Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	V. S. Shirley	NDS 75,377 (1995)	1-Oct-1993

Q(β^-)=−669.6 *17*; S(n)=6367.4 *4*; S(p)=7466 *6*; Q(α)=945.5 *14* 2012Wa38
Note: Current evaluation has used the following Q record −670.8 176367.6 57465 6945.8 15 1993Au05.

^{173}Yb Levels

See 1985Li06, 1987Mu09, 1987Pf01, 1991Ji06, 1991Ki14, 1991Ma48, 1992Ji06, 1992Ki29, and 1992Ku21 for recent hfs and isotope-shift data.

Cross Reference (XREF) Flags

A	^{173}Tm β^- decay	F	^{174}Yb(d,t)
B	^{173}Lu ε decay	G	^{172}Yb(d,p)
C	^{172}Yb(n,γ) E=resonance	H	^{173}Yb(d,d′)
D	^{172}Yb(n,γ) E=thermal	I	^{174}Yb(^{3}He,α)
E	Coulomb excitation		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	XREF	Comments
0.0[e]	5/2$^-$	stable	AB DEFGHI	μ=−0.67989 *3*; Q=+2.80 *4* μ: Optical pumping (1989Ra17). Q: Muonic hyperfine structure, optical spectroscopy (1989Ra17). J$^\pi$: EPR, optical spectroscopy (1976Fu06); L=3 in ^{174}Yb(d,t).
78.647[be] *12*	7/2$^-$	46 ps *5*	B DEFGHI	μ=−0.19 *7* μ: Integral PAC, recalculated for consistency with adopted T$_{1/2}$ (1989Ra17). J$^\pi$: M1+E2 γ to 5/2$^-$; M1+E2 γ from 9/2$^-$. T$_{1/2}$: weighted average of 38 ps *5* (γce(t) in ^{173}Lu ε decay, 1961Be37), 52 ps *6* (microwave pulsed beam in ^{173}Lu ε decay, 1971Da17), and 51 ps *5* (B(E2) in Coulomb excitation).
179.364[be] *9*	9/2$^-$	32 ps *4*	B EFGHI	μ≈+0.20 μ: Integral PAC, recalculated for consistency with adopted T$_{1/2}$ (1989Ra17). J$^\pi$: E2 γ to 5/2$^-$; L=5 in ^{174}Yb(d,t). T$_{1/2}$: B(E2) in Coulomb excitation.
301.859[be] *14*	11/2$^-$[d]	16.7 ps *15*	B EFGHI	
350.764[bf] *10*	7/2$^+$	0.45 ns *2*	B E	μ≈−0.48 μ: Integral PAC, recalculated for consistency with adopted T$_{1/2}$ (1989Ra17). J$^\pi$: E1+M2 γ to 9/2$^-$; E1+M2 γ to 5/2$^-$. T$_{1/2}$: from Xγ(t) in ^{173}Lu ε decay (weighted average of 0.47 ns *3* (1961Be34), 0.42 ns *7* (1961Va36), and 0.43 ns *3* (1966Ja16)).
398.9[@g] *5*	1/2$^-$	2.9[p] μs *1*	A CD FG i	XREF: i(407).
412.967[bf] *11*	9/2$^+$		B FG i	XREF: i(407).
445.7[&e] *1*	13/2$^-$[d]	12.2 ps *11*	E i	XREF: i(453).
461.5[@g] *5*	3/2$^-$	0.56[p] ns *3*	A CD FG i	XREF: i(453). J$^\pi$: L(d,t)=1, 461γ M1 to 5/2$^-$.
482.0[g] *7*	5/2$^-$		D FG I	J$^\pi$: L(d,t)=3, 83γ to 1/2$^-$.
≈531[c]			I	
≈564[c]			I	
603.1[f] *7*	(13/2)$^+$		FG I	J$^\pi$: L(d,t)=6.

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Adopted Levels, Gammas (continued)

^{173}Yb Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
610.6[&e] *1*	15/2−[d]	7.3 ps *6*	E	
626.7[g] *6*	7/2−		D FGH	
636.128[bh] *11*	7/2−	8.0 ps *26*	B DEF i	XREF: i(650). Jπ: 636γ M1+E2 to 5/2−, 457γ M1+E2 to 9/2−. $T_{1/2}$: B(E2) in Coulomb excitation. Older value of 0.19 ns (1961Be34) is precluded by absence of K capture to 636.1 level, and a contaminating peak was explained as reason for discrepancy with early value of 3.2 ps (1980An43).
659.4[g] *9*	9/2−		F i	XREF: i(650).
≈707?[c]			I	
749.1[h] *6*	(9/2−)		FGHI	
796.2[&e] *1*	17/2−[d]	4.3 ps *4*	E	
882.2[g] *8*	(11/2−)		FG I	
≈926?[c]			I	
1001.9[&e] *2*	19/2−[d]	2.6 ps *2*	E	
1032.5[i] *16*	(1/2−)		CD GH	
1058.3 *11*			GH	
1074.5[i] *6*	(3/2)−		CD FG	
1121.6[i] *6*	(5/2)−		FG I	
1142.5 *14*			G	
1159.0 *18*			G	
1172.5[l] *7*	(9/2)−		FGHI	
1195.5 *21*			G	
1219.9[i] *9*	(7/2)−		GHi	XREF: i(1223).
1227.1[&e] *2*	21/2−[d]	1.81 ps *16*	E	
1232.5[j] *7*	(3/2)−		CD FG i	XREF: i(1223).
1287.5 *10*			F	
1306.0[i] *15*	(9/2−)		G I	
1329.0 *8*			F	
1340.9[k] *9*	(3/2)−		CD FG	
1362.4[j] *7*	(7/2−)		FG I	
1406.1[k] *7*	(5/2)−		FG	
≈1438[c]	(5/2−,7/2−)		I	Jπ: L=3 in ^{174}Yb(^{3}He,α).
1443.5 *7*	(7/2+,9/2+)		FG	
1460.8 *11*			F I	
1471.7[&e] *2*	23/2−[d]	1.15 ps *17*	E	
1492.3[a] *10*	1/2,3/2		D	Jπ: fed by primary transition in ^{172}Yb(n,γ) E=thermal.
1493.5[k] *8*	(7/2)−		FG	
1506.8 *8*			FG	
1520.6 *10*			F	
1531.4 *10*			F I	
1578.2 *23*			G	
1586.9[o] *9*	(13/2+)		F I	
1606.5[m] *7*	(5/2+)		FG	
1619.6 *20*			G i	XREF: i(1625).
1629.2 *8*			F i	XREF: i(1625).
1639.3 *9*			FG	
1665.4 *7*	1/2−,3/2−		FG I	
1707.7 *8*	(5/2−,7/2−)		FG I	
1721.3[m] *9*	(9/2+)		F	
1735.0 *7*	(1/2−,3/2,5/2+)		FG	

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Adopted Levels, Gammas (continued)

^{173}Yb Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
1736.0[&e] *3*	25/2⁻[d]	0.60 ps *5*	E	
1746.1 *11*			F	
1761.7 *10*	(⁻)		GHI	
1776.3 *8*	3/2⁺,5/2,7/2⁻		F	
1787.4 *12*			G	
1814.0 *11*			F I	
1829.0 *8*			F	
1839.1 *23*			G	
1853.3 *14*			G I	
1867.2[n] *7*	(7/2)⁻		FG	
≈1877			I	
1894.4 *7*	(3/2⁺,5/2⁺)		FG	
1910.4 *17*			GH	
1922.5 *7*	(3/2⁺,5/2⁺)		F	
1927.9 *15*			G	
1932.6 *9*	(1/2⁻,3/2⁻)		F	
1944.9 *9*	3/2⁺,5/2,7/2⁻		F H	
1953.3 *18*			G	
1980.8 *7*			FGHi	XREF: i(1979).
1988.2 *9*			FG i	XREF: i(1979).
2006.2 *11*			F	
2016.5 *8*			FG	
2018.0[&e] *3*	(27/2⁻)[d]		E	
2031.5 *14*			FG	
2043.8 *9*			F	
2051.5 *9*			FG	
2075.9 *12*			FG	
2086.1 *13*			F	
2107.0 *9*			F	
2129.9 *9*			FG i	XREF: i(2130).
2136.3 *10*			F i	XREF: i(2130).
2162.5 *10*			F	
2176.9 *9*			F	
2200.3 *9*			FG	
2212.4 *12*			F	
2229.2 *15*			FG	
2245.0 *8*			F	
2255.2 *10*			FG	
2267.6 *12*			F	
2277.9 *12*			F	
2312.9 *9*			F	
2331.4 *8*			FG	
2392.8 *16*			G	
2407.8 *11*			G	
2425.7 *13*			G	
2440.7 *21*			G	
2462.8 *17*			G	
2479.9 *11*			G	
2503.5 *16*			G	
2515.8 *11*			G	
2539.2 *15*			G	
2577.4 *19*			G	
2605.2 *15*			G	
2627.4 *12*			G	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{173}Yb Levels (continued)

† Recommended values from 1977Ta13, based on E(level) in ^{172}Yb(d,p), ^{173}Yb(d,d′), and ^{174}Yb(d,t), except where noted.
‡ From consistency of level energies, angular distributions, spectroscopic factors, and relative and absolute cross sections for (d,p) and (d,t) with systematic properties of odd-mass Yb nuclei, except where noted.
# Doppler-shift recoil-distance in Coulomb excitation (1989Os04), except where noted.
@ From ^{173}Tm β^- decay.
& From Coulomb excitation.
[a] From ^{172}Yb(n,γ) E=thermal.
[b] From ^{173}Lu ε decay.
[c] From ^{174}Yb(^{3}He,α).
[d] From γ-ray multipolarities and fits of γ-ray cascades into interconnected bands in Coulomb excitation.
[e] Band(A): 5/2(512) band; α=11.3, β=−3.0 (J=5/2, 7/2, 9/2, 11/2 levels).
[f] Band(B): 7/2(633) band; α=5.66, β=31 (J=7/2, 9/2, 13/2 levels).
[g] Band(C): 1/2(521) band; α=12.6, β=−9.8, a=0.66 (J=1/2, 3/2, 5/2, 7/2 levels).
[h] Band(D): 7/2(514) band; α=12.6 (J=7/2, 9/2 levels).
[i] Band(E): 1/2(510) band; α=11.7, β=2.4, a=0.20 (J=1/2, 3/2, 5/2, 7/2 levels).
[j] Band(F): 3/2(521) band; α=10.8 (J=3/2, 7/2 levels).
[k] Band(G): 3/2(512) band; α=13.6, β=−46 (J=3/2, 5/2, 7/2 levels).
[l] Band(H): 5/2(523) band.
[m] Band(I): 3/2(651) band; α=7.2 (J=5/2, 9/2 levels).
[n] Band(J): 7/2(503) band.
[o] Band(K): 5/2(642) band (tentative assignment).
[p] $\beta\gamma$(t), $\gamma\gamma$(t), and ceγ(t) in ^{173}Tm β^- decay.

Adopted Levels, Gammas (continued)

γ(^{173}Yb)

All γ-ray properties are from ^{173}Lu ε decay except where noted.

E_i(level)	J_i^π	E_γ	I_γ[†]	E_f	J_f^π	Mult.	δ	α[&]	Comments
78.647	7/2⁻	78.63 *3*	100	0.0	5/2⁻	M1+E2	−0.224 *14*	7.01	B(M1)(W.u.)=0.117 *14*; B(E2)(W.u.)=430 *70*
179.364	9/2⁻	100.724 *20*	100.0 *16*	78.647	7/2⁻	M1+E2	−0.205 *10*	3.38	B(M1)(W.u.)=0.136 *18*; B(E2)(W.u.)=250 *50*
		179.365 *11*	26.3 *5*	0.0	5/2⁻	E2		0.392	B(E2)(W.u.)=92 *12*
301.859	11/2⁻	122.55 *3*	100.0[‡] *18*	179.364	9/2⁻	M1+E2[‡]	−0.22[‡] *6*	1.92	B(M1)(W.u.)=0.185 *19*; B(E2)(W.u.)=270 *150*
		223.163[a] *20*	64.3[a‡] *13*	78.647	7/2⁻	E2[‡]		0.189	B(E2)(W.u.)=187 *18*
350.764	7/2⁺	171.393 *13*	13.7 *5*	179.364	9/2⁻	E1+M2	≈−0.026	0.086 *4*	B(E1)(W.u.)≈1.1×10^{-5}; B(M2)(W.u.)≈1.2 B(M2)(W.u.) is somewhat large compared to RUL (=1).
		272.105 *15*	100.0 *15*	78.647	7/2⁻	E1		0.0254	B(E1)(W.u.)=2.02×10^{-5} *10*
		350.774 *18*	1.42 *5*	0.0	5/2⁻	E1+M2	0.090 *45*	0.017 *4*	B(E1)(W.u.)=1.33×10^{-7} *8*; B(M2)(W.u.)=0.04 *4*
398.9	1/2⁻	398.9[#] *6*	100[#]	0.0	5/2⁻	E2[#]		0.0326	B(E2)(W.u.)=0.000327 *12*
412.967	9/2⁺	62.17 *3*	30.3 *15*	350.764	7/2⁺	M1+E2	0.29 *4*	13.5	
		111.109 *12*	9.7 *4*	301.859	11/2⁻				
		233.605 *12*	100.0 *19*	179.364	9/2⁻	E1+M2	≈0.08	0.047 *12*	
		334.321 *11*	19.7 *8*	78.647	7/2⁻	E1(+M2)	<0.084	0.017 *7*	
		412.9	≤0.030	0.0	5/2⁻				
445.7	13/2⁻	144.0[‡] *1*	93.4[‡] *17*	301.859	11/2⁻	M1+E2[‡]	−0.15[‡] *4*	1.21	B(M1)(W.u.)=0.174 *17*; B(E2)(W.u.)=80 *50*
		266.4[‡] *1*	100.0[‡] *17*	179.364	9/2⁻	E2[‡]		0.107	B(E2)(W.u.)=190 *18*
461.5	3/2⁻	62.6[#] *2*	13[#] *5*	398.9	1/2⁻	M1+E2[#]	0.54 *3*	15.4	B(M1)(W.u.)=0.0051 *24*; B(E2)(W.u.)=170 *80* δ: from ^{173}Tm β$^-$ decay.
		461.4[#] *8*	100[#] *4*	0.0	5/2⁻	M1[#]		0.0517	B(M1)(W.u.)=0.00013 *4*
482.0	5/2⁻	82.8[@b] *15*	100[@]	398.9	1/2⁻				
610.6	15/2⁻	164.9[‡] *1*	65.4[‡] *14*	445.7	13/2⁻	M1+E2[‡]	−0.12[‡] *4*	0.830	B(M1)(W.u.)=0.191 *17*; B(E2)(W.u.)=50 *30*
		308.9[‡] *1*	100[‡] *2*	301.859	11/2⁻	E2[‡]		0.0683	B(E2)(W.u.)=213 *19*
626.7	7/2⁻	141.1[@] *10*	100[@]	482.0	5/2⁻				
		623.3[@] *10*	23[@]	0.0	5/2⁻				
636.128	7/2⁻	223.163[a] *20*	9.6[a] *4*	412.967	9/2⁺	E1		0.0420	B(E1)(W.u.)=0.00012 *4*
		285.362 *6*	42.0 *12*	350.764	7/2⁺	E1(+M2)	<0.026	0.0229 *12*	B(E1)(W.u.)>0.00016; B(M2)(W.u.)<12
		334.263[b] *15*	≤0.38	301.859	11/2⁻				
		456.79 *3*	9.7 *3*	179.364	9/2⁻	M1+E2	+0.65 *+13−9*	0.0440 *17*	B(M1)(W.u.)=0.0010 *4*; B(E2)(W.u.)=0.9 *4*
		557.497 *25*	35.8 *13*	78.647	7/2⁻	M1+E2	+1.81 *6*	0.0180	B(M1)(W.u.)=0.00066 *22*; B(E2)(W.u.)=3.1 *11*
		636.11 *3*	100 *3*	0.0	5/2⁻	M1+E2	−0.54 *5*	0.0199	B(M1)(W.u.)=0.0041 *14*; B(E2)(W.u.)=1.3 *5*
796.2	17/2⁻	185.6[‡] *1*	35.9[‡] *6*	610.6	15/2⁻	M1+E2[‡]	−0.15[‡] *4*	0.594	B(M1)(W.u.)=0.174 *18*; B(E2)(W.u.)=50 *30*
		350.5[‡] *1*	100[‡] *3*	445.7	13/2⁻	E2[‡]		0.0471	B(E2)(W.u.)=270 *30*

From ENSDF

$^{173}_{70}Yb_{103}$-5

Adopted Levels, Gammas (continued)

γ(^{173}Yb) (continued)

E_i(level)	J_i^π	E_γ	I_γ[†]	E_f	J_f^π	Mult.	δ	α[&]	Comments
1001.9	19/2$^-$	205.7[‡] *1*	25.8[‡] *10*	796.2	17/2$^-$	M1+E2[‡]	−0.20[‡] *4*	0.444	B(M1)(W.u.)=0.172 *16*; B(E2)(W.u.)=70 *30*
		391.3[‡] *1*	100[‡] *2*	610.6	15/2$^-$	E2[‡]		0.0344	B(E2)(W.u.)=295 *24*
1032.5	(1/2$^-$)	568.4[@] *10*	100[@]	461.5	3/2$^-$				
		633.4[@] *20*	<22[@]	398.9	1/2$^-$				
		1030.6[a@] *10*	<76[a@]	0.0	5/2$^-$				
1074.5	(3/2)$^-$	592.3[@] *15*	35[@]	482.0	5/2$^-$				
		611.3[@] *15*	63[@]	461.5	3/2$^-$				
		674.2[@] *15*	100[@]	398.9	1/2$^-$				
		995.6[@] *10*	27[@]	78.647	7/2$^-$				
1227.1	21/2$^-$	225.2[‡] *1*	16.2[‡] *8*	1001.9	19/2$^-$	M1+E2[‡]	−0.18[‡] *7*	0.347	B(M1)(W.u.)=0.134 *15*; B(E2)(W.u.)=40 *30*
		430.9[‡] *1*	100[‡] *2*	796.2	17/2$^-$	E2[‡]		0.0264	B(E2)(W.u.)=300 *30*
1232.5	(3/2)$^-$	769.1[@] *15*	100[@]	461.5	3/2$^-$				
		831.6[@] *15*	65[@]	398.9	1/2$^-$				
1340.9	(3/2)$^-$	707.2[@b] *15*	100[@]	636.128	7/2$^-$				
		714.2[@] *10*	90[@]	626.7	7/2$^-$				
1471.7	23/2$^-$	244.6[‡] *1*	15.4[‡] *23*	1227.1	21/2$^-$	M1(+E2)[‡]	−0.18[‡] *18*	0.276 *12*	B(M1)(W.u.)=0.16 *4*; B(E2)(W.u.)<170
		469.8[‡] *1*	100[‡] *4*	1001.9	19/2$^-$	E2[‡]		0.0210	B(E2)(W.u.)=310 *50*
1492.3	1/2,3/2	1030.6[a@] *10*	100[a@]	461.5	3/2$^-$				
1736.0	25/2$^-$	264.3[‡] *4*		1471.7	23/2$^-$				
		508.9[‡] *3*		1227.1	21/2$^-$	E2[‡]		0.0173	
2018.0	(27/2$^-$)	546.3[‡] *3*	100	1471.7	23/2$^-$				

[†] Relative photon branching from each level. Upper limits are given for photon branchings affected by multiple placement.
[‡] From Coulomb excitation.
[#] From ^{173}Tm β^- decay.
[@] From ^{172}Yb(n,γ) E=thermal. For E(level)>600, level energies from Eγ values are from 1 to 3 keV lower than adopted values.
[&] 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] Multiply placed with intensity suitably divided.
[b] Placement of transition in the level scheme is uncertain.

From ENSDF

$^{173}_{70}Yb_{103}$-6

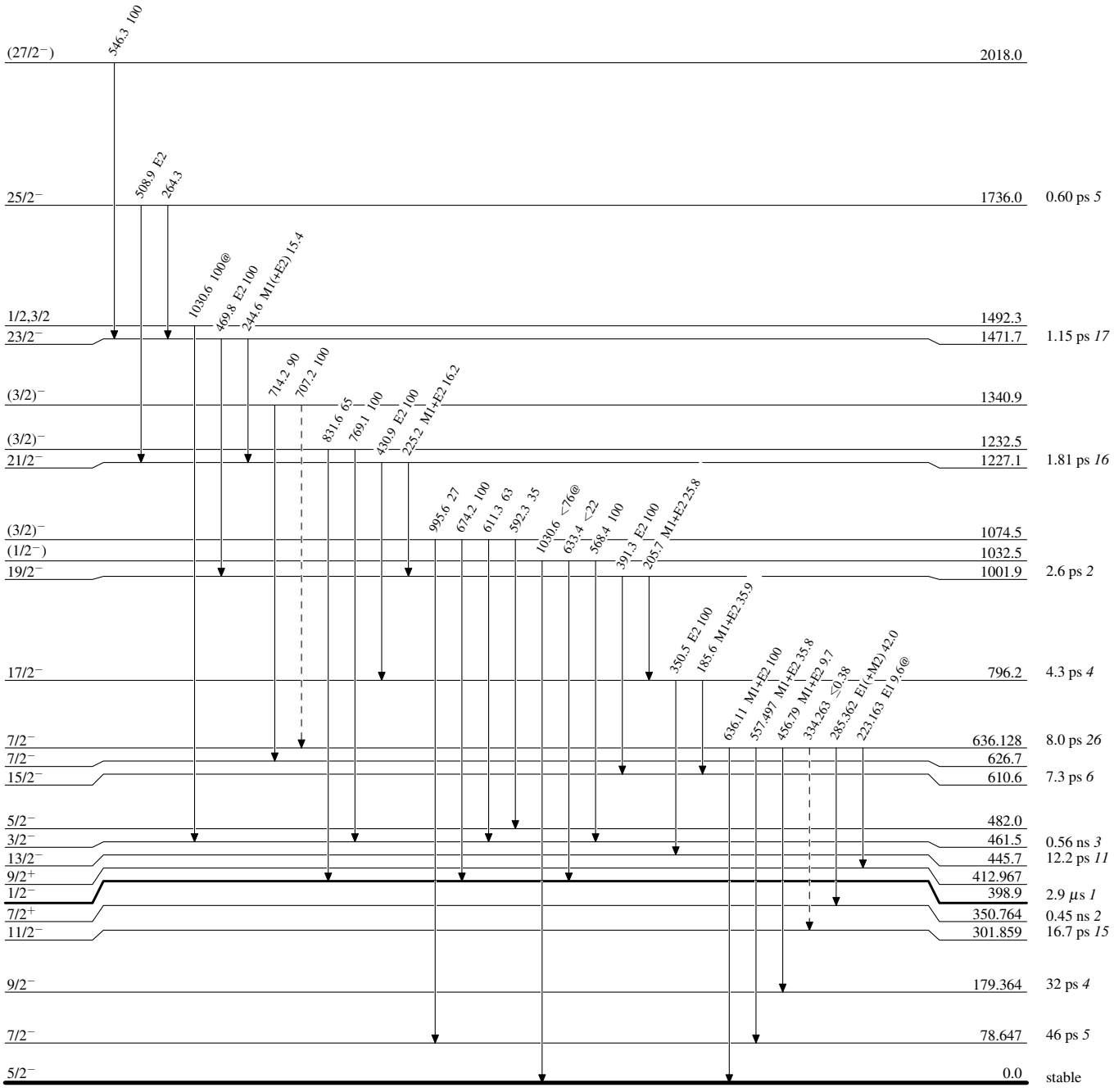
Adopted Levels, Gammas

Legend

Level Scheme

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

- - - - - - ► γ Decay (Uncertain)



$^{173}_{70}Yb_{103}$

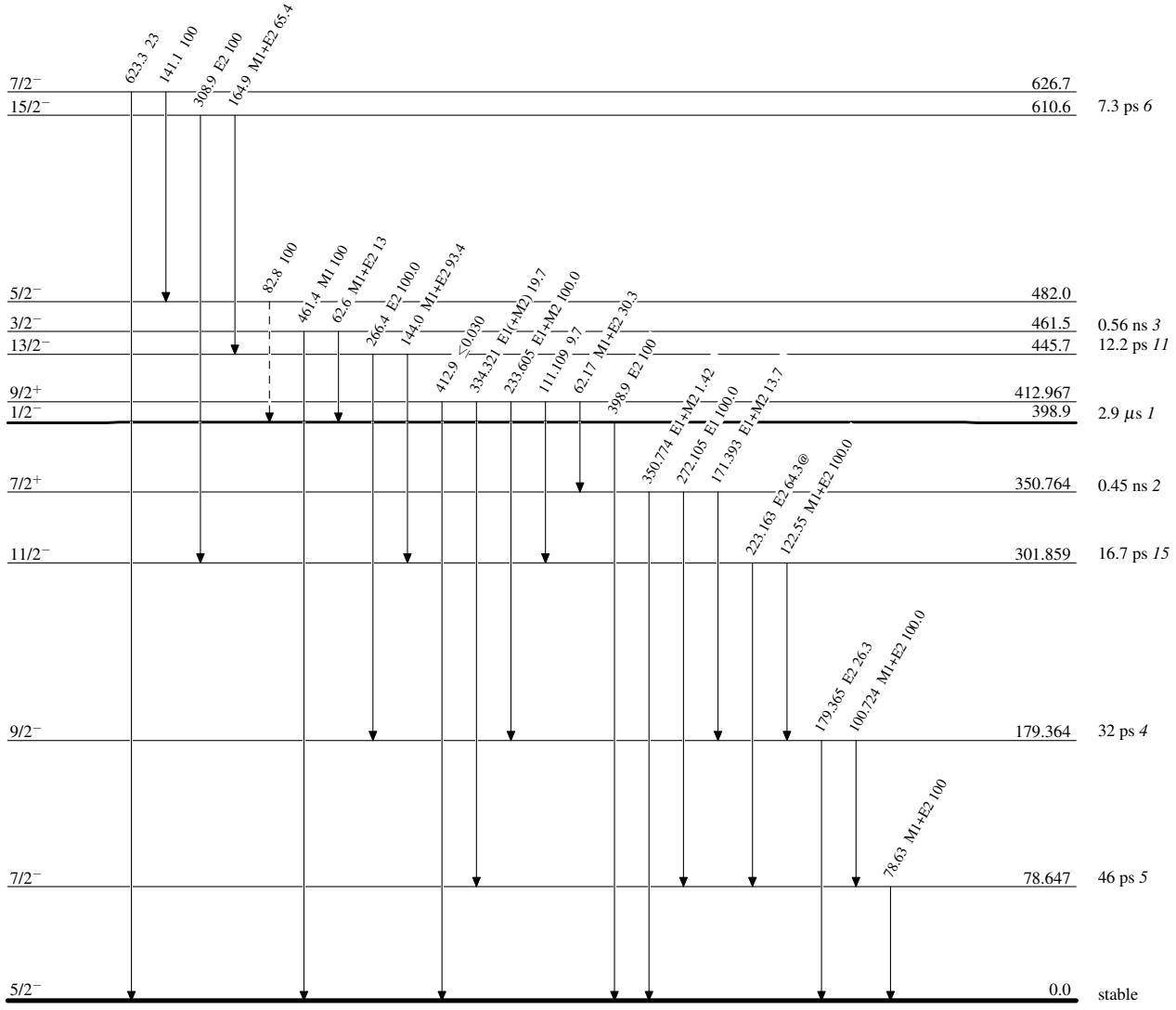
Adopted Levels, Gammas

Legend

Level Scheme (continued)

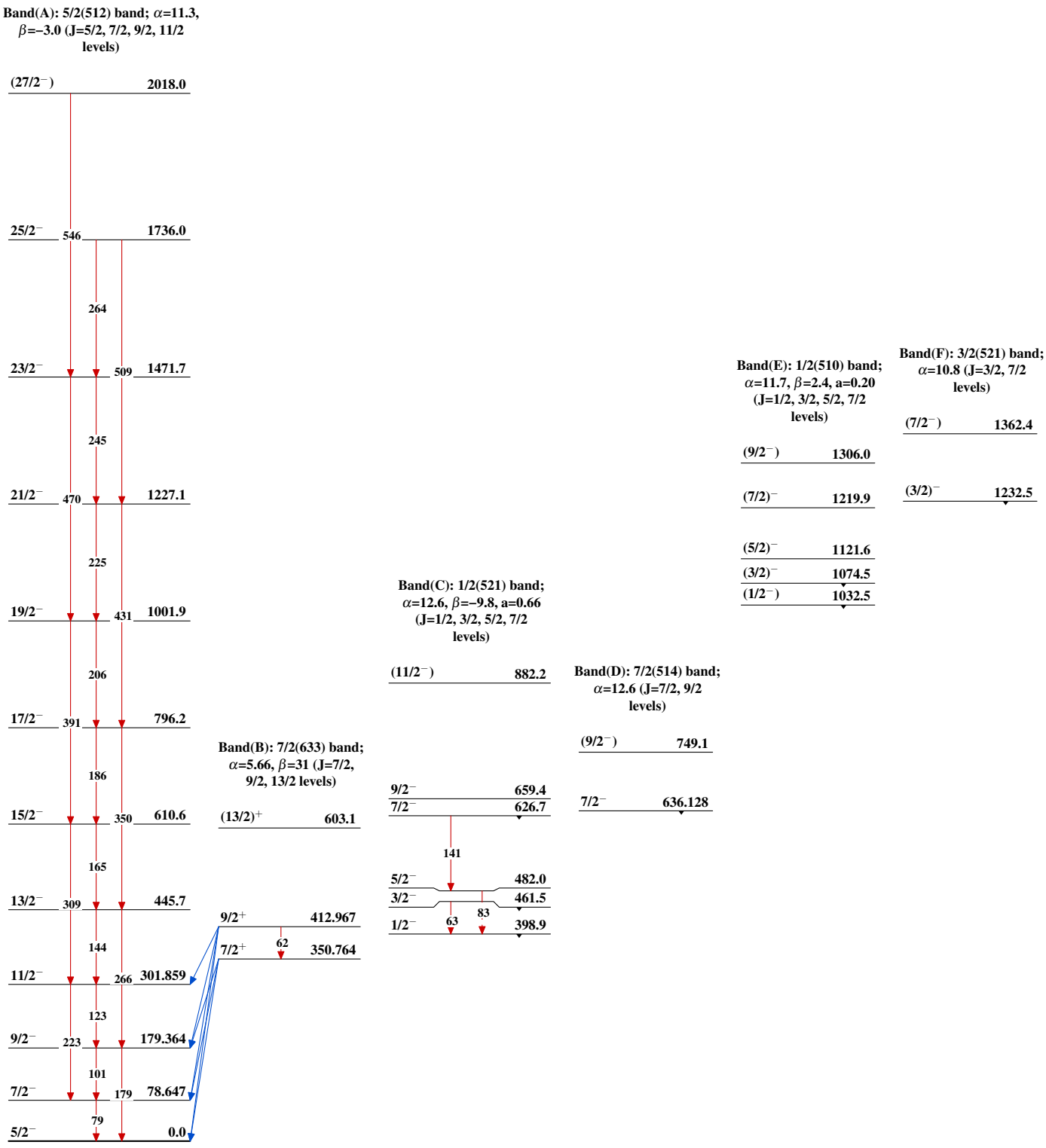
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

- - - - - - ► γ Decay (Uncertain)



$^{173}_{70}Yb_{103}$

Adopted Levels, Gammas



$^{173}_{70}Yb_{103}$

Adopted Levels, Gammas (continued)

Band(J): 7/2(503) band

Band(I): 3/2(651) band; α=7.2 (J=5/2, 9/2 levels)

$(7/2)^-$ 1867.2

$(9/2^+)$ 1721.3

$(5/2^+)$ 1606.5

Band(K): 5/2(642) band (tentative assignment)

Band(G): 3/2(512) band; α=13.6, β=−46 (J=3/2, 5/2, 7/2 levels)

$(13/2^+)$ 1586.9

$(7/2)^-$ 1493.5

$(5/2)^-$ 1406.1

$(3/2)^-$ 1340.9

Band(H): 5/2(523) band

$(9/2)^-$ 1172.5