(HI,xnγ) 1983Ko05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich, Balraj Singh	NDS 111, 1211 (2010)	12-Apr-2010

Additional information 1.

Includes ^{116}Cd(^{50}Ti,3nγ), ^{147}Sm(^{19}F,p2nγ), ^{149}Sm(^{16}O,4nγ), ^{152,154}Sm(^{14}N,xnγ), ^{152,154}Sm(^{16}O,xnγ), and ^{153}Eu(^{14}N,4nγ).

2002Sc11, As a by-product of a study of the lifetimes of triaxial superdeformed levels In ^{163}Lu, ^{164}Lu, deduce Q_t for the normal-deformation yrast band. For a description of the techniques used, see the ^{163}Lu data set.

1983Ko05: ^{149}Sm(^{18}O,4nγ) E=84 MeV. Measured γ′s, γγ-coin, γ(θ), (x ray)γ(t) (multiplicity filter) and ce′s (spect). Cranked shell-model calculations. Systematics.

1979Ri06,1978Ba16,1977Ri13: ^{152}Sm(^{16}O,5nγ),^{154}Sm(^{16}O,7nγ), ^{152}Sm(^{18}O,7nγ) ^{154}Sm(^{18}O,9nγ) E=88,90,95 MeV. Measured excitation functions, ce′s, ce(t) (solenoid,Si(Li); recoil shadow), ceγ coin, γγ-coin.

1992Mc02: ^{116}Cd(^{50}Ti,3nγ) E=215 MeV. Measured $T_{1/2}$ by Doppler shift recoil-distance method (RDM).

1992ScZL: ^{147}Sm(^{19}F,p2nγ) E=85 MeV. Measured $T_{1/2}$ by Doppler shift attenuation (DSA) and recoil-distance (RDM) methods.

Others:

1985GaZS: ^{122}Sn(^{44}Ca,3nγ) E= 195 MeV.

1985In03: ^{159}Tb(^{14}N,α6nγ) E=115 MeV. Obtained shape parameters from γ-multiplicities.

All data are from 1983Ko05, except as noted.

78-198-318-425-519-596-667 cascade (ΔJ=2 band) proposed by 1979Ri06 (1977Ri13) defining levels from 78 to 2800 with J^π=5/2$^-$ to 29/2$^-$ is not confirmed by 1983Ko05 using cross-bombardment reactions. This cascade was proposed (1983Ko05) to belong to ^{164}Yb (see 1986Jo02 for ^{164}Yb level structure).

The following γ rays from 1979Ri06 and associated levels have been omitted due to lack of confirmation by 1983Ko05 and possible reassignment (by 1983Ko05) to ^{164}Yb: 197.6, 220.3 (15/2$^+$ to 13/2$^+$), 317.8, 388, 425.1, 518.6, 532.2, 596.0, 666.8. 532γ probably belongs to ^{164}Yb.

^{163}Yb Levels

The cascade 702-639-563-468-445-515-460-386-293-181 proposed by 1979Ri06 (1977Ri13) is reordered (by 1983Ko05) as 702-633-570-512-468-460-445-386-293-181. Note that Eγ=633, 570, 512 (in 1983Ko05) correspond to 639, 563 and 515 (in 1979Ri06), respectively.

Additional information 2.

E(level)[†]	Jπ[‡]	$T_{1/2}$	Comments
0.0[e]	3/2$^-$		
53.9[d] *2*	5/2$^-$	>5[a] ns	
58.1	(3/2$^-$,5/2,7/2$^-$)		
99.1[b] *2*	(5/2$^+$)	≈10[#] ns	$T_{1/2}$: Prompt component of 41γ(t) and 45γ(t) suggests a side feeding below the isomeric state.
123.8[b] *4*	(9/2$^+$)	≈10[#] ns	
132.5[e] *3*	7/2$^-$	1.15[a] ns *8*	
167.4[b] *4*	(13/2$^+$)	2.37[a] ns *7*	$T_{1/2}$: other: 2.7 ns (1983Ko05; (x ray)γ(t)).
234.5[d] *3*	9/2$^-$		
263.7[c] *4*	(11/2$^+$)		
370.4[b] *4*	(17/2$^+$)	0.104[a] ns *4*	$T_{1/2}$: others: 0.115 ns *14* (RDM 1992Mc02), 1978Ba16. Q_t= 6.5 *4* for K=5/2 (1992Mc02). 2002Sc11 report Q_t=4.9 *+13−4* for this band.
394.0[e] *4*	(11/2$^-$)		
483.7[c] *4*	(15/2$^+$)		
527.5[d] *4*	(13/2$^-$)		
715.4[b] *5*	(21/2$^+$)	8.3[&] ps *9*	$T_{1/2}$: other: 8.3 ps *+28−14* (1992ScZL). Q_t= 6.7 *3* for K=5/2 (1992Mc02). 2002Sc11 report Q_t=4.9 *+13−4* for this band.

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(HI,xnγ) 1983Ko05 (continued)

^{163}Yb Levels (continued)

E(level)[†]	Jπ[‡]	T$_{1/2}$	Comments
854.0[c] *4*	(19/2$^+$)		
913.1[d] *4*	(17/2$^-$)		
1178.4[b] *5*	(25/2$^+$)	2.4[&] ps *5*	T$_{1/2}$: other: 2.4 ps *4* (1992ScZL). Q$_t$= 5.9 *6* for K=5/2 (1992Mc02). 2002Sc11 report Q$_t$=4.9 *+13−4* for this band.
1343.3[c] *5*	(23/2$^+$)		
1358.1[d] *4*	(21/2$^-$)		
1641.4[e] *5*	(23/2$^-$)		
1735.5[b] *6*	(29/2$^+$)	1.1[&] ps *4*	Q$_t$= 5.3 *8* for K=5/2 (1992Mc02). 2002Sc11 report Q$_t$=4.9 *+13−4* for this band.
1818.3[d] *5*	(25/2$^-$)		
1922.8[c] *5*	(27/2$^+$)		
2027.9[f] *5*	(25/2$^-$)		
2114.2[e] *6*	(27/2$^-$)		
2285.9[d] *5*	(29/2$^-$)		
2364.8[b] *6*	(33/2$^+$)	0.42[&] ps *14*	T$_{1/2}$: other: 0.40 ps *+18−14* (DSAM 1992ScZL). Q$_t$= 6.2 *11* for K=5/2 (1992Mc02). 2002Sc11 report Q$_t$=4.9 *+13−4* for this band.
2524.2[f] *6*	(29/2$^-$)		
2527.3[e] *6*	(31/2$^-$)		
2569.9[c] *6*	(31/2$^+$)		
2797.5[d] *6*	(33/2$^-$)		
3023.0[e] *6*	(35/2$^-$)		
3044.4[b] *7*	(37/2$^+$)	0.24[@] ps *+16−10*	
3074.4[f] *7*	(33/2$^-$)		
3265.9[c] *7*	(35/2$^+$)		
3367.7[d] *7*	(37/2$^-$)		
3613.8[e] *7*	(39/2$^-$)		
3679.4[f] *8*	(37/2$^-$)		
3750.9[b] *8*	(41/2$^+$)	0.17[@] ps *+9−6*	
3989.9[c] *7*	(39/2$^+$)		
4000.7[d] *7*	(41/2$^-$)		
4294.8[e] *8*	(43/2$^-$)		
4476.6[b] *8*	(45/2$^+$)	0.17[@] ps *+5−9*	
4702.7[d] *8*	(45/2$^-$)		
5047.5[e] *8*	(47/2$^-$)		
5246.2[b] *9*	(49/2$^+$)	0.17[@] ps *+18−9*	
6081[b] *1*	(53/2$^+$)		

[†] From least-squares fit to Eγ′s assigning 0.3 keV uncertainty to each γ.
[‡] From Adopted Levels.
[#] From (x ray)γ(t) (1983Ko05).
[@] From DSAM (1992ScZL).
[&] From RDM (1992Mc02).
[a] From ce(t) (1979Ri06).
[b] Band(A): (π=+,α=+1/2) (1983Ko05). Favored band based on i$_{13/2}$ orbital (1983Ko05,1979Ri06,1977Ri13).
[c] Band(B): (π=+,α=−1/2) (1983Ko05). Unfavored band based on i$_{13/2}$ orbital (1983Ko05,1979Ri06,1977Ri13).
[d] Band(C): (π=−,α=+1/2) (1983Ko05). Based on ν3/2[521] orbital (1983Ko05). 1979Ri06 (1977Ri13) propose it as the ν5/2[523]

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(HI,xnγ) 1983Ko05 (continued)

^{163}Yb Levels (continued)

band.

[e] Band(D): (π=−,α=−1/2) (1983Ko05). Based on the ν3/2[521] orbital.

[f] Band(E): (π=−,α=+1/2) (1983Ko05).

$\gamma(^{163}Yb)$

A 262.7γ appears in figure 1 of 1983Ko05, 370.3 keV-gated coin spectrum, but it is not placed in the level scheme.

γ rays from $^{152}Sm(^{16}O,5n\gamma)$ E= 95 MeV
(from 1979Ri06 (also 1977Ri13))

Eγ	Iγ	Eγ	Iγ
43.0			
53.6			
78.3		514.6 2	5.5 14
79.3 2		518.6 2	a 5.3 7
102.1 2	4.0 5	532.2 2	a 12.8 14
181.1 2	9.2 9	557.1 2	75 3
197.6 2	a 10.9 5	563.4 2	10.9 13
203.2 2	112 5	579.2 2	23.2 14
217.8 2	a 2.8 4	596.0 2	a 7.1 14
220.3 2	3.4 4	629.4 2	47.5 17
293.3 2	13.0 9	638.5 2	4.1 10
317.8 2	a 13.5 9	666.8 2	a 1.1 9
345.3 2	122 6	679.5 2	32.4 17
370.7 2	12.8 9	702.3 2	4.4 11
385.9 2	14.0 10	706.3 2	19.8 13
388	a		
425.1 2	a 8.4 17	725.3 2	11.1 21
445.3 2	17.2 10		
460.3 2	17.9 14		
463.0 2	170 7		
467.8 2	15.8 11		
489.7 2	38.9 19		

a: γ not reported by 1983Ko05, probably in ^{164}Yb

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[&]	Comments
(4.2[‡])		58.1	(3/2⁻,5/2,7/2⁻)	53.9	5/2⁻				
(24.7)		123.8	(9/2⁺)	99.1	(5/2⁺)	[E2]		1.94×10^3	
41.0	≈700	99.1	(5/2⁺)	58.1	(3/2⁻,5/2,7/2⁻)	D,E2			Mult.: comparison with RUL.
43.6	≈80	167.4	(13/2⁺)	123.8	(9/2⁺)	[E2]		116.8	
45.3	≈160	99.1	(5/2⁺)	53.9	5/2⁻	[E1]		0.538	
53.9	91.8	53.9	5/2⁻	0.0	3/2⁻	M1+E2	≈−1.5	≈29.7	A_2=− 0.28 *1*, A_4=+ 0.27 *1*.
58[‡]		58.1	(3/2⁻,5/2,7/2⁻)	0.0	3/2⁻				
73.1[a]	6.6	132.5	7/2⁻	58.1	(3/2⁻,5/2,7/2⁻)				E_γ: placement from ε decay and its appearance in 370γ-gated spectrum (figure 1 of 1983Ko05). Level-energy

From ENSDF

$^{163}_{70}Yb_{93}$-4

γ(^{163}Yb) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[&]	Comments
									difference=74.4. Eγ=75.0 in ^{163}Lu ε decay. I_γ: from adopted branching ratios and Iγ(78.6γ).
78.6	11.3	132.5	7/2⁻	53.9	5/2⁻	M1(+E2)	+0.03	6.75	A_2=− 0.12 *10*, A_4=+ 0.22 *20*. Mult.: from γ(θ). δ=0.46 *13* from K/L=0.5 *1* (1979Ri06). But K/L may be contaminated by ce(73γ)'s (evaluators).
96.3	1.0[#]	263.7	(11/2⁺)	167.4	(13/2⁺)	(M1+E2)	+0.4	3.75	A_2=+ 0.5 *3*, A_4=− 0.23 *20*.
102.0	2.6	234.5	9/2⁻	132.5	7/2⁻	(M1+E2)	−0.4	3.16	A_2=+ 0.27 *20*, A_4=+ 0.16 *30*.
113.3	2.5	483.7	(15/2⁺)	370.4	(17/2⁺)	(M1+E2)	−0.5	2.29	A_2=+ 0.30 *8*, A_4=+ 0.30 *18*.
133.5	2.8	527.5	(13/2⁻)	394.0	(11/2⁻)	D+Q			A_2=+ 0.05 *3*, A_4=− 0.33 *4*.
138.6	1.0[#]	854.0	(19/2⁺)	715.4	(21/2⁺)	[M1,E2]		1.14 *19*	
139.9	1.0[#]	263.7	(11/2⁺)	123.8	(9/2⁺)	(M1+E2)	+1.2	1.076	A_2=+ 0.89 *10*, A_4=+ 0.24 *11*.
159.5	2.4	394.0	(11/2⁻)	234.5	9/2⁻	(D)			A_2=− 0.07 *20*, A_4=− 0.16 *20*.
162.5[a]	≈0.5	2527.3	(31/2⁻)	2364.8	(33/2⁺)				
180.6	3.5	234.5	9/2⁻	53.9	5/2⁻	E2		0.379	A_2=+ 0.28 *3*, A_4=− 0.12 *3*.
203.0	100.0	370.4	(17/2⁺)	167.4	(13/2⁺)	E2		0.256	A_2=+ 0.31 *4*, A_4=− 0.10 *4*.
220.0	2.5	483.7	(15/2⁺)	263.7	(11/2⁺)	(Q)			A_2=+ 0.20 *3*, A_4= 0.00 *3*.
227.6	2.8	2797.5	(33/2⁻)	2569.9	(31/2⁺)	D+Q			A_2=+ 0.36 *15*, A_4=+ 0.24 *15*.
261.5	1.3	394.0	(11/2⁻)	132.5	7/2⁻	E2		0.1128	A_2=+ 0.32 *2*, A_4=− 0.09 *2*.
263.8	≤3.3[@]	527.5	(13/2⁻)	263.7	(11/2⁺)	D+Q			A_2=− 0.24 *4*, A_4=− 0.07 *4*.
293.0	9.2	527.5	(13/2⁻)	234.5	9/2⁻	Q			A_2=+ 0.31 *5*, A_4=− 0.10 *6*.
316.3	3.9	483.7	(15/2⁺)	167.4	(13/2⁺)	M1+E2	+0.65	0.1147	A_2=+ 0.51 *4*, A_4=+ 0.15 *5*. α(K)exp= 0.12 *2*.
345.0	85.0	715.4	(21/2⁺)	370.4	(17/2⁺)	E2		0.0489	α(K)(345γ,E2) used for normalization of ce data. A_2=+ 0.32 *4*, A_4=− 0.09 *4*.
363.1	3.2	2285.9	(29/2⁻)	1922.8	(27/2⁺)	D+Q			A_2=− 0.05 *14*, A_4=− 0.24 *11*.
370.3	13.0	854.0	(19/2⁺)	483.7	(15/2⁺)	Q			A_2=+ 0.33 *1*, A_4=− 0.03 *1*.
378.7	≈1.3	2114.2	(27/2⁻)	1735.5	(29/2⁺)	D			A_2=− 0.38 *20*.
385.6	11.6	913.1	(17/2⁻)	527.5	(13/2⁻)	Q			A_2=+ 0.30 *7*, A_4=− 0.11 *8*.
413.1	3.2	2527.3	(31/2⁻)	2114.2	(27/2⁻)	Q			A_2=+ 0.28 *3*, A_4=− 0.22 *4*.
429.4	1.8	913.1	(17/2⁻)	483.7	(15/2⁺)	D			A_2=+ 0.07 *6*, A_4=− 0.08 *6*.
445.0	11.5	1358.1	(21/2⁻)	913.1	(17/2⁻)	Q			A_2=+ 0.32 *5*, A_4=− 0.10 *6*.
460.2	12.2	1818.3	(25/2⁻)	1358.1	(21/2⁻)	E2		0.0221	α(K)=0.01718 A_2=+ 0.34 *5*, A_4=− 0.10 *6*. α(K)exp= 0.023 *6*.
463.0	83.8	1178.4	(25/2⁺)	715.4	(21/2⁺)	E2		0.0217	A_2=+ 0.32 *3*, A_4=− 0.09 *4*. α(K)exp= 0.013 *3*.
467.6	15.0	2285.9	(29/2⁻)	1818.3	(25/2⁻)	Q			A_2=+ 0.29 *3*, A_4=− 0.07 *3*.
472.8	≈2.0	2114.2	(27/2⁻)	1641.4	(23/2⁻)				
475.0	4.5	1818.3	(25/2⁻)	1343.3	(23/2⁺)	D			A_2=− 0.23 *6*, A_4=+ 0.04 *6*.
483.6	3.0[#]	854.0	(19/2⁺)	370.4	(17/2⁺)	M1+E2	+0.51	0.0394	A_2=+ 0.44 *13*, A_4=+ 0.24 *14*. α(K)exp= 0.035 *7*.
489.3	≤15.2[@]	1343.3	(23/2⁺)	854.0	(19/2⁺)	E2		0.0188	A_2=+ 0.35 *5*, A_4=− 0.11 *5*. α(K)exp= 0.027 *8*.
495.7	4.0	3023.0	(35/2⁻)	2527.3	(31/2⁻)	E2		0.0182	A_2=+ 0.24 *4*, A_4=− 0.12 *4*. α(K)exp= 0.031 *6*.
496.3	1.5	2524.2	(29/2⁻)	2027.9	(25/2⁻)	(Q)			A_2=+ 0.25 *15*, A_4=− 0.15 *16*.
504.1	2.0[#]	1358.1	(21/2⁻)	854.0	(19/2⁺)	(D)			A_2=+ 0.12 *9*, A_4=− 0.05 *9*.

From ENSDF

$^{163}_{70}Yb_{93}$-5

γ(^{163}Yb) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	α[&]	Comments
511.6	15.7[#]	2797.5	(33/2⁻)	2285.9	(29/2⁻)	(Q)			A_2=+ 0.53 *10*, A_4=− 0.03 *10*.
550.2	2.0[#]	3074.4	(33/2⁻)	2524.2	(29/2⁻)	(Q)			A_2=+ 0.18 *8*, A_4=− 0.06 *8*.
557.1	55.5	1735.5	(29/2⁺)	1178.4	(25/2⁺)	E2		0.01362	A_2=+ 0.31 *3*, A_4=− 0.09 *3*. α(K)exp= 0.0106 *10*.
570.2	15.1[#]	3367.7	(37/2⁻)	2797.5	(33/2⁻)	(Q)			A_2=+ 0.40 *5*, A_4=− 0.02 *5*.
579.5	10.6	1922.8	(27/2⁺)	1343.3	(23/2⁺)	Q			A_2=+ 0.29 *6*, A_4=− 0.12 *6*.
590.8	5.7[#]	3613.8	(39/2⁻)	3023.0	(35/2⁻)	Q			A_2=+ 0.40 *5*, A_4=− 0.10 *5*.
605.0	1.9	3679.4	(37/2⁻)	3074.4	(33/2⁻)	(Q)			A_2=+ 0.16 *18*, A_4=− 0.20 *18*.
629.3	43.7	2364.8	(33/2⁺)	1735.5	(29/2⁺)	E2		0.01017	A_2=+ 0.30 *4*, A_4=− 0.09 *5*. α(K)exp= 0.00696 *19*.
633.0	6.7	4000.7	(41/2⁻)	3367.7	(37/2⁻)	Q			A_2=+ 0.36 *6*, A_4=− 0.13 *4*.
647.1	6.7	2569.9	(31/2⁺)	1922.8	(27/2⁺)	E2		0.00953	A_2=+ 0.12 *3*, A_4=− 0.07 *3*. α(K)exp= 0.00402 *15*.
658.2	3.8	3023.0	(35/2⁻)	2364.8	(33/2⁺)	E1(+M2)	<−0.6	0.010 *8*	A_2=− 0.38 *8*, A_4=− 0.04 *8*. α(K)exp<0.0040.
669.8	3.0[#]	2027.9	(25/2⁻)	1358.1	(21/2⁻)	(Q)			A_2=+ 0.39 *4*, A_4=− 0.05 *5*.
679.6	22.1	3044.4	(37/2⁺)	2364.8	(33/2⁺)	E2		0.00851	A_2=+ 0.23 *3*, A_4=− 0.09 *3*. α(K)exp= 0.0052 *10*.
681.0	≈4.0	4294.8	(43/2⁻)	3613.8	(39/2⁻)				
696.0	5.0[@]	3265.9	(35/2⁺)	2569.9	(31/2⁺)	(Q)			A_2=+ 0.4 *3*, A_4=− 0.19 *20*.
702.0	3.0	4702.7	(45/2⁻)	4000.7	(41/2⁻)	(Q)			A_2=+ 0.45 *22*, A_4=− 0.24 *24*.
706.5	15.6	3750.9	(41/2⁺)	3044.4	(37/2⁺)	E2		0.00780	A_2=+ 0.34 *8*, A_4=− 0.12 *8*. α(K)exp= 0.0050 *10*.
724.0	1.9	3989.9	(39/2⁺)	3265.9	(35/2⁺)	(Q)			A_2=+ 0.44 *20*, A_4=− 0.20 *18*.
725.7	5.6	4476.6	(45/2⁺)	3750.9	(41/2⁺)	E2		0.00734	A_2=+ 0.12 *8*, A_4=− 0.10 *8*.
752.7	≈1.9	5047.5	(47/2⁻)	4294.8	(43/2⁻)	(Q)			A_2=+ 0.50 *25*.
769.6	3.6	5246.2	(49/2⁺)	4476.6	(45/2⁺)	(E2)		0.00645	A_2=+ 0.38 *22*, A_4=+ 0.13 *20*.
791.8	9.7	2527.3	(31/2⁻)	1735.5	(29/2⁺)	E1(+M2)	<−0.05	0.00237 *6*	A_2=− 0.31 *7*, A_4=+ 0.05 *7*. α(K)exp= 0.0016 *4*.
835	≈3.3	6081	(53/2⁺)	5246.2	(49/2⁺)	(Q)			A_2=+ 0.6 *3*, A_4=− 0.22 *25*.
926.0	2.0	1641.4	(23/2⁻)	715.4	(21/2⁺)	D			A_2=− 0.36 *25*, A_4=+ 0.15 *15*.
935.8	4.3	2114.2	(27/2⁻)	1178.4	(25/2⁺)	D(+Q)	<−0.07		A_2=− 0.38 *14*, A_4=− 0.02 *14*.

[†] From γ(θ) and α(K)exp. Mult=Q is assigned when γ(θ) data are consistent with ΔJ=2, stretched quadrupole (most likely E2 from RUL) and mult=D+Q or D is assigned for ΔJ=1 transitions. When lifetime data are available, mult=Q or D+Q are restricted (by RUL) to E2 and M1+E2, respectively. ce data are normalized to α(K)(345γ, assumed E2)=0.0361. 1983Ko05 used α(K)=0.037.

[‡] From ε decay.

[#] From γγ.

[@] Contains contribution from other lines or nuclides.

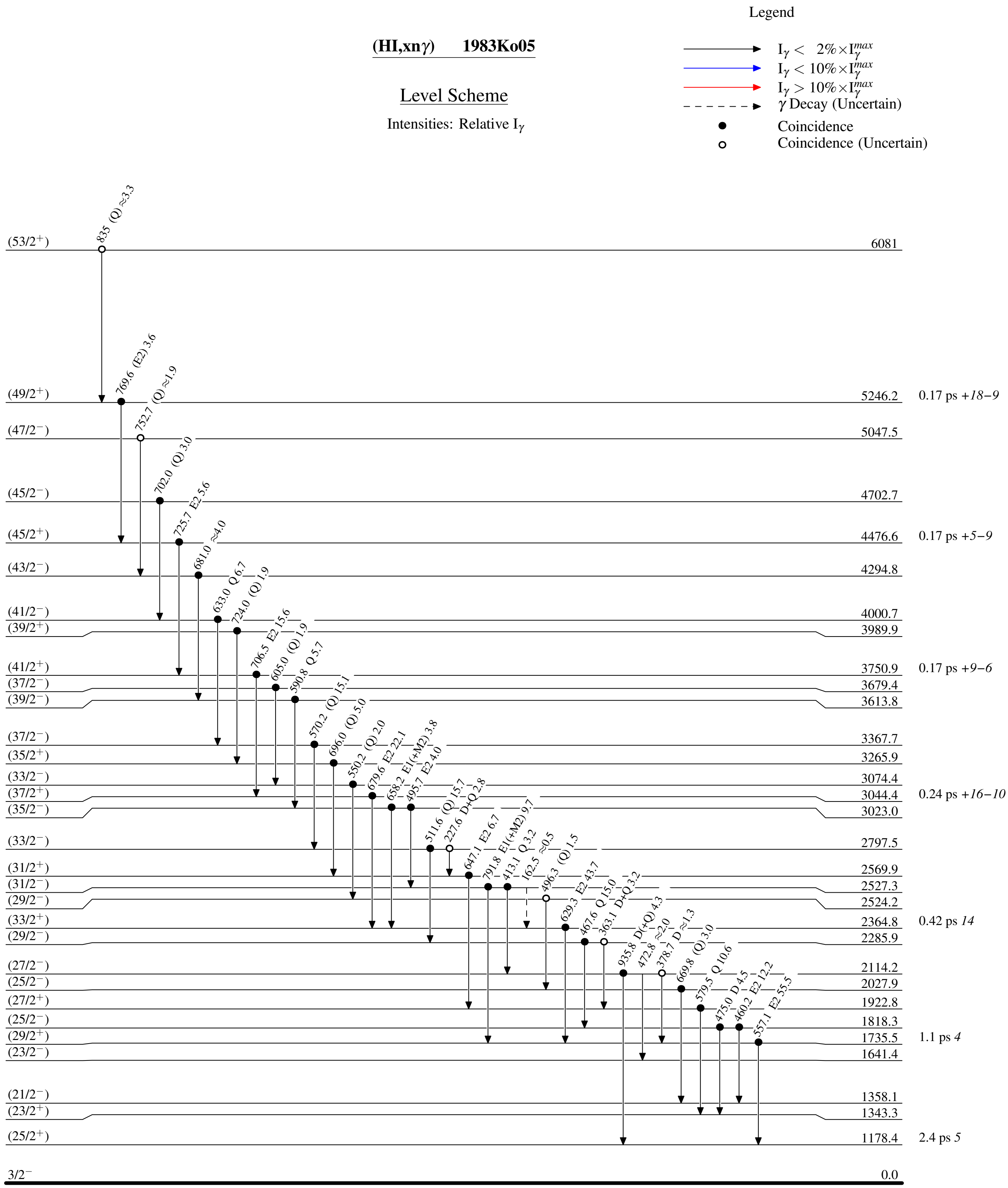
[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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

(HI,xnγ) 1983Ko05

Level Scheme

Intensities: Relative I_γ



$^{163}_{70}Yb_{93}$

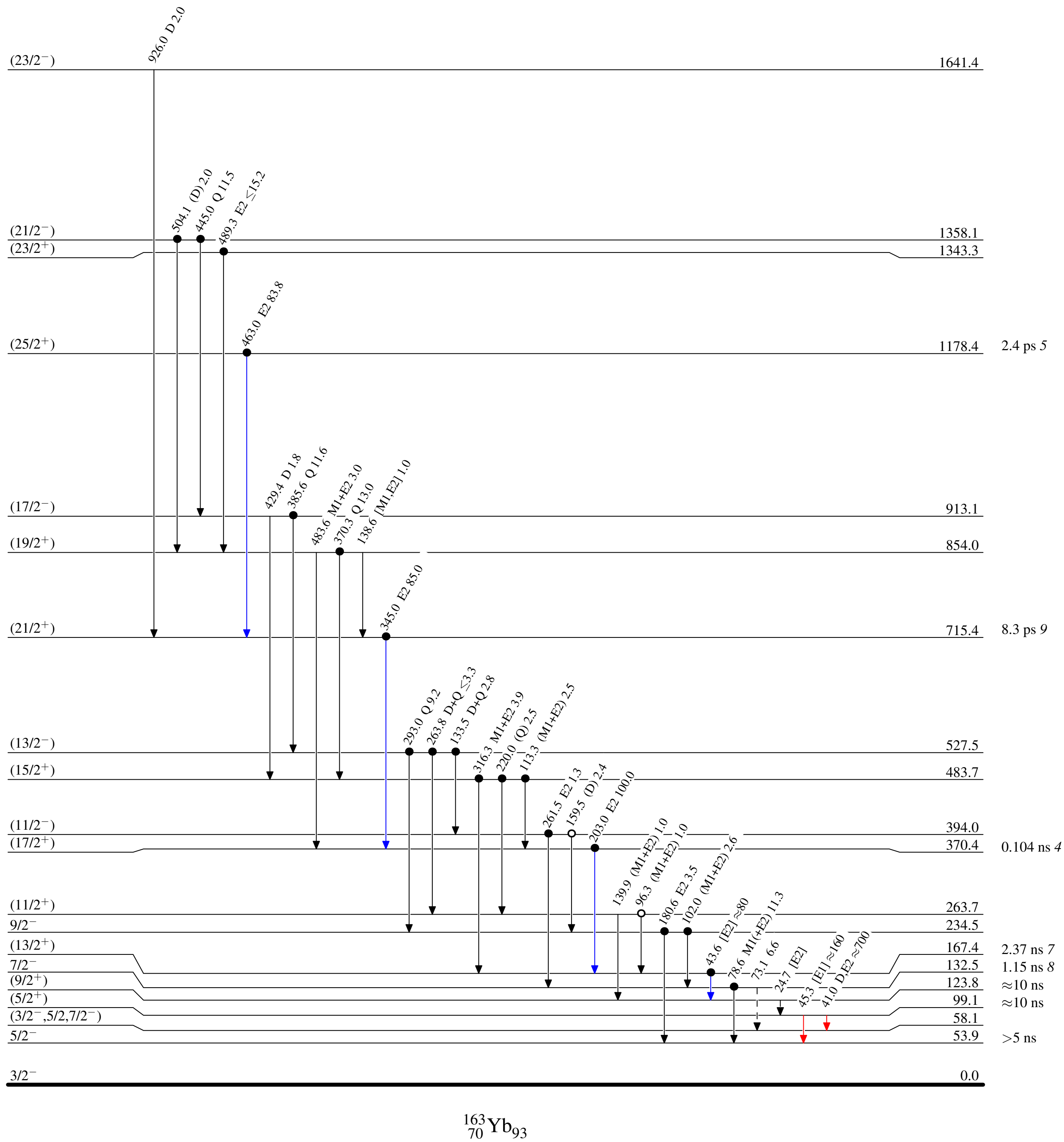
(HI,xnγ) 1983Ko05

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence
- Coincidence (Uncertain)

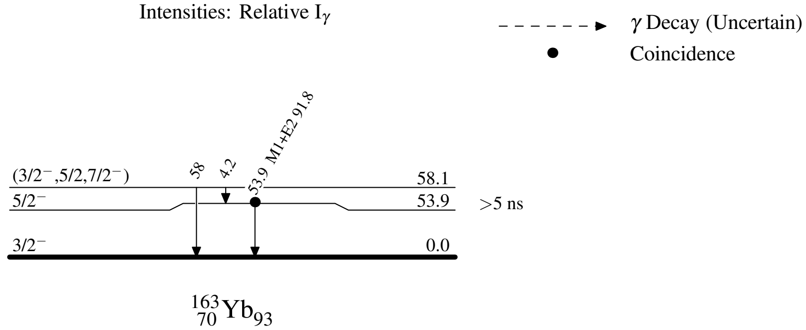


(HI,xnγ) 1983Ko05

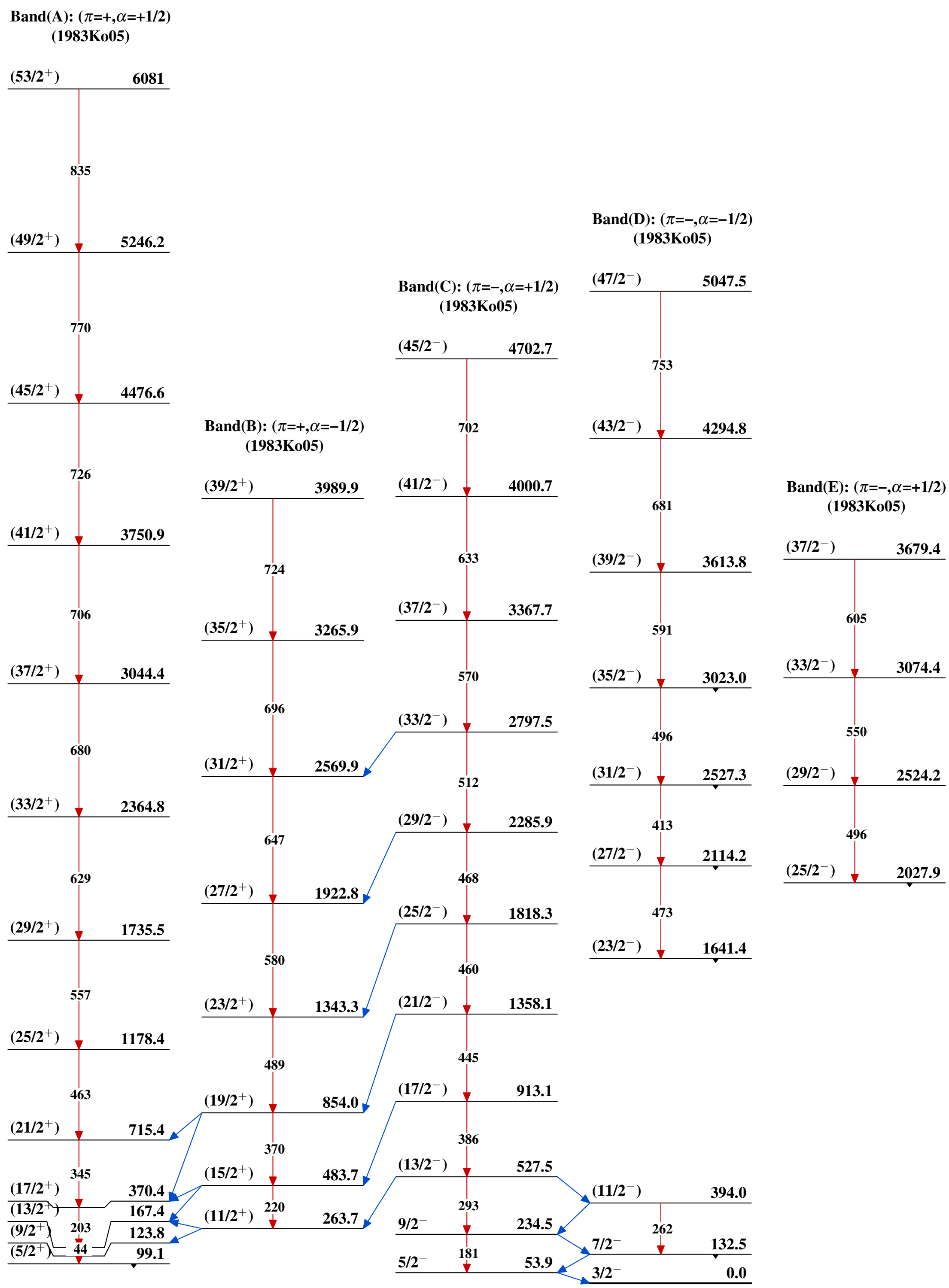
Legend

Level Scheme (continued)

Intensities: Relative I_γ



(HI,xnγ) 1983Ko05



$^{163}_{70}Yb_{93}$