^{124}Sn(^{48}Ca,5nγ) 1996Sm05,1995Fi01,1985Ba47

History

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

Includes ^{154}Sm(^{16}O,3nγ),(^{16}O,3ne$^-$),E(^{16}O)=65 MeV from 2019Sm01 for conversion electrons; and ^{154}Sm(^{18}O,5nγ), E(^{18}O)=80 MeV from 2013Gl01 for lifetime measurements.

1995Fi01, 1996Sm05: E(^{48}Ca)=210 MeV. Measured Eγ, Iγ, γγ-coin with 50 ns timing resolution using EUROGAM phase 1 array with 45 large coaxial, Compton-suppressed HPGe detectors, each surrounded by a BGO suppression shield at Daresbury tandem accelerator facility. Extended ν11/2[505] band to (49/2$^-$), with possible band crossing due to a pair of $i_{13/2}$ neutrons at $\hbar\omega\approx$0.31 MeV, extended two other bands, and discovered a 3-quasineutron band with its signature partner from (37/2$^-$) to (61/2$^-$). Deduced experimental alignments and Routhians and compared with tilted axis cranking (TAC) model calculations.

1985Ba47: E(^{48}Ca)=201 MeV. Measured Eγ, Iγ, γγ-coin, γ(θ) at θ=30°, 90°, 150° using TESSA-II array, six Compton-suppressed Ge detectors, and 50 BGO crystals.

Other supporting measurements:

2019Sm01: ^{154}Sm(^{16}O,3nγ),(^{16}O,3ne$^-$),E(^{16}O)=65 MeV from K130 cyclotron of University in Jyvaskyla. Target=99% enriched ^{154}Sm foil of 1 mg/cm^2 thickness. Measured Eγ, γγγ-coin, γγ(ce)-coin using 24 Clover and ten Eurogam array HPGe detectors for γ rays, and SAGE solenoidal spectrometer for conversion electrons. Confirmed ν5/2[523] band up to (41/2$^-$), ν5/2[642] band with both signatures up to (41/2$^+$), and ν11/2[505] band with both signatures up to (35/2$^-$), along with some confirmed interband γ−ray transitions. Determined K− and L+M−conversion coefficient for four transitions (174.9, 210.4, 263.4 and 314.3 keV).

2013Gl01: ^{154}Sm(^{18}O,5nγ),E(^{18}O)=80 MeV from Cologne University FN tandem accelerator. Target=1.1 mg/cm^2 thick enriched ^{154}Sm evaporated onto a 2.1 mg/cm^2 Ta foil. Measured Eγ, γ(θ), γγ-coin, lifetimes of nine levels in ν5/2[642] and ν5/2[523] bands by recoil-distance Doppler-shift (RDDS) method and DDCM analysis using five large volume HPGe detectors. Deduced B(E2), B(E1), photon branching ratio of 61.2γ from 1122, 25/2$^+$ level, and compared with particle plus triaxial rotor model (PTRM) calculations.

1997Wi19: E(^{40}Ca)=215 MeV. Measured Eγ, Iγ, γγ-coin. Searched for evidence of hyperdeformed bands, but no such structures were found.

1994Ol04: E(^{48}Ca)=210, 220, 225 MeV. 97% ^{124}Sn stacked-foil target. Measured Eγ, Iγ, γγ-coin using HERA detector array of 20 Compton-suppressed Ge detectors and an inner ball of 40 BGO detectors. Comparison with tilted-axis cranking model. Established a high-K band, with its signature partners.

1989Sc05: E(^{48}Ca)=201 MeV. Enriched ^{124}Sn, unbacked and gold-backed targets. Measured Eγ, Iγ, γγ-coin, γ(θ) at θ=30°, 63°, 79°, 101°, 117°, 143°, lifetime for quasicontinuum ridge structure by DSAM using ESSA30 detector array of 30 escape-suppressed Ge detectors.

The level scheme is mainly from 1995Fi01 and 1996Sm05. 1994Ol04 report a 317.0γ connecting the 35/2 and 33/2 members of the 11/2[505] bands, but 1996Sm05 observe only a 317.6γ which they place elsewhere; a tentatively-placed 325.5γ (37/2 to 35/2) in 1994Ol04 is also absent in 1996Sm05, and neither it nor the 317.0γ is included here. The 773γ, 829γ, 878γ connecting the 39/2, 43/2, 47/2, 51/2 members of the ν5/2[642], α=−1/2 band in 1985Ba47 are also omitted here; the latter two transitions are absent from 1995Fi01, and 1995Fi01 report three alternative placements for a 773γ.

^{167}Yb Levels

Band structures are from 1995Fi01 and 1996Sm05. However, the π=−, α=−1/2 configuration assignments suggested by 1995Fi01 are not adopted here.

E(level)[†]	Jπ[‡]
0.0[a]	5/2$^-$
29.66[@c] 1	5/2$^+$
33.91[@d] 1	7/2$^+$
58.538[@c] 10	9/2$^+$
78.679[b] 12	7/2$^-$
125.912[d] 21	11/2$^+$
178.879[a] 17	9/2$^-$

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$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47 (continued)

^{167}Yb Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[&]	Comments
185.96[#c] *11*	13/2⁺		
301.49[b] *3*	11/2⁻		
330.3[d] *3*	15/2⁺	60.9 ps *63*	$T_{1/2}$: measured mean lifetime τ=87.8 ps *91* (2013Gl01, RDDS for 204.3γ).
407.8[c] *3*	17/2⁺	21.3 ps *17*	$T_{1/2}$: measured mean lifetime τ=30.7 ps *25* (2013Gl01, RDDS for 221.9γ).
442.4[a] *4*	13/2⁻	27.9 ps *35*	$T_{1/2}$: measured mean lifetime τ=40.3 ps *50* (2013Gl01, RDDS for 263.4γ).
571.48[g] *8*	11/2⁻		
607.3[b] *7*	15/2⁻		
644.3[d] *4*	19/2⁺	9.1 ps *17*	$T_{1/2}$: measured mean lifetime τ=13.2 ps *24* (2013Gl01, RDDS for 314.2γ).
721.2[c] *5*	21/2⁺	5.0 ps *15*	$T_{1/2}$: measured mean lifetime τ=7.2 ps *21* (2013Gl01, RDDS for 313.4γ).
726.48[f] *12*	(13/2⁻)		
783.6[a] *4*	17/2⁻	7.0 ps *22*	$T_{1/2}$: measured mean lifetime τ=10.1 ps *32* (2013Gl01, RDDS for 341.2γ).
901.39[g] *15*	(15/2⁻)		
987.3[b] *7*	19/2⁻		
1060.6[d] *5*	23/2⁺	2.70 ps *49*	$T_{1/2}$: measured mean lifetime τ=3.9 ps *7* (2013Gl01, RDDS for 416.3γ).
1094.64[f] *22*	(17/2⁻)		
1121.7[c] *5*	25/2⁺	2.29 ps *42*	$T_{1/2}$: measured mean lifetime τ=3.3 ps *6* (2013Gl01, RDDS for 400.5γ).
1192.6[a] *5*	21/2⁻	2.84 ps *56*	$T_{1/2}$: measured mean lifetime τ=4.1 ps *8* (2013Gl01, RDDS for 409.1γ).
1304.92[g] *24*	(19/2⁻)		
1432.9[b] *8*	23/2⁻		
1531.0[f] *3*	(21/2⁻)		
1569.5[d] *6*	27/2⁺		
1601.1[c] *6*	29/2⁺		
1656.5[a] *6*	25/2⁻		
1771.5[g] *3*	(23/2⁻)		
1894.7[e] *10*	27/2⁻		
1934.3[b] *8*	27/2⁻		
2025.6[f] *4*	(25/2⁻)		
2148.1[c] *7*	33/2⁺		
2158.3[a] *6*	29/2⁻		
2158.5[d] *6*	31/2⁺		
2292.6[g] *4*	(27/2⁻)		
2358.8[e] *9*	31/2⁻		
2482.2[b] *9*	31/2⁻		
2571.6[f] *4*	(29/2⁻)		
2683.6[a] *7*	33/2⁻		
2750.9[c] *9*	37/2⁺		
2817.0[d] *7*	35/2⁺		
2862.7[g] *4*	(31/2⁻)		
2881.5[e] *10*	35/2⁻		
3072.2[b] *10*	35/2⁻		
3164.8[f] *5*	(33/2⁻)		
3237.0[a] *9*	37/2⁻		
3398.5[c] *10*	41/2⁺		
3459.5[e] *15*	39/2⁻		
3481.2[g] *6*	(35/2⁻)		
3533.1[d] *9*	39/2⁺		
3702.2[b] *14*	39/2⁻		

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^{124}Sn(^{48}Ca,5nγ) 1996Sm05,1995Fi01,1985Ba47 (continued)

^{167}Yb Levels (continued)

E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]	E(level)[†]	J^{π}[‡]
3807.3[f] *7*	(37/2⁻)	5234.0?[f] *14*	(45/2⁻)	7446.3[c] *15*	61/2⁺	10713[b] *4*	71/2⁻
3815.4?[h] *7*	(37/2⁻)	5443.5[e] *23*	51/2⁻	7639[b] *3*	59/2⁻	10809.4[a] *17*	73/2⁻
3837.7[a] *10*	41/2⁻	5454.0[i] *10*	(47/2⁻)	7640.0[d] *14*	59/2⁺	11052[e] *4*	75/2⁻
4077.5[e] *18*	43/2⁻	5615.8?[g] *15*	(47/2⁻)	7713.4[a] *15*	61/2⁻	11641.0[d] *18*	75/2⁺
4090.8[c] *11*	45/2⁺	5636.7[c] *14*	53/2⁺	7744.0[i] *14*	(59/2⁻)	11813.2[c] *18*	77/2⁺
4116.6[i] *8*	(39/2⁻)	5812.7[h] *10*	(49/2⁻)	7964[e] *3*	63/2⁻	11967.0[a] *18*	77/2⁻
4141.7[g] *8*	(39/2⁻)	5878.2[b] *23*	51/2⁻	8173.8?[h] *16*	(61/2⁻)	12764.1[d] *20*	79/2⁺
4295.3[d] *10*	43/2⁺	5919.9[d] *13*	51/2⁺	8453.1[c] *16*	65/2⁺	12990.0[c] *19*	81/2⁺
4372.2[b] *18*	43/2⁻	5985.7[a] *13*	53/2⁻	8568.5[d] *15*	63/2⁺	13179.8[a] *19*	81/2⁻
4434.4[h] *8*	(41/2⁻)	6016.2?[f] *16*	(49/2⁻)	8605.0?[i] *16*	(63/2⁻)	13887.1[d] *23*	83/2⁺
4495.7[a] *11*	45/2⁻	6178.7[i] *11*	(51/2⁻)	8613[b] *3*	63/2⁻	14172.7[c] *20*	85/2⁺
4503.3?[f] *11*	(41/2⁻)	6216.5[e] *25*	55/2⁻	8677.6[a] *16*	65/2⁻	14358.8[a] *21*	85/2⁻
4733.5[e] *20*	47/2⁻	6507.1[c] *14*	57/2⁺	8937[e] *3*	67/2⁻	15051.5[d] *23*	87/2⁺
4764.3[i] *9*	(43/2⁻)	6552.9[h] *11*	(53/2⁻)	9523.6[c] *17*	69/2⁺	15384.1[c] *20*	89/2⁺
4833.5[c] *13*	49/2⁺	6726.2[b] *25*	55/2⁻	9540.5[d] *16*	67/2⁺	15547.8[a] *24*	89/2⁻
4860.7[g] *12*	(43/2⁻)	6758.7[d] *14*	55/2⁺	9637[b] *3*	67/2⁻	16275.5[d] *25*	91/2⁺
5094.7[d] *12*	47/2⁺	6817.8[a] *14*	57/2⁻	9710.6[a] *17*	69/2⁻	16767[a] *3*	93/2⁻
5095.2[b] *20*	47/2⁻	6936.2[i] *12*	(55/2⁻)	9972[e] *4*	71/2⁻		
5106.1[h] *9*	(45/2⁻)	7056[e] *3*	59/2⁻	10563.5[d] *17*	71/2⁺		
5212.3[a] *12*	49/2⁻	7335.1[h] *14*	(57/2⁻)	10648.9[c] *18*	73/2⁺		

[†] From a least-squares fit to Eγ data.

[‡] From 1995Fi01 and 1996Sm05, based on multipolarity determinations and band structures.

[#] Intensity imbalance at this level implies the existence of additional transition(s) deexciting the level with I(γ+ce)≥68 *4*.

[@] Level shown in level-scheme Fig. 1 of 2019Sm01.

[&] From Recoil-Distance Doppler-Shift (RDDS) method (2013Gl01) using Cologne plunger, and analyzed using Differential Decay Curve Method (DDCM).

[a] Band(A): ν5/2[523],α=+1/2. Band assignment from 1995Fi01.

[b] Band(a): ν5/2[523],α=−1/2. 1995Fi01 suggest 3/2[521] or 1/2[521] for this band, but neither is compatible with earlier assignments (e.g., 1971Ab04), for the low-spin members of those bands. Also, the 301 level, assigned by 1995Fi01 as the 11/2 member of this band, previously had been assigned (1976Gr06,1976Me06) as the 11/2 member of the 5/2[523] band. The 11/2 through 31/2 members have energies very close to those of the 5/2[523] band in the isotone ^{169}Hf, and the alignment appears to be consistent with this being the signature partner of the 5/2[523], α=+1/2 band.

[c] Band(B): ν5/2[642],α=+1/2.

[d] Band(b): ν5/2[642],α=−1/2.

[e] Band(C): Band based on 27/2⁻,α=−1/2. 1995Fi01 suggest that this is the ν5/2[523], α=−1/2 band, but see comment on 5/2[523], α=−1/2 band above.

[f] Band(D): ν11/2[505],α=+1/2. Band assignment from 1996Sm05, with possible band crossing at ħω≈0.31 MeV due to a pair of $i_{13/2}$ neutrons.

[g] Band(d): ν11/2[505],α=−1/2. Band assignment from 1996Sm05, with possible band crossing at ħω≈0.31 MeV due to a pair of $i_{13/2}$ neutrons.

[h] Band(E): 3-qp (neutron) band,α=+1/2. Band assignment from 1996Sm05.

[i] Band(e): 3-qp (neutron) band,α=−1/2. Band assignment from 1996Sm05.

γ(^{167}Yb)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ	α[c]	Comments
(20.19[a] *3*)		78.679	7/2⁻	58.538	9/2⁺				
(24.63[a] *1*)		58.538	9/2⁺	33.91	7/2⁺				
(28.88[a] *1*)		58.538	9/2⁺	29.66	5/2⁺				
(29.66[a] *1*)		29.66	5/2⁺	0.0	5/2⁻				
(33.91[a] *1*)		33.91	7/2⁺	0.0	5/2⁻				
(44.77[a] *2*)		78.679	7/2⁻	33.91	7/2⁺				
(49.02[a] *2*)		78.679	7/2⁻	29.66	5/2⁺				
(60.1[a] *2*)		185.96	13/2⁺	125.912	11/2⁺				
(61.2[a] *5*)		1121.7	25/2⁺	1060.6	23/2⁺				Measured Iγ(61.2γ)=2.4 *8*, relative to 100 for 400.5γ (2013Gl01) by determining Iγ values of 416.8γ, 339.4γ and 401.0γ with gate on 479.9γ in γγ-coin and using intensity balance arguments.
(67.37[a] *2*)		125.912	11/2⁺	58.538	9/2⁺				
(76.9[a] *5*)		721.2	21/2⁺	644.3	19/2⁺				
(77.5[a] *1*)		407.8	17/2⁺	330.3	15/2⁺				
(78.67[a] *2*)		78.679	7/2⁻	0.0	5/2⁻				
(92.05[a] *7*)		125.912	11/2⁺	33.91	7/2⁺				
(100.22[a] *2*)		178.879	9/2⁻	78.679	7/2⁻				
(120.31[a] *3*)		178.879	9/2⁻	58.538	9/2⁺				
(122.63[a] *4*)		301.49	11/2⁻	178.879	9/2⁻				
127.5 *5*	64.1 *12*	185.96	13/2⁺	58.538	9/2⁺	Q			Iγ(30°)/Iγ(90°)=1.08 *2* (1985Ba47).
144.2 *5*	48.0 *10*	330.3	15/2⁺	185.96	13/2⁺				
(144.97[a] *3*)		178.879	9/2⁻	33.91	7/2⁺				
155.0[@] *1*		726.48	(13/2⁻)	571.48	11/2⁻				
174.9[@] *1*		901.39	(15/2⁻)	726.48	(13/2⁻)	E2		0.423	α(K)exp=0.19 *5*; α(L)exp+α(M)exp=0.14 *5* (2019Sm01) Mult.: α(K)theory=0.241 for E2 and 0.579 for M1 gives pure E2, with no M1 admixture, when compared with α(K)exp value; α(L+M)exp overlaps M1 and E2 for all δ values. 2019Sm01 give δ^2(E2/M1)≥2.5 or δ≥1.58.
178.9 *5*	50.4 *25*	178.879	9/2⁻	0.0	5/2⁻	Q			Iγ(30°)/Iγ(90°)=0.96 *6* (1985Ba47).
193.3[@] *2*		1094.64	(17/2⁻)	901.39	(15/2⁻)				Iγ:Iγ(593.2)=75 *5*:100 *6* (1996Sm05).
204.4 *5*	92 *3*	330.3	15/2⁺	125.912	11/2⁺	E2		0.250	B(E2)↓=1.13 *12*; B(E2)(W.u.)=207 *23* (2013Gl01) Iγ(30°)/Iγ(90°)=0.90 *2* (1985Ba47).
210.4[@] *2*		1304.92	(19/2⁻)	1094.64	(17/2⁻)	E2+M1	1.6 *6*	0.28 *5*	α(K)exp=0.20 *5* (2019Sm01) Iγ:Iγ(593.2)=66 *4*:100 *6* (1996Sm05). Mult.,δ: α(K)theory=0.347 for M1 and 0.143 for E2 gives M1+E2, with δ(E2/M1)=1.6 *6*, when compared with α(K)exp value. 2019Sm01 give δ^2(E2/M1)≥0.9 or δ≥0.95.
221.9 *5*	100.0 *14*	407.8	17/2⁺	185.96	13/2⁺	E2		0.191	B(E2)↓=1.44 *42*; B(E2)(W.u.)=265 *76* (2013Gl01)

$^{167}_{70}$Yb$_{97}$-4

γ(^{167}Yb) (continued)

Eγ[†]	Iγ[‡]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[#]	α[c]	Comments
								Iγ(30°)/Iγ(90°) data normalized so ratio=1.00 *2* for this transition (1985Ba47).
(222.79[a] *4*)		301.49	11/2−	78.679	7/2−			
226.2[@] *2*		1531.0	(21/2−)	1304.92	(19/2−)			Iγ:Iγ(593.2)=56 *4*:100 *6* (1996Sm05).
236.5 *5*	23.0 *8*	644.3	19/2+	407.8	17/2+			
240.7[@] *3*		1771.5	(23/2−)	1531.0	(21/2−)			Iγ:Iγ(593.2)=48 *3*:100 *6* (1996Sm05).
243 *1*	[b]	301.49	11/2−	58.538	9/2+			
254.2[@] *3*		2025.6	(25/2−)	1771.5	(23/2−)			Iγ:Iγ(593.2)=40.1 *25*:100 *6* (1996Sm05).
263.4 *5*	52.1 *25*	442.4	13/2−	178.879	9/2−	E2	0.1103 *17*	α(K)exp=0.057 *11*; α(L)exp+α(M)exp=0.032 *16* (2019Sm01) B(E2)↓=1.10 *14*; B(E2)(W.u.)=202 *25* (2013Gl01) Iγ(30°)/Iγ(90°)=0.93 *5* (1985Ba47). Mult.: α(K)(theory)=0.0757 for E2 and 2.68 for M3 gives pure E2, when compared with α(K)exp, with no M3 admixture; α(L+M)exp gives δ(M3/E2)<0.11, consistent with pure E2.
267.1[@] *3*		2292.6	(27/2−)	2025.6	(25/2−)			Iγ:Iγ(593.2)=29.5 *19*:100 *6* (1996Sm05).
(270.00[a] *10*)		571.48	11/2−	301.49	11/2−			
279.2[@] *3*		2571.6	(29/2−)	2292.6	(27/2−)			Iγ:Iγ(593.2)=31.9 *20*:100 *6* (1996Sm05).
291.2[@] *4*		2862.7	(31/2−)	2571.6	(29/2−)			Iγ:Iγ(593.2)=17.8 *11*:100 *6* (1996Sm05).
301.6[@e] *3*		4116.6	(39/2−)	3815.4?	(37/2−)			
301.9[@] *3*		3164.8	(33/2−)	2862.7	(31/2−)			
304.6[&e]		3837.7	41/2−	3533.1	39/2+			
306 *1*	9.0 *3*	607.3	15/2−	301.49	11/2−			
308.9[@] *5*		4116.6	(39/2−)	3807.3	(37/2−)			Iγ:Iγ(593.2)=14.2 *9*:100 *6* (1996Sm05).
313.4 *5*	[b]	721.2	21/2+	407.8	17/2+	[E2]	0.0648	B(E2)↓=1.85 *57*; B(E2)(W.u.)=339 *104* (2013Gl01)
314.2 *5*	[b]	644.3	19/2+	330.3	15/2+	E2	0.0644	α(K)exp=0.048 *6*; α(L)exp+α(M)exp=0.020 *3* (2019Sm01) B(E2)↓=1.16 *22*; B(E2)(W.u.)=212 *40* (2013Gl01) Mult.: α(K)theory=0.0465 for E2 and 1.39 for M3 gives δ(M3/E2)<0.075, when compared with α(K)exp value; α(L+M)exp gives δ(M3/E2)<0.11; both consistent with pure E2.
316.6 *5*	17.1 *9*	442.4	13/2−	125.912	11/2+	[E1]	0.0175	B(E1)↓=1.12×10^{-6} *15*; B(E1)(W.u.)=5.71×10^{-5} *78* (2013Gl01)
317.6[@] *4*		4434.4	(41/2−)	4116.6	(39/2−)			Iγ:Iγ(593.2)=28.4 *18*:100 *6* (1996Sm05).
329.9[@] *4*		901.39	(15/2−)	571.48	11/2−			
330.0[@] *4*		4764.3	(43/2−)	4434.4	(41/2−)			Iγ:Iγ(593.2)=30.0 *19*:100 *6* (1996Sm05).
334.3[@e] *5*		3815.4?	(37/2−)	3481.2	(35/2−)			Iγ:Iγ(593.2)=18.1 *11*:100 *6* (1996Sm05).
339.4 *5*	14.2 *6*	1060.6	23/2+	721.2	21/2+			
341.2 *5*	98.6 *21*	783.6	17/2−	442.4	13/2−	E2	0.0505	B(E2)↓=1.51 *48*; B(E2)(W.u.)=277 *88* (2013Gl01) Mult.: Iγ(30°)/Iγ(90°)=1.24 *3* (1985Ba47).
341.7[@] *4*		5106.1	(45/2−)	4764.3	(43/2−)			

From ENSDF

$^{167}_{70}$Yb$_{97}$-5

γ(^{167}Yb) (continued)

Eγ[†]	Iγ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[c]	Comments
347.6[@] 4		5454.0	(47/2⁻)	5106.1	(45/2⁻)			
358.7[@] 4		5812.7	(49/2⁻)	5454.0	(47/2⁻)			
366.0[@] 6		6178.7	(51/2⁻)	5812.7	(49/2⁻)			
368.2[@] 4		1094.64	(17/2⁻)	726.48	(13/2⁻)			
374.0[@] 5		6552.9	(53/2⁻)	6178.7	(51/2⁻)			
380 1	10.4 3	987.3	19/2⁻	607.3	15/2⁻			
383.5[@] 6		6936.2	(55/2⁻)	6552.9	(53/2⁻)			
(385.55[a] 12)		571.48	11/2⁻	185.96	13/2⁺			
(392.61[a] 10)		571.48	11/2⁻	178.879	9/2⁻			
400.5 5	176 6	1121.7	25/2⁺	721.2	21/2⁺	[E2]	0.0321	B(E2)↓=2.14 39; B(E2)(W.u.)=391 72 (2013Gl01)
403.4[@] 3		1304.92	(19/2⁻)	901.39	(15/2⁻)			Iγ:Iγ(593.2)=53 3:100 6 (1996Sm05).
409.1 5	103 3	1192.6	21/2⁻	783.6	17/2⁻	E2	0.0303	B(E2)↓=1.51 30; B(E2)(W.u.)=276 54 (2013Gl01) Iγ(30°)/Iγ(90°)=1.58 7 (1985Ba47).
416.3 5	64 3	1060.6	23/2⁺	644.3	19/2⁺	E2	0.0289	B(E2)↓=1.31 24; B(E2)(W.u.)=240 43 (2013Gl01) Iγ(30°)/Iγ(90°)=1.44 2 (1985Ba47).
420.0[&e]		3237.0	37/2⁻	2817.0	35/2⁺			
421 1	[b]	607.3	15/2⁻	185.96	13/2⁺			
436.2[@] 3		1531.0	(21/2⁻)	1094.64	(17/2⁻)			Iγ:Iγ(593.2)=81 5:100 6 (1996Sm05).
445 1	15.6 4	1432.9	23/2⁻	987.3	19/2⁻			
(445.56[a] 12)		571.48	11/2⁻	125.912	11/2⁺			
447.8 5	6.6 3	1569.5	27/2⁺	1121.7	25/2⁺			
453.4 5	10.2 5	783.6	17/2⁻	330.3	15/2⁺	[E1]	0.00753	B(E1)↓=6.0×10^{-7} 19; B(E1)(W.u.)=3.05×10^{-5} 98 (2013Gl01)
463.9 5	94 3	1656.5	25/2⁻	1192.6	21/2⁻	Q		Iγ(30°)/Iγ(90°)=1.00 4 (1985Ba47).
464 1	1.7 4	2358.8	31/2⁻	1894.7	27/2⁻			
466.5[@] 3		1771.5	(23/2⁻)	1304.92	(19/2⁻)			Iγ:Iγ(593.2)=65 4:100 6 (1996Sm05).
479.4 5	167 6	1601.1	29/2⁺	1121.7	25/2⁺			
494.6[@] 3		2025.6	(25/2⁻)	1531.0	(21/2⁻)			Iγ:Iγ(593.2)=81 5:100 6 (1996Sm05).
501 1	15.8 5	1934.3	27/2⁻	1432.9	23/2⁻			
501.8 5	96 3	2158.3	29/2⁻	1656.5	25/2⁻	Q		Iγ(30°)/Iγ(90°)=1.08 2 (1985Ba47).
508.9 5	57 3	1569.5	27/2⁺	1060.6	23/2⁺			
512.8[@] 3		571.48	11/2⁻	58.538	9/2⁺			Iγ:Iγ(593.2)=8.9 6:100 6 (1996Sm05).
520.9[@] 3		2292.6	(27/2⁻)	1771.5	(23/2⁻)			Iγ:Iγ(593.2)=70 4:100 6 (1996Sm05).
523 1	9.7 5	2881.5	35/2⁻	2358.8	31/2⁻			
525.1 5	28.4 11	2683.6	33/2⁻	2158.5	31/2⁺			
525.3 5	86 3	2683.6	33/2⁻	2158.3	29/2⁻			Iγ(30°)/Iγ(90°)=0.95 3 (1985Ba47), presumably for doublet.
546.0[@] 4		2571.6	(29/2⁻)	2025.6	(25/2⁻)			Iγ:Iγ(593.2)=90 6:100 6 (1996Sm05).
547.0 5	148 6	2148.1	33/2⁺	1601.1	29/2⁺	Q		Iγ(30°)/Iγ(90°)=0.92 2 (1985Ba47).
548 1	13.3 5	2482.2	31/2⁻	1934.3	27/2⁻			

From ENSDF

γ(^{167}Yb) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[c]	Comments
548.3 5	[b]	1192.6	21/2⁻	644.3	19/2⁺	[E1]	0.00496	B(E1)↓=9.7×10^{-7} 27; B(E1)(W.u.)=5.0×10^{-5} 14 (2013Gl01)
553.4 5	69 3	3237.0	37/2⁻	2683.6	33/2⁻			
557.4 5	6.8 3	2158.5	31/2⁺	1601.1	29/2⁺			
570.1[@] 2		2862.7	(31/2⁻)	2292.6	(27/2⁻)			Iγ:Iγ(593.2)=61 4:100 6 (1996Sm05).
578 1	2.2 3	3459.5	39/2⁻	2881.5	35/2⁻			
579 1	[b]	987.3	19/2⁻	407.8	17/2⁺			
588.8 5	[b]	2158.3	29/2⁻	1569.5	27/2⁺			
589.0 5	59 3	2158.5	31/2⁺	1569.5	27/2⁺			Iγ(30°)/Iγ(90°)=0.89 2 (1985Ba47).
590 1	11.4 5	3072.2	35/2⁻	2482.2	31/2⁻			
593.2[@] 3		3164.8	(33/2⁻)	2571.6	(29/2⁻)			
595.9 5	[b]	1656.5	25/2⁻	1060.6	23/2⁺			
600.7 5	60 3	3837.7	41/2⁻	3237.0	37/2⁻			Iγ(30°)/Iγ(90°)=0.88 6 for possibly contaminated line (1985Ba47).
602.8 5	146 7	2750.9	37/2⁺	2148.1	33/2⁺	Q		Iγ(30°)/Iγ(90°)=0.91 6 (1985Ba47).
618 1	2.0 3	4077.5	43/2⁻	3459.5	39/2⁻			
618.6[@] 4		3481.2	(35/2⁻)	2862.7	(31/2⁻)			
618.6[@e] 4		4434.4	(41/2⁻)	3815.4?	(37/2⁻)			
627.4[@] 4		4434.4	(41/2⁻)	3807.3	(37/2⁻)			Iγ:Iγ(593.2)=21.1 13:100 6 (1996Sm05).
630 1	9.8 4	3702.2	39/2⁻	3072.2	35/2⁻			
642.5[@] 5		3807.3	(37/2⁻)	3164.8	(33/2⁻)			Iγ:Iγ(593.2)=52 3:100 6 (1996Sm05).
647.6 5	107 6	3398.5	41/2⁺	2750.9	37/2⁺			
648.3[@e] 7		4764.3	(43/2⁻)	4116.6	(39/2⁻)			
650.3[@e] 7		3815.4?	(37/2⁻)	3164.8	(33/2⁻)			
656 1	1.6 4	4733.5	47/2⁻	4077.5	43/2⁻			
658.0 5	46.1 20	4495.7	45/2⁻	3837.7	41/2⁻			
658.5 5	60.1 20	2817.0	35/2⁺	2158.5	31/2⁺			I_γ: uncertainty of 0.2 is presumed a misprint of 2.0 (evaluators).
660.5[@] 6		4141.7	(39/2⁻)	3481.2	(35/2⁻)			Iγ:Iγ(593.2)=25.5 16:100 6 (1996Sm05).
668.9 5	[b]	2817.0	35/2⁺	2148.1	33/2⁺			
670 1	7.5 4	4372.2	43/2⁻	3702.2	39/2⁻			
671.3[@] 9		5106.1	(45/2⁻)	4434.4	(41/2⁻)			Iγ:Iγ(593.2)=32.7 21:100 6 (1996Sm05).
690.3[@] 7		5454.0	(47/2⁻)	4764.3	(43/2⁻)			Iγ:Iγ(593.2)=29.8 18:100 6 (1996Sm05).
692.3 5	83 6	4090.8	45/2⁺	3398.5	41/2⁺	Q		Iγ(30°)/Iγ(90°)=0.98 3 (1985Ba47).
696.0[@e] 8		4503.3?	(41/2⁻)	3807.3	(37/2⁻)			Iγ:Iγ(593.2)=16.5 10:100 6 (1996Sm05).
706.8[@] 6		5812.7	(49/2⁻)	5106.1	(45/2⁻)			Iγ:Iγ(593.2)=33.8 21:100 6 (1996Sm05).
710 1	2.1 4	5443.5	51/2⁻	4733.5	47/2⁻			
712 1	4.3 3	1432.9	23/2⁻	721.2	21/2⁺			
716.1 5	41.0 11	3533.1	39/2⁺	2817.0	35/2⁺			
716.6 5	37.8 19	5212.3	49/2⁻	4495.7	45/2⁻			
719.0[@] 8		4860.7	(43/2⁻)	4141.7	(39/2⁻)			Iγ:Iγ(593.2)=20.5 5:100 6 (1996Sm05).

$^{167}_{70}$Yb$_{97}$-7

γ(^{167}Yb) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	Comments
723 *1*	5.0 *4*	5095.2	47/2$^-$	4372.2	43/2$^-$		
724.0 [@] *8*		6178.7	(51/2$^-$)	5454.0	(47/2$^-$)		Iγ:Iγ(593.2)=22.8 *14*:100 *6* (1996Sm05).
730.7 [@e] *8*		5234.0?	(45/2$^-$)	4503.3?	(41/2$^-$)		Iγ:Iγ(593.2)=15.1 *10*:100 *6* (1996Sm05).
733 *1*	[b]	2881.5	35/2$^-$	2148.1	33/2$^+$		
741.0 [@] *8*		6552.9	(53/2$^-$)	5812.7	(49/2$^-$)		Iγ:Iγ(593.2)=25.7 *16*:100 *6* (1996Sm05).
742.6 *5*	62 *5*	4833.5	49/2$^+$	4090.8	45/2$^+$	Q	Iγ(30°)/Iγ(90°)=1.16 *5* (1985Ba47).
755.1 [@e] *9*		5615.8?	(47/2$^-$)	4860.7	(43/2$^-$)		Iγ:Iγ(593.2)=18.7 *23*:100 *6* (1996Sm05).
757.0 [@] *9*		6936.2	(55/2$^-$)	6178.7	(51/2$^-$)		Iγ:Iγ(593.2)=15.3 *23*:100 *6* (1996Sm05).
758 *1*	[b]	2358.8	31/2$^-$	1601.1	29/2$^+$		
762.2 *5*	20.8 *8*	4295.3	43/2$^+$	3533.1	39/2$^+$		
773 *1*	[b]	1894.7	27/2$^-$	1121.7	25/2$^+$		
773 *1*	3.8 *4*	6216.5	55/2$^-$	5443.5	51/2$^-$		
773.4 *5*	28.1 *18*	5985.7	53/2$^-$	5212.3	49/2$^-$		
782.1 [&e]		3533.1	39/2$^+$	2750.9	37/2$^+$		
782.2 [@e] *9*		6016.2?	(49/2$^-$)	5234.0?	(45/2$^-$)		
782.2 [@] *9*		7335.1	(57/2$^-$)	6552.9	(53/2$^-$)		
783 *1*	4.8 *4*	5878.2	51/2$^-$	5095.2	47/2$^-$		
799.4 *5*	12.7 *7*	5094.7	47/2$^+$	4295.3	43/2$^+$		
803.2 *5*	52 *5*	5636.7	53/2$^+$	4833.5	49/2$^+$	Q	Iγ(30°)/Iγ(90°)=1.14 *7* (1985Ba47).
807.8 [@] *7*		7744.0	(59/2$^-$)	6936.2	(55/2$^-$)		
813 *1*	5.7 *4*	1934.3	27/2$^-$	1121.7	25/2$^+$		
825.2 *5*	13.8 *7*	5919.9	51/2$^+$	5094.7	47/2$^+$		
832.1 *5*	23.2 *19*	6817.8	57/2$^-$	5985.7	53/2$^-$		
838.7 [@e] *8*		8173.8?	(61/2$^-$)	7335.1	(57/2$^-$)		
838.8 *5*	12.3 *6*	6758.7	55/2$^+$	5919.9	51/2$^+$		
840 *1*	2.0 *4*	7056	59/2$^-$	6216.5	55/2$^-$		
848 *1*	4.1 *4*	6726.2	55/2$^-$	5878.2	51/2$^-$		
861.0 [@e] *8*		8605.0?	(63/2$^-$)	7744.0	(59/2$^-$)		
870.4 *5*	37 *5*	6507.1	57/2$^+$	5636.7	53/2$^+$	Q	Iγ(30°)/Iγ(90°)=1.14 *10* (1985Ba47).
881 *1*	3.9 *4*	2482.2	31/2$^-$	1601.1	29/2$^+$		
881.3 *5*	8.3 *3*	7640.0	59/2$^+$	6758.7	55/2$^+$		
895.6 *5*		7713.4	61/2$^-$	6817.8	57/2$^-$		I_γ: probably contaminated by nearby transition (1995Fi01).
908 *1*	1.3 *4*	7964	63/2$^-$	7056	59/2$^-$		
913 *1*	2.5 *4*	7639	59/2$^-$	6726.2	55/2$^-$		
924 *1*	2.5 *4*	3072.2	35/2$^-$	2148.1	33/2$^+$		
928.5 *5*	6.9 *4*	8568.5	63/2$^+$	7640.0	59/2$^+$		
939.2 *5*	22.6 *10*	7446.3	61/2$^+$	6507.1	57/2$^+$		Iγ(30°)/Iγ(90°)=0.86 *9* (1985Ba47).
964.2 *5*	10.7 *8*	8677.6	65/2$^-$	7713.4	61/2$^-$		
972.0 *5*	4.3 *6*	9540.5	67/2$^+$	8568.5	63/2$^+$		

$^{167}_{70}$Yb$_{97}$-8

^{124}Sn(^{48}Ca,5nγ) 1996Sm05,1995Fi01,1985Ba47 (continued)

γ(^{167}Yb) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π
973 *1*	0.8 *4*	8937	67/2⁻	7964	63/2⁻	1123[d] *1*	4.1[d] *4*	13887.1	83/2⁺	12764.1	79/2⁺
974 *1*	1.5 *4*	8613	63/2⁻	7639	59/2⁻	1125.3 *5*	4.5 *9*	10648.9	73/2⁺	9523.6	69/2⁺
1006.8 *5*	15.4 *9*	8453.1	65/2⁺	7446.3	61/2⁺	1157.6 *5*	2.7 *3*	11967.0	77/2⁻	10809.4	73/2⁻
1023.0 *5*	3.5 *3*	10563.5	71/2⁺	9540.5	67/2⁺	1164.3 *5*	2.7 *6*	11813.2	77/2⁺	10648.9	73/2⁺
1024 *1*	1.2 *4*	9637	67/2⁻	8613	63/2⁻	1164.4 *5*	1.9 *6*	15051.5	87/2⁺	13887.1	83/2⁺
1033.0 *5*	6.9 *3*	9710.6	69/2⁻	8677.6	65/2⁻	1176.8 *5*	2.7 *6*	12990.0	81/2⁺	11813.2	77/2⁺
1035 *1*	[b]	9972	71/2⁻	8937	67/2⁻	1179 *1*	1.2 *3*	14358.8	85/2⁻	13179.8	81/2⁻
1070.5 *5*	9.7 *9*	9523.6	69/2⁺	8453.1	65/2⁺	1182.7 *5*	1.9 *6*	14172.7	85/2⁺	12990.0	81/2⁺
1076 *1*	1.0 *4*	10713	71/2⁻	9637	67/2⁻	1189 *1*	0.7 *3*	15547.8	89/2⁻	14358.8	85/2⁻
1077.5 *5*	2.6 *6*	11641.0	75/2⁺	10563.5	71/2⁺	1211.4 *5*	1.3 *3*	15384.1	89/2⁺	14172.7	85/2⁺
1080 *1*	0.4 *2*	11052	75/2⁻	9972	71/2⁻	1212.8 *5*	1.9 *3*	13179.8	81/2⁻	11967.0	77/2⁻
1098.8 *5*	4.4 *3*	10809.4	73/2⁻	9710.6	69/2⁻	1219 *1*	0.9 *4*	16767	93/2⁻	15547.8	89/2⁻
1123[d] *1*	4.1[d] *4*	12764.1	79/2⁺	11641.0	75/2⁺	1224 *1*	0.8 *2*	16275.5	91/2⁺	15051.5	87/2⁺

† From 1995Fi01, except as noted. $\Delta E_\gamma \le 0.5$ keV except for weak transitions and doublets (for those, uncertainty ≤1 keV) (1995Fi01); the evaluator assigns ΔE_γ=0.5 keV to all transitions except those for which the authors round off Eγ to the nearest keV.

‡ Photon intensity relative to Iγ(221.9)=100.0; obtained from projected coincidence spectra (1995Fi01) for E(^{48}Ca)=210 MeV, except as noted. See 1985Ba47 for Iγ (uncertainty unstated) obtained from average of 30° and 90° projected spectra for E(^{48}Ca)=201 MeV.

1985Ba47 report Iγ(30°)/Iγ(90°), normalized so that the ratio is 1.0 for the stretched quadrupole 222γ. Authors assign multipolarities as stretched quadrupole or stretched dipole for ratios of ≈1.0 and ≈0.5, respectively. Assignments for four transitions (174.9γ from 901 level, 210.4γ from 1305 level, 263.4γ from 442 level, and 314.3γ from 644 level) are from ce data in 2019Sm01. In addition, RUL is used to assign E2 for stretched quadrupole transitions when level half-life is available from measurements by 2013Gl01.

@ From 1996Sm05.

& From level energy difference. Shown in Fig. 4 of 1995Fi01, but absent in authors′ Table 2; γ not listed in the Adopted dataset.

a From the Adopted Gammas. Transition shown in level-scheme Fig. 1 of 2019Sm01.

b Iγ could not be determined due either to proximity of another transition or to low photon intensity.

c 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.

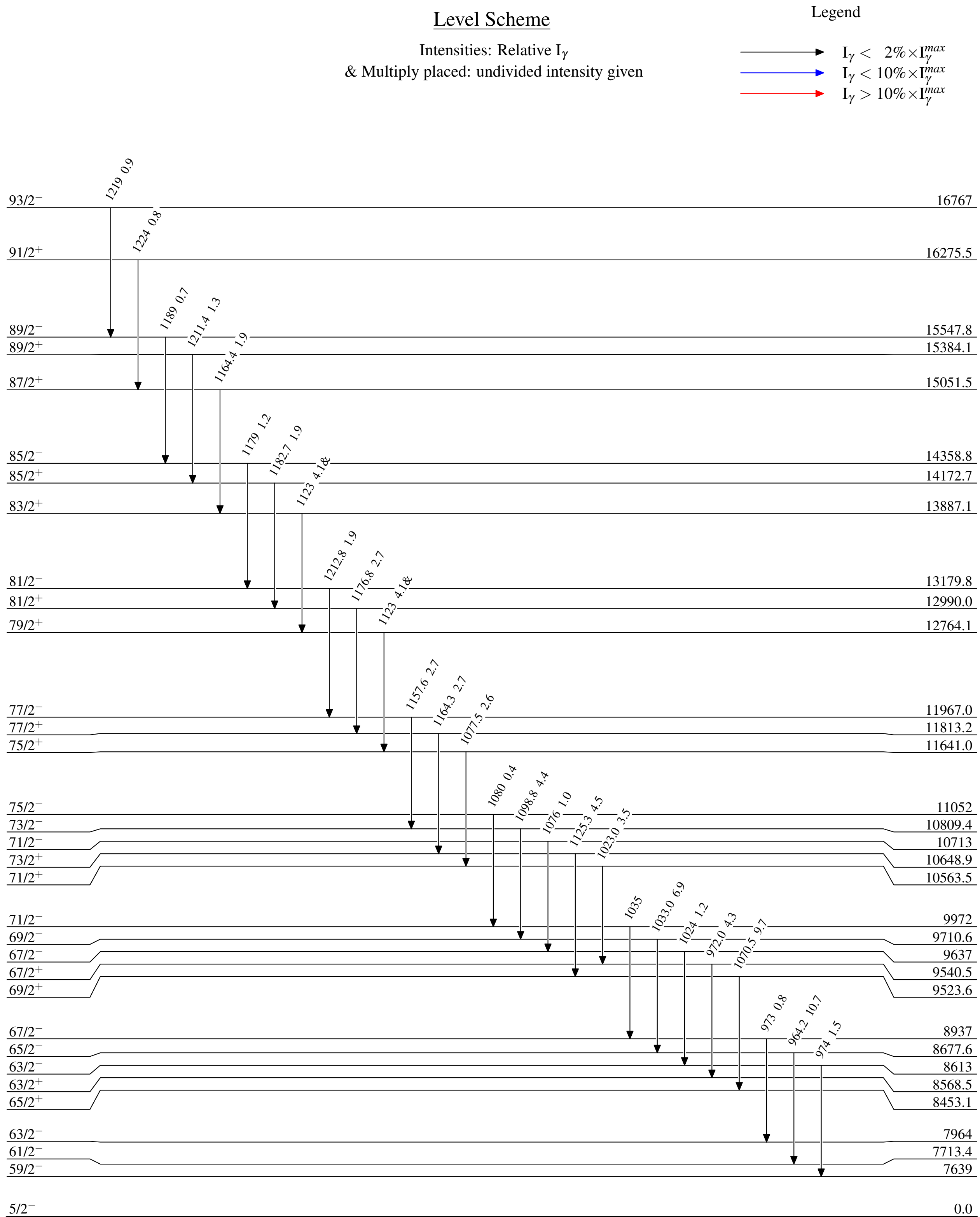
d Multiply placed with undivided intensity.

e Placement of transition in the level scheme is uncertain.

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

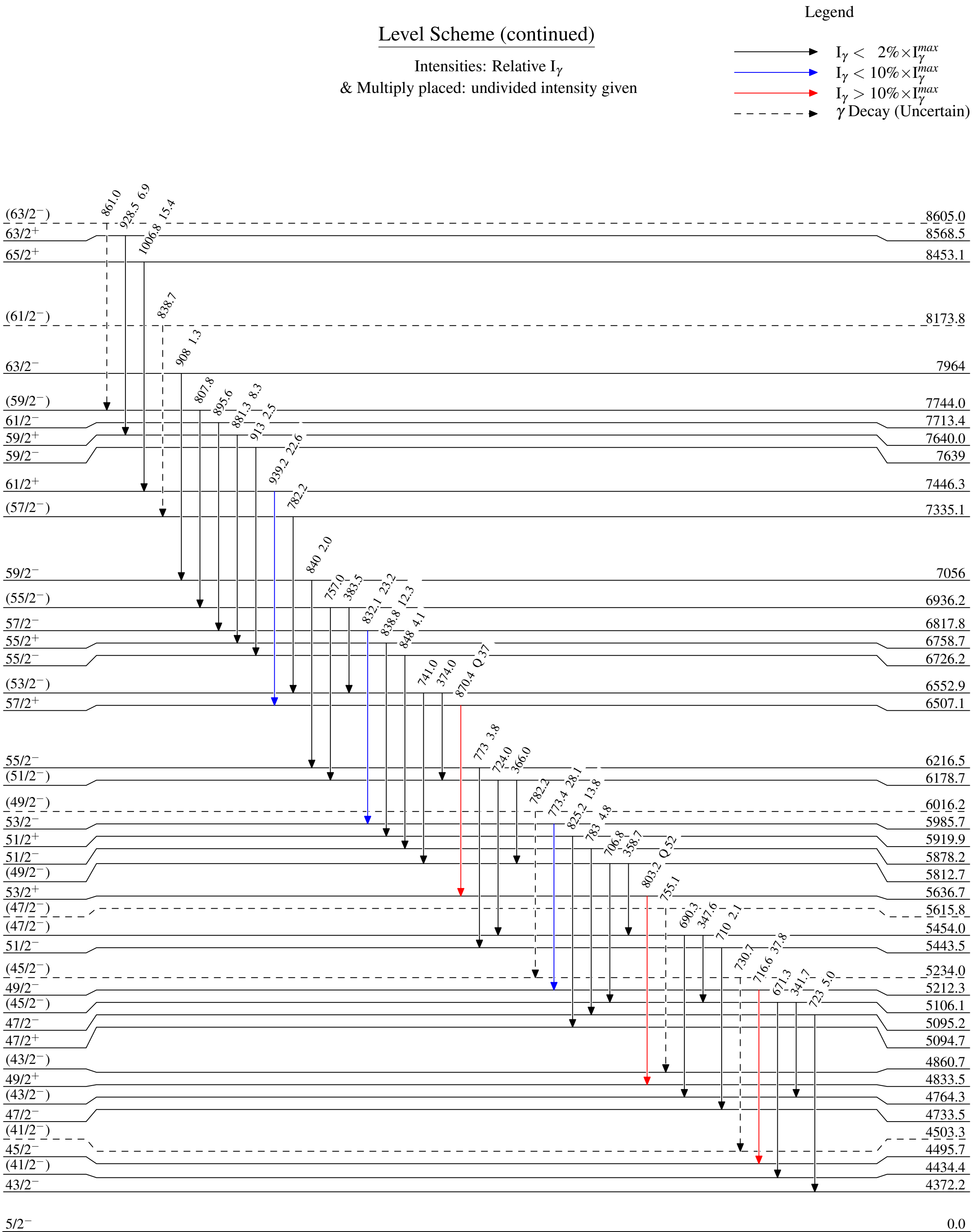


$^{167}_{70}Yb_{97}$

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



$^{167}_{70}Yb_{97}$

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

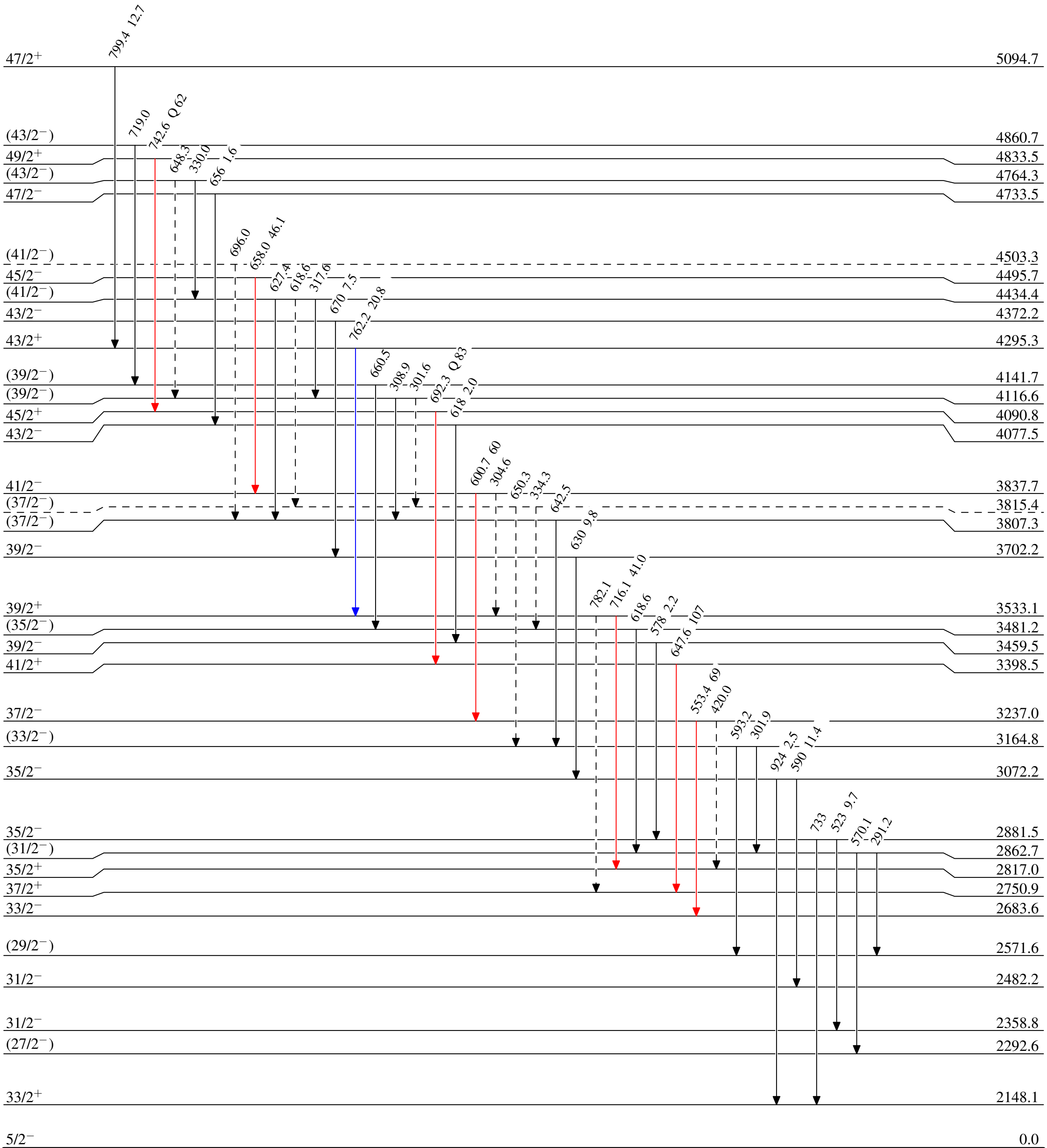
Legend

$I_\gamma <$ 2%×I_γ^{max}

$I_\gamma <$ 10%×I_γ^{max}

$I_\gamma >$ 10%×I_γ^{max}

γ Decay (Uncertain)



$^{167}_{70}Yb_{97}$

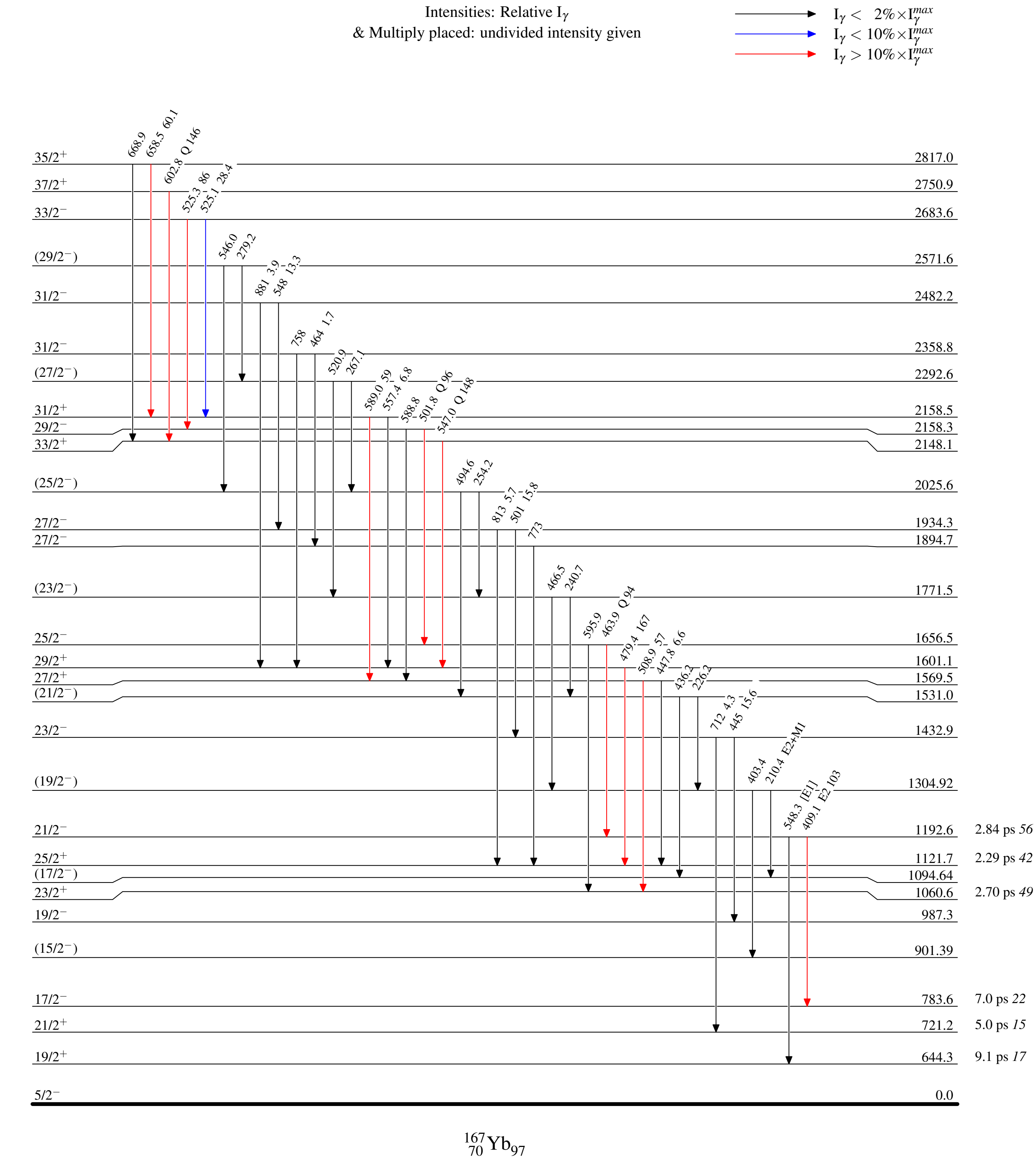
$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

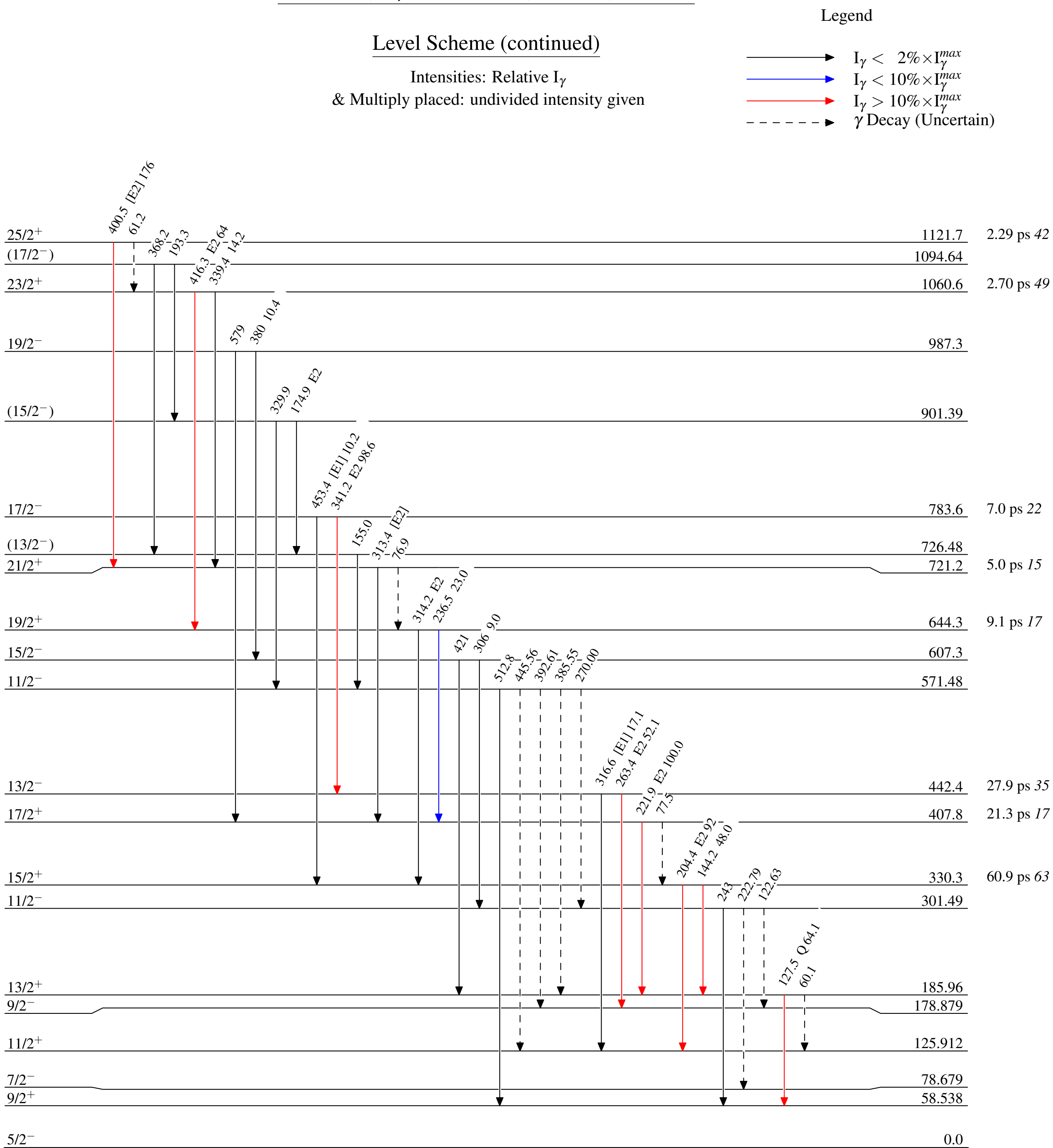
Legend



$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



$^{167}_{70}Yb_{97}$

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47

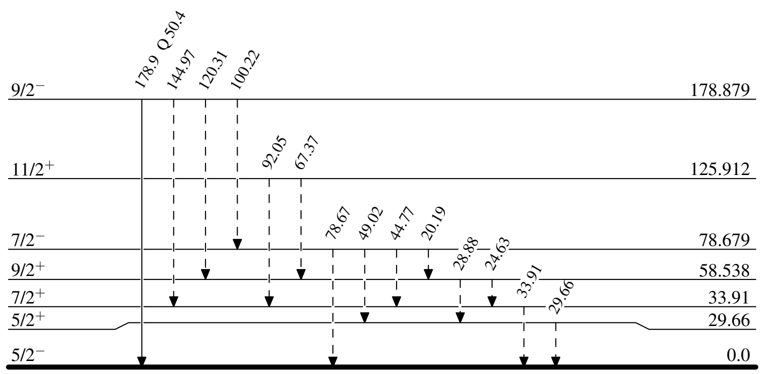
Legend

Level Scheme (continued)

Intensities: Relative I_γ

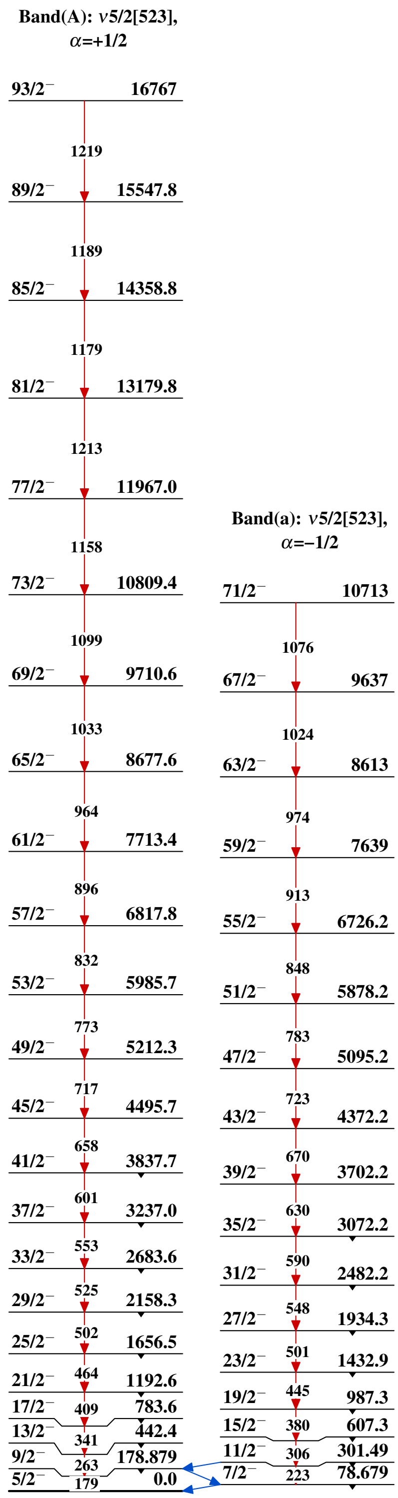
& Multiply placed: undivided intensity given

- - - - - -► γ Decay (Uncertain)



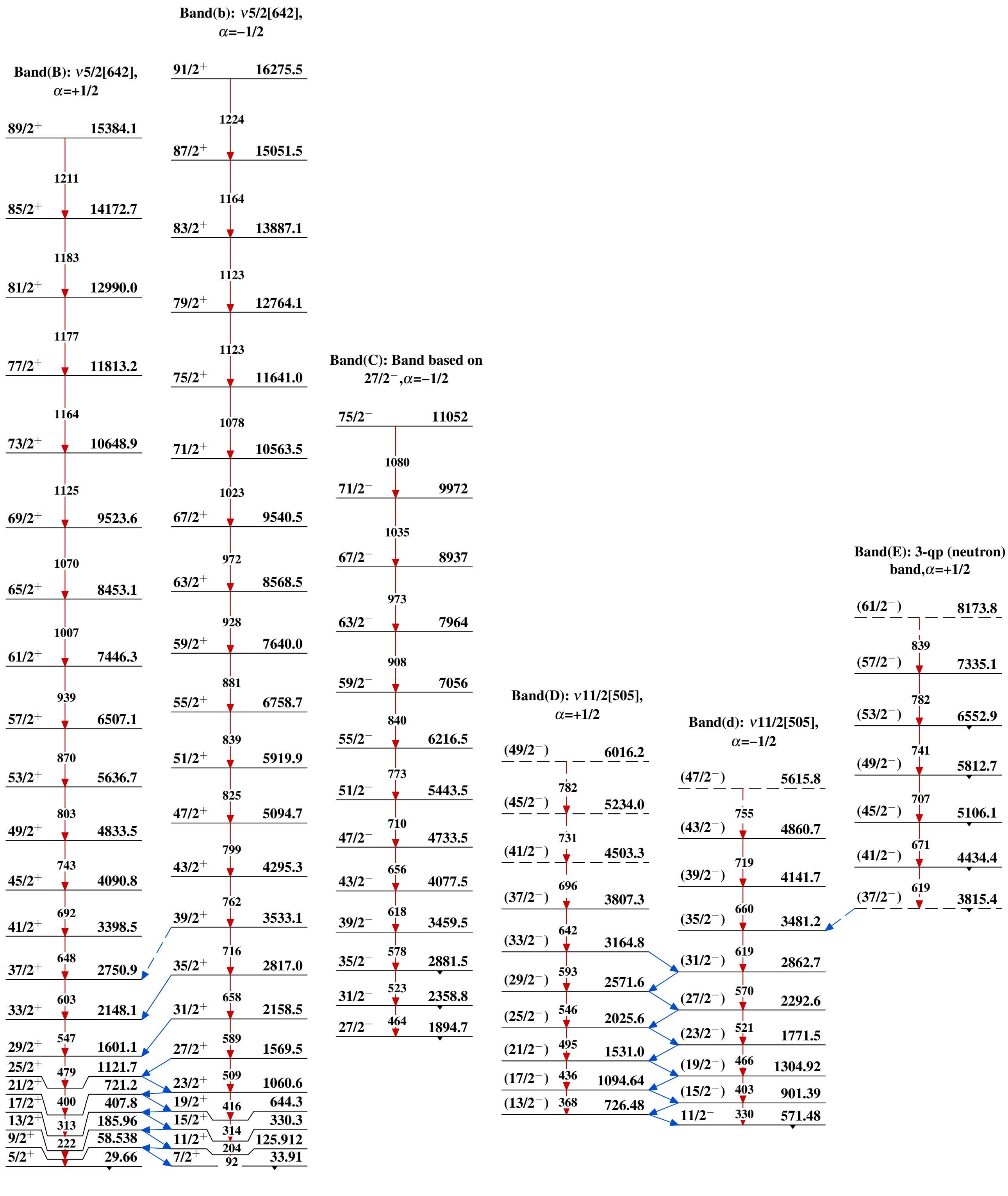
$^{167}_{70}Yb_{97}$

^{124}Sn(^{48}Ca,5nγ) 1996Sm05,1995Fi01,1985Ba47



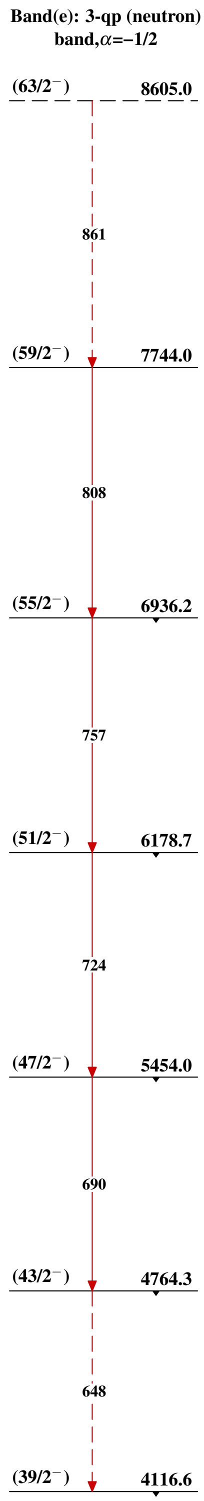
$^{167}_{70}Yb_{97}$

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47 (continued)



$^{167}_{70}Yb_{97}$

$^{124}Sn(^{48}Ca,5n\gamma)$ 1996Sm05,1995Fi01,1985Ba47 (continued)



$^{167}_{70}Yb_{97}$