)=0.4 *1*:0.05 *2* (1993AbZZ). Mult.: not M2 from K/L1. I_γ,$I_{(\gamma+ce)}$: from Ice(K)=0.4 *1* (1993AbZZ), assuming mult=D,E2.
(112.89 *4*)	0.007 *7*	496.6?	11/2⁻	383.68	9/2⁻	M1+E2	+0.16 *1*	2.186 *31*		α(K)=1.809 *26*; α(L)=0.293 *5*; α(M)=0.0658 *10* α(N)=0.01535 *24*; α(O)=0.002173 *33*; α(P)=0.0001106 *16* %Iγ=0.0015 *15* E_γ,Mult.,δ: from the Adopted Gammas. This γ not resolved from 113.32γ in ^{167}Yb ε decay. I_γ: from α and I(γ+ce)=0.017 *17* from intensity balance at 497 level.
113.32 *2*	270 *10*	292.798	7/2⁻	179.464	7/2⁺	E1		0.2397 *34*		%Iγ=56.2 *30* α(K)exp=0.25 (1971Fu10) K/L=5.5 *15* α(K)=0.1992 *28*; α(L)=0.0317 *4*; α(M)=0.00705 *10* α(N)=0.001621 *23*; α(O)=0.0002165 *30*; α(P)=9.04×10^{-6} *13* Eγ=113.30 *5*, Iγ=450 (1971GoYX). K:L1:L2:L3:M1:M2:M3:N=69:8.7:1.2:1.3:1.6: 0.19:0.21:0.5 (1971Fu10). L1:L2:L3=1.00:0.244 *12*:0.270 *15* (1987BaZB). L1:L2:L3=7.4 *20*:1:1 (1965Gr20).
116.57 *2*	13.8 *3*	116.564	5/2⁺	0.0	1/2⁺	E2		1.727 *24*		%Iγ=2.87 *13* K/L=0.87 *10* α(K)exp=0.72 (1971Fu10); α(K)exp=0.70 *7* (1993AbZZ) α(K)=0.726 *10*; α(L)=0.767 *11*; α(M)=0.1872 *26*

$^{167}_{69}Tm_{98}$-7

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	α[b]	$I_{(\gamma+ce)}$[a]	Comments
									α(N)=0.0426 *6*; α(O)=0.00499 *7*; α(P)=3.05×10^{-5} *4* Eγ=116.55 *5*, Iγ=23.3 (1971GoYX). Ice(K):Ice(L1):Ice(L2):Ice(L3)=9.7 10:0.86 9:4.3 5:4.3 5 (1993AbZZ, same values but without uncertainties in 1971Fu10). K:L1:L2:L3:M1:M2:M3:N=9.7:0.86:4.3:4.3:0.14:0.75:0.31 (1971Fu10). L1:L2:L3=1:5.5 *10*: 5 *1* (1965Gr20).
116.66[@] *3*	0.12 *5*	296.14	9/2$^+$	179.464	7/2$^+$	M1	1.995 *28*	0.37 *16*	α(K)=1.671 *23*; α(L)=0.2526 *35*; α(M)=0.0563 *8* α(N)=0.01318 *18*; α(O)=0.001894 *27*; α(P)=0.0001025 *14* %Iγ=0.025 *11* E$_\gamma$: other: Eγ=116.6 *1* (1971Fu10). Ice(K)/Ice(L1)=0.5 *1*/≈0.08 (1993AbZZ). I$_\gamma$: from α and I(γ+ce), the latter from intensity balance at 296 level, assuming no $\varepsilon+\beta^+$ branch to that level.
131.99 *2*	13.6 *4*	142.404	7/2$^+$	10.412	3/2$^+$	E2	1.098 *15*		%Iγ=2.83 *14* α(K)exp=0.48 (1971Fu10) K/L=1.3 *2* α(K)=0.525 *7*; α(L)=0.439 *6*; α(M)=0.1069 *15* α(N)=0.02434 *34*; α(O)=0.00287 *4*; α(P)=2.245×10^{-5} *31* Eγ=132.01 *5*, Iγ=19.8 (1971GoYX). Ice(K):Ice(L1):Ice(L2):Ice(L3)=6.5 8:0.65 8:2.0 3:1.9 3 (1993AbZZ, same values but without uncertainties in 1971Fu10). K:L1:L2:L3:M2:M3=6.5:0.65:2.0:1.9:0.32:0.33 (1971Fu10). L1:L2:L3=1:5.0 *10*:3.5 *5* (1965Gr20).
143.46 *2*	10.3 *3*	285.864	9/2$^-$	142.404	7/2$^+$	E1	0.1284 *18*		%Iγ=2.14 *10* α(K)exp=0.08 (1971Fu10) α(K)=0.1072 *15*; α(L)=0.01657 *23*; α(M)=0.00368 *5* α(N)=0.000849 *12*; α(O)=0.0001149 *16*; α(P)=5.03×10^{-6} *7* Eγ=143.41 *5*, Iγ=13.9 (1971GoYX, unplaced). Ice(K)=0.78 (1971Fu10).
150.40 *3*	0.18 *5*	292.798	7/2$^-$	142.404	7/2$^+$	E1	0.1133 *16*		%Iγ=0.037 *11* α(K)exp=0.11 (1971Fu10) α(K)=0.0947 *13*; α(L)=0.01456 *20*; α(M)=0.00324 *5* α(N)=0.000747 *10*; α(O)=0.0001013 *14*; α(P)=4.47×10^{-6} *6* Eγ=150.5 *3*, Iγ=0.192 (1971GoYX, tentative γ). Ice(K)=0.02 (1971Fu10), ≈0.02 (1993AbZZ).
^{x}156.5[#] *5*	0.25[#]								%Iγ=0.0520
161.32 *8*	0.17 *5*	171.72	(1/2)$^-$	10.412	3/2$^+$	(E1)	0.0942 *13*		α(K)exp=0.71 *27* (1993AbZZ) α(K)=0.0788 *11*; α(L)=0.01204 *17*; α(M)=0.00268 *4* α(N)=0.000617 *9*; α(O)=8.41×10^{-5} *12*; α(P)=3.76×10^{-6} *5* %Iγ=0.035 *11* Ice(K)=0.12 *3* (1993AbZZ).

γ(^{167}Tm) (continued)

E_γ [†]	I_γ [†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [&]	α [b]	Comments
								1993AbZZ assigned E1 suggesting that quoted I(ce) is high by an order of magnitude.
^{x}162.6[#] 6	1.04[#]							%Iγ=0.216
169.04 3	0.77 7	179.464	7/2$^+$	10.412	3/2$^+$	E2	0.460 6	%Iγ=0.160 16 α(K)exp=0.32 (1971Fu10) α(K)=0.265 4; α(L)=0.1495 21; α(M)=0.0361 5 α(N)=0.00824 12; α(O)=0.000991 14; α(P)=1.192×10^{-5} 17 Eγ=169.7 5, Iγ=1.03 (1971GoYX, tentative and unplaced). Ice(K)=0.25 (1971Fu10).
171.75 8	0.18 5	171.72	(1/2)$^-$	0.0	1/2$^+$	E1	0.0799 11	α(K)exp≈0.07 (1993AbZZ) α(K)=0.0669 9; α(L)=0.01016 14; α(M)=0.002258 32 α(N)=0.000521 7; α(O)=7.12×10^{-5} 10; α(P)=3.21×10^{-6} 5 %Iγ=0.037 11 Ice(K)≈0.012 (1993AbZZ). Mult.: α(K)exp consistent with multipolarity from the Adopted Gammas.
(174.26 7)	0.061 24	290.87	(3/2$^-$)	116.564	5/2$^+$	(E1)	0.0769 11	α(K)=0.0644 9; α(L)=0.00977 14; α(M)=0.002171 30 α(N)=0.000501 7; α(O)=6.85×10^{-5} 10; α(P)=3.10×10^{-6} 4 %Iγ=0.013 5 E_γ: from the Adopted Gammas, γ masked by neighboring intense γ rays in 1971Fu10. I_γ: from Iγ(280.5γ) and adopted I(174.25γ)/I(280.5γ)=2.04 63, taken from average value of (α,2nγ) and (p,nγ).
176.23 3	100	292.798	7/2$^-$	116.564	5/2$^+$	E1	0.0747 10	%Iγ=20.8 8 α(K)exp=0.036 (1971Fu10) K/L=7.3 15 α(K)=0.0625 9; α(L)=0.00948 13; α(M)=0.002106 30 α(N)=0.000486 7; α(O)=6.65×10^{-5} 9; α(P)=3.02×10^{-6} 4 Eγ=176.31 10, Iγ=100 (1971GoYX). Ice(K)=3.6 (1971Fu10). L1:L2:L3=4.0 10:1.3:1 (1965Gr20).
177.22 3	13.3 5	187.622	5/2$^-$	10.412	3/2$^+$	E1	0.0736 10	%Iγ=2.77 15 α(K)exp=0.034 (1971Fu10) α(K)=0.0616 9; α(L)=0.00934 13; α(M)=0.002074 29 α(N)=0.000479 7; α(O)=6.55×10^{-5} 9; α(P)=2.97×10^{-6} 4 Ice(K)=0.45 (1971Fu10). Ice(K)/Ice(L1)=0.45 6/0.06 2 (1993AbZZ).
179.55[@] 5	0.22 9	296.14	9/2$^+$	116.564	5/2$^+$	[E2]	0.374 5	α(K)=0.2229 31; α(L)=0.1159 16; α(M)=0.0279 4 α(N)=0.00638 9; α(O)=0.000770 11; α(P)=1.018×10^{-5} 14 %Iγ=0.046 19 I_γ: from I(ce(K))=0.05 2 (1993AbZZ), assuming E2 transition.
^{x}184.0[#] 5	0.072[#]							%Iγ=0.0150

$^{167}_{69}$Tm$_{98}$-9

^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX (continued)

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	Comments
184.1 *2*	0.07 *4*	326.57	9/2$^+$	142.404	7/2$^+$	(M1+E2)	−0.12 *+11−18*	0.548 *16*	α(K)=0.458 *19*; α(L)=0.0698 *26*; α(M)=0.0156 *7* α(N)=0.00365 *15*; α(O)=0.000522 *14*; α(P)=2.80×10^{-5} *13* %Iγ=0.015 *8* Eγ=184.0 *5*, Iγ=0.072 (1971GoYX, tentative and unplaced). δ: from Adopted Gammas.
^{x}198.3[#] *5*	0.069[#]								%Iγ=0.0144
(209.93 *3*)	0.031 *18*	326.57	9/2$^+$	116.564	5/2$^+$	E2		0.2214 *31*	α(K)=0.1424 *20*; α(L)=0.0607 *9*; α(M)=0.01455 *20* α(N)=0.00333 *5*; α(O)=0.000408 *6*; α(P)=6.75×10^{-6} *9* %Iγ=0.006 *4* E_γ: from the Adopted Gammas. I_γ: from Iγ(184.1γ) and γ-branching ratio in Adopted Gammas.
^{x}218.6[‡] *3*	0.48[‡]								%Iγ=0.100
^{x}225.7[‡] *4*	0.60[‡]								%Iγ=0.125
272.1 *2*	0.013 *4*	282.20	(3/2)	10.412	3/2$^+$	[D,E2]		0.11 *8*	%Iγ=0.0027 *8*
280.5 *2*	0.030 *7*	290.87	(3/2$^-$)	10.412	3/2$^+$				%Iγ=0.0062 *15* Placement based on the Adopted dataset, unplaced in 1971Fu10.
^{x}282.1[‡] *2*	0.53[‡]								%Iγ=0.110
282.4 *2*	0.041 *8*	282.20	(3/2)	0.0	1/2$^+$	[D,E2]		0.09 *7*	%Iγ=0.0085 *17*
^{x}290.0[‡] *5*	0.60[‡]								%Iγ=0.125
290.86 *7*	0.283 *32*	290.87	(3/2$^-$)	0.0	1/2$^+$	(E1)		0.02074 *29*	α(K)=0.01747 *24*; α(L)=0.00255 *4*; α(M)=0.000566 *8* α(N)=0.0001312 *18*; α(O)=1.829×10^{-5} *26*; α(P)=8.91×10^{-7} *12* %Iγ=0.059 *7* Placement based on the Adopted dataset, unplaced in 1971Fu10.
^{x}321.1 *5*	0.011 *5*								%Iγ=0.0023 *11*
^{x}323.5 *5*	0.017 *5*								%Iγ=0.0035 *11*
^{x}343.29 *8*	0.167 *20*								%Iγ=0.035 *4* Eγ=343.3 *2*, Iγ=0.129 (1971GoYX).
^{x}351.8 *4*	0.016 *6*								%Iγ=0.0033 *13* Eγ=351.8 *2*, Iγ=0.089 (1971GoYX, tentative).
354.57		470.93	3/2$^+$	116.564	5/2$^+$				
^{x}375.9 *2*	0.033 *8*								%Iγ=0.0069 *17*
379.9 *3*	0.021 *7*	522.15	5/2$^+$	142.404	7/2$^+$	M1		0.0773 *11*	α(K)=0.0650 *9*; α(L)=0.00958 *14*; α(M)=0.002131 *30* α(N)=0.000499 *7*; α(O)=7.19×10^{-5} *10*; α(P)=3.93×10^{-6} *6* %Iγ=0.0044 *15* Mult.: from the Adopted Gammas.
^{x}387.0 *4*	0.011 *5*								%Iγ=0.0023 *11*

γ(^{167}Tm) (continued)

Eγ[†]	Iγ[†a]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[&]	α[b]	Comments
x398.1 *2*	0.023 *5*							%Iγ=0.0048 *11*
405.57 *8*	0.070 *10*	522.15	5/2+	116.564	5/2+	(M1)	0.0651 *9*	α(K)=0.0548 *8*; α(L)=0.00806 *11*; α(M)=0.001791 *25* α(N)=0.000419 *6*; α(O)=6.04×10^{-5} *8*; α(P)=3.31×10^{-6} *5* %Iγ=0.0146 *22* Eγ=405.6 *2*, Iγ=0.083 (1971GoYX, unplaced). Mult.: from Adopted Gammas.
415.4 *2*	0.020 *5*	557.84	5/2+	142.404	7/2+	(M1+E2)	0.045 *17*	α(K)=0.037 *15*; α(L)=0.0063 *13*; α(M)=0.00141 *27* α(N)=0.00033 *6*; α(O)=4.6×10^{-5} *11*; α(P)=2.1×10^{-6} *10* %Iγ=0.0042 *11*
x421.4 *2*	0.020 *5*							%Iγ=0.0042 *11*
441.2 *1*	0.055 *11*	557.84	5/2+	116.564	5/2+	(M1)	0.0523 *7*	α(K)=0.0440 *6*; α(L)=0.00645 *9*; α(M)=0.001434 *20* α(N)=0.000336 *5*; α(O)=4.84×10^{-5} *7*; α(P)=2.65×10^{-6} *4* %Iγ=0.0114 *23* Eγ=441.2 *2*, Iγ=0.056 (1971GoYX, unplaced).
x446.8 *3*	0.012 *4*							%Iγ=0.0025 *8* Eγ=447.1 *3*, Iγ=0.038 (1971GoYX).
x457.0 *1*	0.033 *7*							%Iγ=0.0069 *15* Eγ=457.0 *5*, Iγ=0.085 (1971GoYX).
460.36 *9*	0.130 *17*	470.93	3/2+	10.412	3/2+	(M1)	0.0468 *7*	%Iγ=0.027 *4* α(K)exp≈0.04 (1993AbZZ) α(K)=0.0394 *6*; α(L)=0.00577 *8*; α(M)=0.001282 *18* α(N)=0.000300 *4*; α(O)=4.33×10^{-5} *6*; α(P)=2.374×10^{-6} *33* Eγ=460.4 *4*, Iγ=0.151 (1971GoYX, unplaced). Ice(K)≈0.005 (1993AbZZ). Mult.: from the Adopted Gammas.
470.65 *9*	0.111 *14*	470.93	3/2+	0.0	1/2+	(M1)	0.0442 *6*	%Iγ=0.0231 *31* α(K)exp≈0.04 (1993AbZZ) α(K)=0.0372 *5*; α(L)=0.00545 *8*; α(M)=0.001210 *17* α(N)=0.000283 *4*; α(O)=4.08×10^{-5} *6*; α(P)=2.241×10^{-6} *31* Eγ=470.6 *2*, Iγ=0.095 (1971GoYX, tentative and unplaced). Ice(K)≈0.004 (1993AbZZ). Mult.: from the Adopted Gammas.
x486.6 *2*	0.033 *8*							%Iγ=0.0069 *17*
511[d]		522.15	5/2+	10.412	3/2+			Eγ: this γ, if present, is not resolved from the 511-keV annihilation radiation.
x541.4 *2*	0.022 *6*							%Iγ=0.0046 *13* Eγ=541.5 *3*, Iγ=0.033 (1971GoYX).
547.5 *1*	0.061 *10*	557.84	5/2+	10.412	3/2+	M1	0.0300 *4*	%Iγ=0.0127 *21* α(K)exp≈0.05 (1993AbZZ) α(K)=0.02524 *35*; α(L)=0.00367 *5*; α(M)=0.000816 *11* α(N)=0.0001909 *27*; α(O)=2.75×10^{-5} *4*; α(P)=1.515×10^{-6} *21* Eγ=547.6 *2*, Iγ=0.102 (1971GoYX, unplaced). Ice(K)≈0.003 (1993AbZZ).

$^{167}_{69}$Tm$_{98}$-11

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[b]	Comments
[x]561.8 *4*	0.014 *5*							%Iγ=0.0029 *11*
571.3 *2*	0.032 *7*	867.72?	(5/2$^+$,7/2,9/2$^-$)	296.14	9/2$^+$			%Iγ=0.0067 *15*
[x]590.9 *4*	0.023 *8*							%Iγ=0.0048 *17*
[x]600.2 *4*	0.020 *6*							%Iγ=0.0042 *13*
[x]664.9 *2*	0.044 *12*							%Iγ=0.0092 *25* Eγ=665.1 *5*, Iγ=0.029 (1971GoYX, tentative).
672.1 *2*	0.039 *10*	1229.82	(7/2$^-$)	557.84	5/2$^+$			%Iγ=0.0081 *21* Eγ=672.1 *3*, Iγ=0.044 (1971GoYX, tentative and unplaced).
680.3 *5*	0.021 *7*	867.72?	(5/2$^+$,7/2,9/2$^-$)	187.622	5/2$^-$			%Iγ=0.0044 *15* Eγ=680.4 *3*, Iγ=0.025 (1971GoYX, tentative and unplaced).
[x]686.9 *5*	0.026 *13*							%Iγ=0.0054 *27* Eγ=687.1 *2*, Iγ=0.025 (1971GoYX).
688.5 *2*	0.057 *16*	867.72?	(5/2$^+$,7/2,9/2$^-$)	179.464	7/2$^+$			%Iγ=0.0119 *34* Eγ=688.6 *4*, Iγ=0.058 (1971GoYX, tentative and unplaced).
[x]694.5 *6*	0.020 *13*							%Iγ=0.0042 *27* Eγ=694.1 *4*, Iγ=0.033 (1971GoYX, tentative).
[x]695.6[‡] *4*	0.021[‡]							%Iγ=0.00437
[x]697.1 *6*	0.020 *14*							%Iγ=0.0042 *29* Eγ=697.3 *4*, Iγ=0.045 (1971GoYX).
707.7 *4*	0.016 *9*	1229.82	(7/2$^-$)	522.15	5/2$^+$			%Iγ=0.0033 *19* Eγ=707.7 *4*, Iγ=0.045 (1971GoYX, unplaced).
[x]719.5 *3*	0.019 *6*							%Iγ=0.0040 *13* Eγ=719.7 *4*, Iγ=0.048 (1971GoYX).
733.2[d] *3*	0.034 *10*	1229.82	(7/2$^-$)	496.6?	11/2$^-$			%Iγ=0.0071 *21* Eγ=733.1 *3*, Iγ=0.042 (1971GoYX, tentative and unplaced).
[x]791.5 *2*	0.063 *12*							%Iγ=0.0131 *26* Eγ=791.6 *2*, Iγ=0.076 (1971GoYX).
[x]794.2[‡] *5*	0.011[‡]							%Iγ=0.00229
[x]815.9[‡] *3*	0.039[‡]							%Iγ=0.0081
[x]829.4 *3*	0.034 *9*							%Iγ=0.0071 *19* Eγ=829.3 *3*, Iγ=0.070 (1971GoYX).
832.9 *3*	0.051	1216.51	7/2$^+$	383.68	9/2$^-$			%Iγ=0.0106 E_γ,I_γ: γ from 1971GoYX only.
846.1 *2*	0.065 *12*	1229.82	(7/2$^-$)	383.68	9/2$^-$			%Iγ=0.0135 *26* Eγ=846.2 *2*, Iγ=0.103 (1971GoYX).
903.3 *2*	0.033 *9*	1229.82	(7/2$^-$)	326.57	9/2$^+$			%Iγ=0.0069 *19* Eγ=903.3 *2*, Iγ=0.015 (1971GoYX). This γ unplaced in 1971Fu10.
[x]905.3[‡] *3*	0.020[‡]							%Iγ=0.00416
920.32 *8*	0.570 *86*	1216.51	7/2$^+$	296.14	9/2$^+$	M1	0.00815 *11*	%Iγ=0.119 *19* α(K)exp=0.0070 *20* (1993AbZZ) α(K)=0.00689 *10*; α(L)=0.000985 *14*; α(M)=0.0002181 *31*

$^{167}_{69}Tm_{98}$-12

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[b]	Comments
								α(N)=5.11×10^{-5} *7*; α(O)=7.38×10^{-6} *10*; α(P)=4.09×10^{-7} *6* Eγ=920.3 *2*, Iγ=0.744 (1971GoYX). Ice(K)=0.004 *1* (1993AbZZ).
923.7 *4*	0.030 *12*	1216.51	7/2$^+$	292.798	7/2$^-$			%Iγ=0.0062 *25* Eγ=923.5 *3*, Iγ=0.044 (1971GoYX).
^{x}927.1 *8*	0.020 *9*							%Iγ=0.0042 *19*
933.8 *3*	0.026 *10*	1229.82	(7/2$^-$)	296.14	9/2$^+$			%Iγ=0.0054 *21* Eγ=933.5 *3*, Iγ=0.052 (1971GoYX).
936.7 *3*	0.035 *11*	1229.82	(7/2$^-$)	292.798	7/2$^-$			%Iγ=0.0073 *23* Eγ=936.5 *3*, Iγ=0.058 (1971GoYX).
^{x}970.8[‡] *4*	0.031[‡]							%Iγ=0.00645
^{x}977.9 *3*	0.021 *7*							%Iγ=0.0044 *15*
^{x}998.3 *3*	0.021 *7*							%Iγ=0.0044 *15* Eγ=998.4 *2*, Iγ=0.038 (1971GoYX).
^{x}1008.6 *5*	0.018 *7*							%Iγ=0.0037 *15* Eγ=1009.0 *2*, Iγ=0.034 (1971GoYX).
1022.9 *2*	0.053 *10*	1580.95	(5/2$^+$,7/2$^+$)	557.84	5/2$^+$			%Iγ=0.0110 *21* Eγ=1022.8 *2*, Iγ=0.062 (1971GoYX, placed from a 1319 level).
^{x}1025.9 *3*	0.022 *8*							%Iγ=0.0046 *17* Eγ=1026.2 *2*, Iγ=0.029 (1971GoYX; placed from a 1319 level).
1037.07 *7*	3.00 *35*	1216.51	7/2$^+$	179.464	7/2$^+$	M1	0.00608 *9*	%Iγ=0.62 *8* α(K)exp=0.0050 *18* (1993AbZZ) α(K)=0.00514 *7*; α(L)=0.000733 *10*; α(M)=0.0001622 *23* α(N)=3.80×10^{-5} *5*; α(O)=5.49×10^{-6} *8*; α(P)=3.05×10^{-7} *4* Eγ=1037.0 *1*, Iγ=4.13 (1971GoYX). Ice(K)=0.015 *5* (1993AbZZ).
1048.5 *3*	0.060 *30*	1432.29?	(5/2$^-$,7/2)	383.68	9/2$^-$			%Iγ=0.013 *6* Eγ=1048.7 *2*, Iγ=0.121 (1971GoYX, unplaced).
1050.3 *2*	0.190 *45*	1229.82	(7/2$^-$)	179.464	7/2$^+$			%Iγ=0.040 *10* Eγ=1050.3 *2*, Iγ=0.217 (1971GoYX).
^{x}1068.2 *4*	0.034 *13*							%Iγ=0.0071 *27* Eγ=1067.6 *3*, Iγ=0.040 (1971GoYX).
^{x}1070.3 *6*	0.017 *10*							%Iγ=0.0035 *21* Eγ=1069.5 *3*, Iγ=0.042 (1971GoYX).
1110.3 *1*	0.052 *10*	1580.95	(5/2$^+$,7/2$^+$)	470.93	3/2$^+$			%Iγ=0.0108 *21* Eγ=1110.4 *2*, Iγ=0.073 (1971GoYX, unplaced).
^{x}1137.1[‡] *5*	0.024[‡]							%Iγ=0.00499 Tentative placement from an uncertain 321.7 level in 1971GoYX.
1139.5 *1*	0.193 *27*	1432.29?	(5/2$^-$,7/2)	292.798	7/2$^-$			%Iγ=0.040 *6* Eγ=1139.6 *2*, Iγ=0.309 (1971GoYX, unplaced).
^{x}1165.5 *4*	0.015 *6*							%Iγ=0.0031 *13* Eγ=1165.7 *4* (1971GoYX, placed from a 1458 level).

$^{167}_{69}Tm_{98}$-13

γ(^{167}Tm) (continued)

Eγ[†]	Iγ[†a]	Ei(level)	J^{π}_{i}	Ef	J^{π}_{f}	Comments
1213.3 2	0.030 10	1597.54	(5/2⁻,7/2⁺)	383.68	9/2⁻	%Iγ=0.0062 21 Eγ=1213.2 2, Iγ=0.054 (1971GoYX, placed from a 1535 level).
1217.1 2	0.033 10	1543.84		326.57	9/2⁺	%Iγ=0.0069 21 Eγ=1217.1 2, Iγ=0.047 (1971GoYX).
1234.63 7	0.77 9	1527.41	(5/2⁻)	292.798	7/2⁻	%Iγ=0.16 2 Eγ=1234.6 1, Iγ=1.14 (1971GoYX).
[x]1242.0 1	0.081 14					%Iγ=0.0169 30 Eγ=1241.9 2, Iγ=0.123 (1971GoYX, placed from a 1535 level).
1254.5 4	0.013 5	1580.95	(5/2⁺,7/2⁺)	326.57	9/2⁺	%Iγ=0.0027 11
1288.1 1	0.168 24	1580.95	(5/2⁺,7/2⁺)	292.798	7/2⁻	%Iγ=0.035 5 Eγ=1288.0 3, Iγ=0.281 (1971GoYX).
1298.2 6	0.011 5	1580.95	(5/2⁺,7/2⁺)	282.20	(3/2)	%Iγ=0.0023 11
1304.9 1	0.160 24	1597.54	(5/2⁻,7/2⁺)	292.798	7/2⁻	%Iγ=0.033 5 Eγ=1304.8 2, Iγ=0.245 (1971GoYX).
[x]1320.9 1	0.061 10					%Iγ=0.0127 21 Eγ=1320.8 2, Iγ=0.097 (1971GoYX).
1332.5 2	0.027 7	1629.17	(5/2⁺,7/2⁺)	296.14	9/2⁺	%Iγ=0.0056 15 Placement from 1971GoYX, unplaced in 1971Fu10. Eγ=1332.8 2, Iγ=0.039 (1971GoYX).
1337.2 5	0.014 7	1629.17	(5/2⁺,7/2⁺)	292.798	7/2⁻	%Iγ=0.0029 15 Eγ=1336.7 5, Iγ=0.0087 (1971GoYX).
1340.1 4	0.020 7	1527.41	(5/2⁻)	187.622	5/2⁻	%Iγ=0.0042 15 Eγ=1339.9 4, Iγ=0.014 (1971GoYX, unplaced).
[x]1342.4 4	0.019 7					%Iγ=0.0040 15 Eγ=1342.3 4, Iγ=0.032 (1971GoYX, placed from a 1458 level).
[x]1355.3[‡] 3	0.014[‡]					%Iγ=0.00291 γ placed from a 1535 level in 1971GoYX.
1358.3 4	0.0054	1654.29	(5/2⁺,7/2⁺)	296.14	9/2⁺	%Iγ=1.12×10⁻³ E_{γ},I_{γ}: γ from 1971GoYX only.
1361.5 1	0.090 17	1654.29	(5/2⁺,7/2⁺)	292.798	7/2⁻	%Iγ=0.019 4 Eγ=1361.6 2, Iγ=0.122 (1971GoYX).
[x]1366.5 7	0.015 6					%Iγ=0.0031 13 Eγ=1365.5 5, Iγ=0.020 (1971GoYX).
[x]1370.2 1	0.058 11					%Iγ=0.0121 23 Eγ=1369.9 2, Iγ=0.081 (1971GoYX).
1384.8 2	0.041 9	1527.41	(5/2⁻)	142.404	7/2⁺	%Iγ=0.0085 19 Eγ=1385.1 2, Iγ=0.055 (1971GoYX, unplaced).
1393.1 2	0.030 6	1580.95	(5/2⁺,7/2⁺)	187.622	5/2⁻	%Iγ=0.0062 13 Eγ=1393.1 2, Iγ=0.043 (1971GoYX, unplaced).
1401.9 3	0.014 5	1580.95	(5/2⁺,7/2⁺)	179.464	7/2⁺	%Iγ=0.0029 11 Eγ=1401.9 3, Iγ=0.023 (1971GoYX, also placed from a 1544 level).

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1410.7 *4*	0.015 *5*	1527.41	(5/2⁻)	116.564	5/2⁺	%Iγ=0.0031 *11* Eγ=1410.4 *3*, Iγ=0.024 (1971GoYX).
1427.8 *3*	0.015 *5*	1543.84		116.564	5/2⁺	%Iγ=0.0031 *11* Eγ=1427.7 *2*, Iγ=0.027 (1971GoYX).
[x]1433.7 *3*	0.014 *5*					%Iγ=0.0029 *11* Eγ=1433.5 *4*, Iγ=0.012 (1971GoYX).
1438.3 *1*	0.107 *16*	1580.95	(5/2⁺,7/2⁺)	142.404	7/2⁺	%Iγ=0.0223 *34* Eγ=1438.4 *1*, Iγ=0.165 (1971GoYX).
1455.1 *1*	0.110 *16*	1597.54	(5/2⁻,7/2⁺)	142.404	7/2⁺	%Iγ=0.0229 *35* Eγ=1455.1 *1*, Iγ=0.170 (1971GoYX).
[x]1460.7[‡] *4*	0.013[‡]					%Iγ=0.00270 γ placed from a 1597 level in 1971GoYX.
1464.8 *2*	0.029 *6*	1580.95	(5/2⁺,7/2⁺)	116.564	5/2⁺	%Iγ=0.0060 *13* Eγ=1464.7 *3*, Iγ=0.038 (1971GoYX).
1481.1 *3*	0.012 *5*	1597.54	(5/2⁻,7/2⁺)	116.564	5/2⁺	%Iγ=0.0025 *11* Eγ=1481.0 *3*, Iγ=0.017 (1971GoYX).
[x]1486.5[‡] *3*	0.034[‡]					%Iγ=0.00707 γ placed from a 1597 level in 1971GoYX.
1487.4 *2*	0.043 *10*	1629.17	(5/2⁺,7/2⁺)	142.404	7/2⁺	%Iγ=0.0089 *21* Eγ=1487.6 *2*, Iγ=0.052 (1971GoYX).
[x]1498.2 *3*	0.020 *6*					%Iγ=0.0042 *13* Eγ=1498.1 *2*, Iγ=0.033 (1971GoYX).
[x]1509.0[‡] *5*	0.013[‡]					%Iγ=0.00270
1511.9[cd] *2*		1629.17	(5/2⁺,7/2⁺)	116.564	5/2⁺	No intensity is attributed to the tentative second placement of this γ.
1511.9[c] *2*	0.064 *10*	1654.29	(5/2⁺,7/2⁺)	142.404	7/2⁺	%Iγ=0.0133 *22* Eγ=1511.9 *3*, Iγ=0.101 (1971GoYX).
1517.0 *2*	0.042 *8*	1527.41	(5/2⁻)	10.412	3/2⁺	%Iγ=0.0087 *17* Eγ=1517.3 *3*, Iγ=0.064 (1971GoYX).
[x]1525.7 *3*	0.010 *3*					%Iγ=0.0021 *6* Eγ=1525.5 *3*, Iγ=0.012 (1971GoYX).
1533.1 *4*	0.008 *3*	1543.84		10.412	3/2⁺	%Iγ=0.0017 *6* Eγ=1533.6 *3*, Iγ=0.0083 (1971GoYX).
1537.5 *4*	0.015 *7*	1654.29	(5/2⁺,7/2⁺)	116.564	5/2⁺	%Iγ=0.0031 *15* Eγ=1537.6 *3*, Iγ=0.018 (1971GoYX).
[x]1542.0 *5*	0.005 *3*					%Iγ=0.0010 *6*
[x]1549.5 *4*	0.006 *3*					%Iγ=0.0013 *6*
1570.4 *2*	0.140 *21*	1580.95	(5/2⁺,7/2⁺)	10.412	3/2⁺	%Iγ=0.029 *5* Eγ=1570.5 *1*, Iγ=0.222 (1971GoYX).
1587.1 *2*	0.136 *18*	1597.54	(5/2⁻,7/2⁺)	10.412	3/2⁺	%Iγ=0.028 *4* Eγ=1587.2 *2*, Iγ=0.205 (1971GoYX).
1619.2 *2*	0.056 *8*	1629.17	(5/2⁺,7/2⁺)	10.412	3/2⁺	%Iγ=0.0117 *17* Eγ=1619.2 *2*, Iγ=0.088 (1971GoYX).

$^{167}_{69}$Tm$_{98}$-15

γ(^{167}Tm) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Comments
[x]1631.7 *3*	0.007 *3*					%Iγ=0.0015 *6* Eγ=1631.9 *2*, Iγ=0.015 (1971GoYX).
1643.8 *2*	0.072 *9*	1654.29	(5/2$^+$,7/2$^+$)	10.412	3/2$^+$	%Iγ=0.015 *2* Eγ=1643.9 *2*, Iγ=0.109 (1971GoYX).
[x]1675.0 *7*	0.003 *2*					%Iγ=0.0006 *4*
[x]1680.7 *6*	0.005 *3*					%Iγ=0.0010 *6* Eγ=1681.0 *5* (1971GoYX).
[x]1693.6 *5*	0.004 *2*					%Iγ=0.0008 *4* Eγ=1694.9 *5* (1971GoYX).
[x]1793.4 *6*	0.003 *2*					%Iγ=0.0006 *4*
[x]1807.8 *5*	0.006 *3*					%Iγ=0.0013 *6* Eγ=1808.0 *5* (1971GoYX).

[†] From 1971Fu10 unless otherwise indicated. Values from 1971GoYX are listed under comments for comparison, with author′s relative intensities renormalized to 100 for the 176.31γ by dividing each intensity in Table 9.2 in 1971GoYX by a factor of 24.2. Note that uncertainties for intensities are not available in 1971GoYX.

[‡] This γ from 1971GoYX only.

[#] Tentative γ from 1971GoYX only.

[@] From 1993AbZZ.

[&] From α(K)exp and/or ce subshell ratios, except where noted; the photon and ce intensity scales were normalized through α(K)=2.23 (M1+E2 theory, δ=0.090) for 106.2γ. Uncertainties in I(ce) data quoted from 1971Fu10 are typically 20-30%, but at low energies they may be much larger. Where no such data are available, the assignments are from the Adopted Gammas. Quoted values are the same as those in Adopted Gammas.

[a] For absolute intensity per 100 decays, multiply by 0.208 *8*.

[b] 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.

[c] Multiply placed.

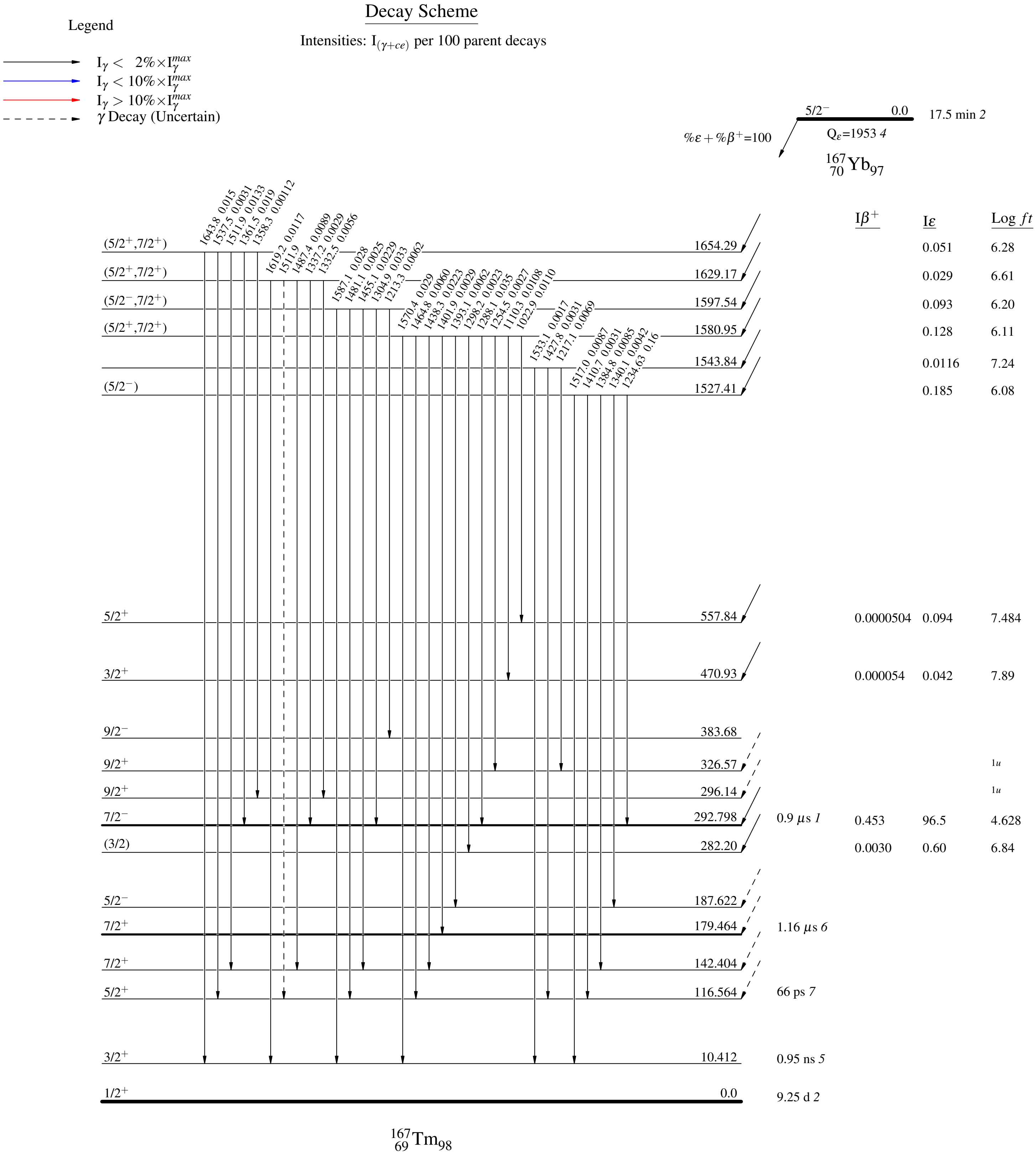
[d] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

From ENSDF

^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX

Decay Scheme

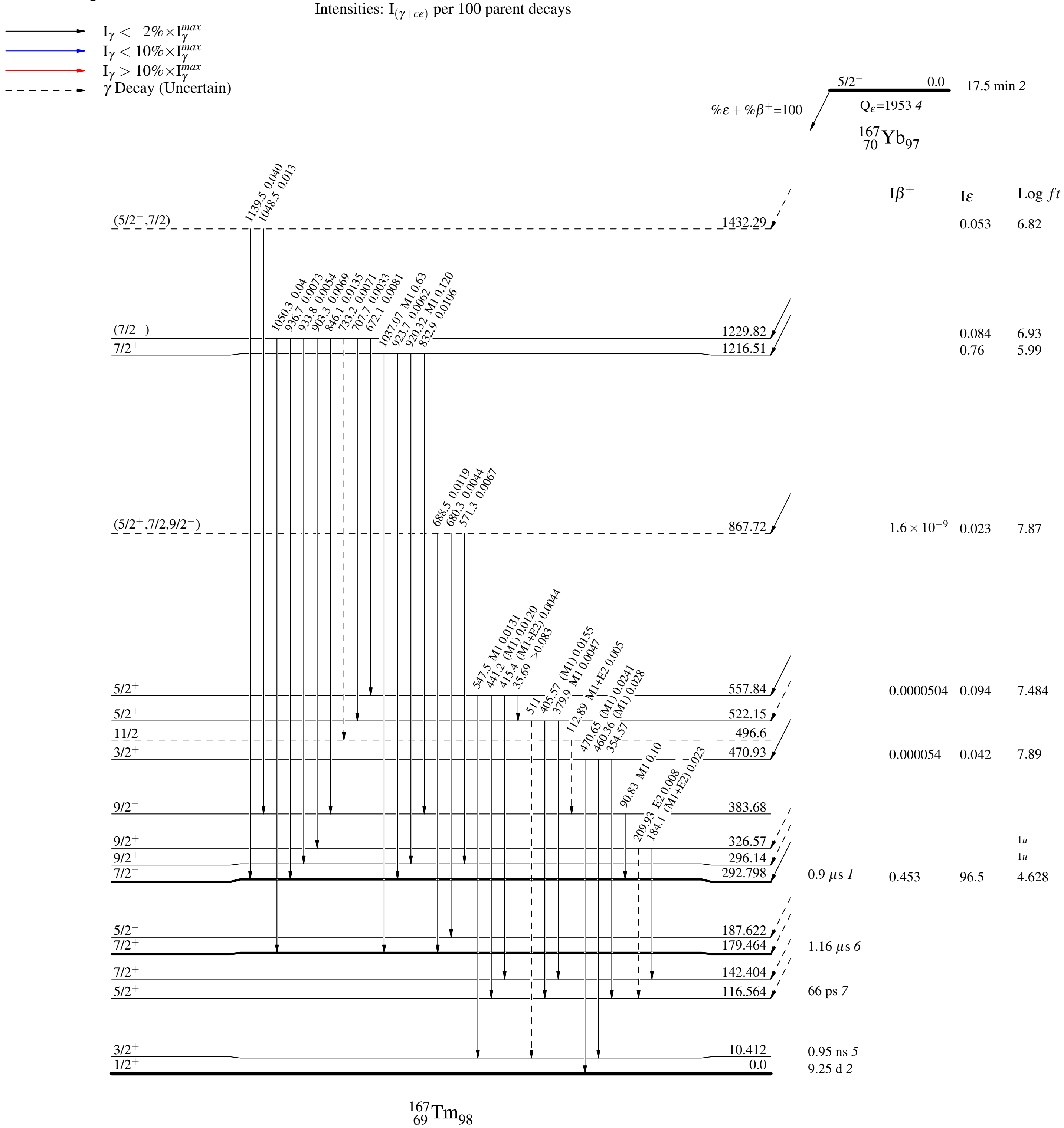


^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX

Decay Scheme (continued)

Legend

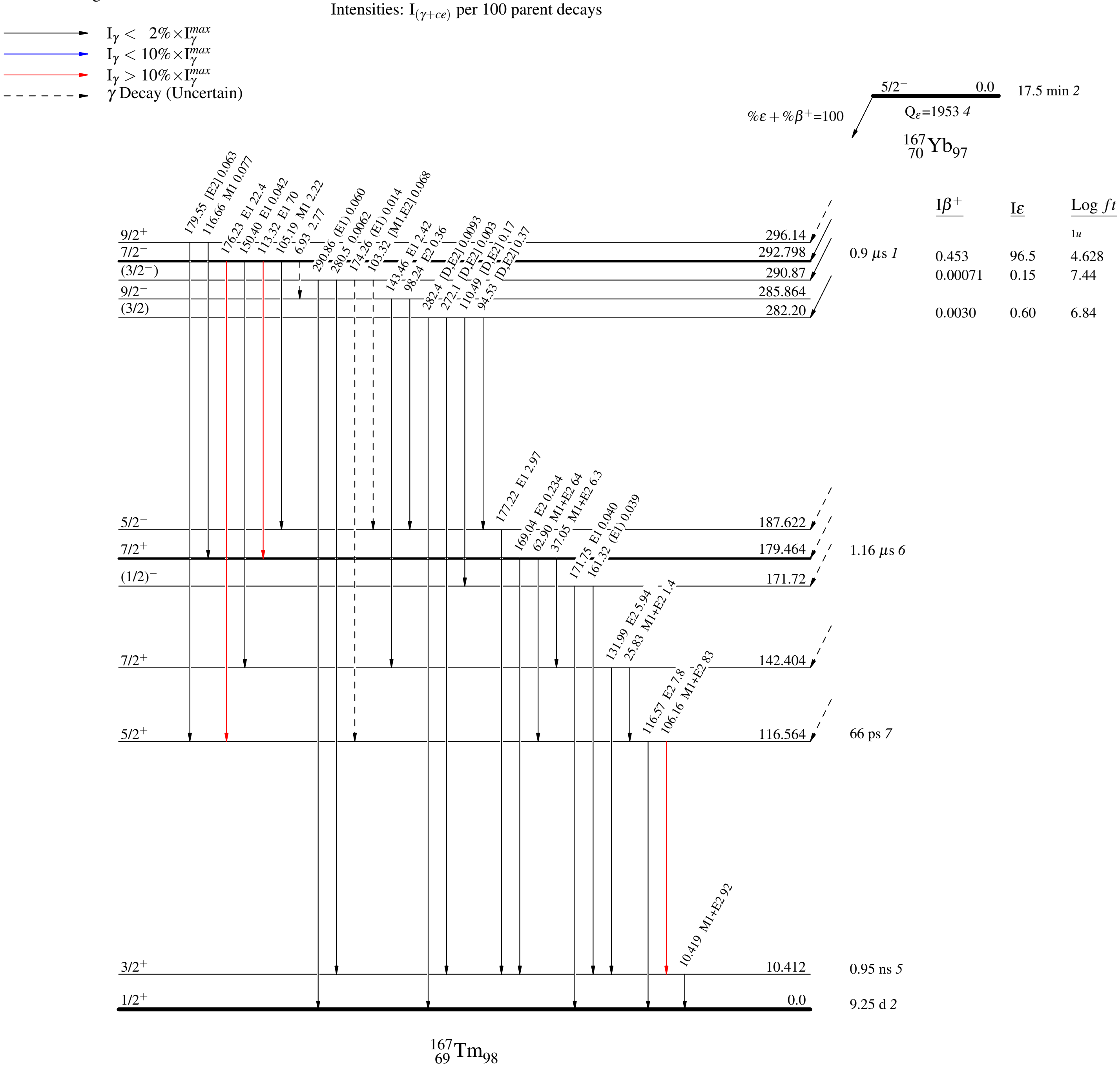
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



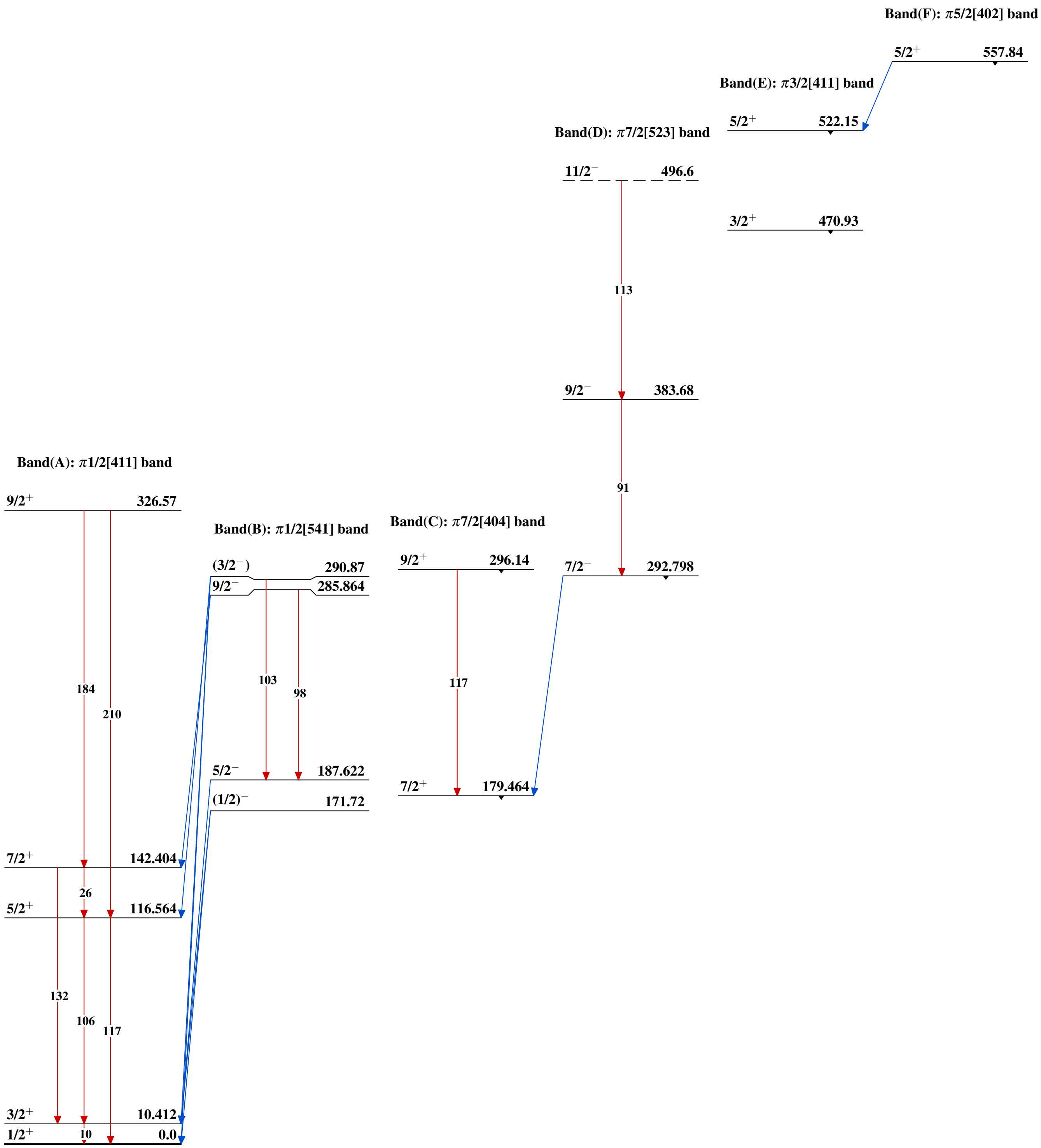
^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{167}Yb ε decay (17.5 min) 1971Fu10,1971GoYX



$^{167}_{69}Tm_{98}$