Adopted Levels, Gammas

History

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

Q(β^-)=−4.51×10^3 *4*; S(n)=7544 *22*; S(p)=5.11×10^3 *3*; Q(α)=2836 *16* 2012Wa38
Note: Current evaluation has used the following Q record $ −4510 *30* 7544 *21* 5110 *30* 2838 *16* 2009AuZZ,2003Au03.
Additional information 1.
Mass measurement: 2001Bo59.
Nuclear structure calculations: 1993Ha11, 1991Hs02, 1990Ka24, 1989Zh01, 1989Pa23, 1982Ch12.

^{163}Yb Levels

Additional information 2.

Cross Reference (XREF) Flags

A ^{163}Lu ε decay (3.97 min)
B (HI,xnγ)

E(level)[†]	J$^{\pi}$[#]	T$_{1/2}$[‡]	XREF	Comments
0.0[b]	3/2$^-$	11.05 min *35*	AB	%ε+%β^+=100 μ=−0.374 *8* (1983Ne13,1989Ra17,2005St24) Q=+1.24 *2* (1983Ne13,1989Ra17,2005St24) J$^{\pi}$,μ,Q: spin from atomic beam (1983Ne13; LASER). Parity: μ and Q consistent only with ν3/2[521] orbital. Other: 1982Bu21 (from the same group as 1983Ne13). Δ<r^2>(^{163}Yb−^{176}Yb)=0.887 fm^2 *23* (1994Ma57). From an evaluation of nuclear rms charge radii, 2004An14 report <r^2>$^{1/2}$=5.211 fm 7. T$_{1/2}$: weighted average of 10.9 min *5* (1967Pa20), 10.96 min *35* (1972Ch23), and 11.4 min *5* (1972De57).
53.88[a] *5*	5/2$^-$	3.8 ns *3*	AB	J$^{\pi}$: ΔJ=1, non-isotropic γ to 3/2$^-$ and RUL (for E2 and M2). T$_{1/2}$: $\gamma\gamma$(t) (1980AdZU).
58.1	(3/2$^-$,5/2,7/2$^-$)	>10 ns	AB	J$^{\pi}$: γ to 3/2$^-$ and from 7/2$^-$. T$_{1/2}$: $\gamma\gamma$(t) or ceγ(t) (1994MoZY).
99.2[@] *2*	(5/2$^+$)	≈10 ns	B	J$^{\pi}$: γ to 5/2$^-$ and i$_{13/2}$ bandhead. T$_{1/2}$: Xγ(t) (1983Ko05). Prompt component of 41γ and 45γ suggests a side feeding below the isomeric state.
124.0[@] *3*	(9/2$^+$)	≈10 ns	B	J$^{\pi}$: band member. T$_{1/2}$: Xγ(t) (1983Ko05).
133.06[b] *6*	7/2$^-$	1.15 ns *8*	AB	J$^{\pi}$: ΔJ=1, M1(+E2) γ to 5/2$^-$ and ΔJ=(1) γ from 9/2$^{(-)}$. T$_{1/2}$: ce(t) (1979Ri06).
156.21 *5*			A	
167.6[@] *4*	(13/2$^+$)	2.37 ns *7*	B	J$^{\pi}$: γ to (9/2$^+$) and band member. T$_{1/2}$: ce(t) (1979Ri06). Other: 2.7 ns (1983Ko05).
221.12 *4*	≤7/2		A	J$^{\pi}$: 1/2$^-$,3/2,5/2,7/2$^-$ from γ's to 3/2$^-$ and 5/2$^-$.
234.8[a] *2*	9/2$^-$		B	J$^{\pi}$: ΔJ=2, non-isotropic E2 γ to 5/2$^-$.
263.9[&] *3*	(11/2$^+$)		B	J$^{\pi}$: ΔJ=1, (M1+E2) γ to (9/2$^+$), γ to (13/2$^+$).
370.6[@] *4*	(17/2$^+$)	0.104 ns *4*	B	J$^{\pi}$: ΔJ=2, E2 γ to (13/2$^+$). T$_{1/2}$: ce(t) (1979Ri06). Others: 0.115 ns *14* (RDM 1992Mc02), 1978Ba16.
371.81 *5*	≤7/2		A	J$^{\pi}$: 1/2$^-$,3/2,5/2,7/2$^-$ from γ's to 3/2$^-$ and 5/2$^-$.
394.4[b] *2*	(11/2$^-$)		B	J$^{\pi}$: ΔJ=2 γ to 7/2$^-$, γ to 9/2$^{(-)}$.

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Adopted Levels, Gammas (continued)

^{163}Yb Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[‡]	XREF	Comments
450.01 *10*	≤9/2		A	Jπ: γ to 5/2⁻.
465.05 *9*			A	
474.23 *8*	≤7/2		A	Jπ: 1/2,3/2,5/2,7/2⁻ from γ to 3/2⁻.
483.9[&] *4*	(15/2⁺)		B	Jπ: ΔJ=1, M1+E2 γ to (13/2⁺), ΔJ=1 γ to (17/2⁺).
514.6 *3*	≤9/2		A	Jπ: γ to 5/2⁻.
527.8[a] *3*	(13/2⁻)		B	Jπ: ΔJ=2 γ to 9/2⁻, ΔJ=1 γ to (11/2⁺).
537.91 *13*	≤7/2		A	Jπ: 1/2⁻,3/2,5/2,7/2⁻ from γ's to 3/2⁻ and 5/2⁻.
578.50 *16*			A	
620.6 *4*			A	
674.27 *9*	≤9/2		A	Jπ: γ to 5/2⁻.
715.6[@] *4*	(21/2⁺)	8.3 ps *9*	B	Jπ: ΔJ=2, E2 γ to (17/2⁺).
749 *1*			A	
768.37 *9*			A	
854.2[&] *4*	(19/2⁺)		B	Jπ: ΔJ=1, M1+E2 γ to (17/2⁺), ΔJ=2 γ to (15/2⁺).
855.30 *19*			A	
870.64 *25*	≤7/2		A	Jπ: 1/2,3/2,5/2,7/2⁻ from γ to 3/2⁻.
913.4[a] *4*	(17/2⁻)		B	Jπ: ΔJ=2 γ to (13/2⁻), ΔJ=1 γ to (15/2⁺).
938.60 *12*			A	
1178.6[@] *5*	(25/2⁺)	2.4 ps *5*	B	Jπ: ΔJ=2, E2 γ to (21/2⁺).
1343.5[&] *5*	(23/2⁺)		B	Jπ: ΔJ=2, E2 γ to (19/2⁺).
1358.4[a] *4*	(21/2⁻)		B	Jπ: ΔJ=2 γ to (17/2⁻), ΔJ=(1) γ to (19/2⁺).
1641.6[b] *5*	(23/2⁻)		B	Jπ: ΔJ=1 γ to (21/2⁺).
1735.7[@] *6*	(29/2⁺)	1.1 ps *4*	B	Jπ: ΔJ=2, E2 γ to (25/2⁺).
1818.5[a] *5*	(25/2⁻)		B	Jπ: ΔJ=2, E2 γ to (21/2⁻), ΔJ=1 γ to (23/2⁺).
1923.0[&] *5*	(27/2⁺)		B	Jπ: ΔJ=2 γ to (23/2⁺).
2028.2[c] *5*	(25/2⁻)		B	Jπ: ΔJ=(2) γ to (21/2⁻).
2114.4[b] *6*	(27/2⁻)		B	Jπ: ΔJ=1 γ's to (25/2⁺) and (29/2⁺), γ to (23/2⁻).
2286.1[a] *5*	(29/2⁻)		B	Jπ: ΔJ=2 γ to (25/2⁻), ΔJ=1 γ to (27/2⁺).
2365.0[@] *6*	(33/2⁺)	0.42 ps *14*	B	Jπ: ΔJ=2, E2 γ to (29/2⁺).
2524.5[c] *6*	(29/2⁻)		B	Jπ: ΔJ=(2) γ to (25/2⁻).
2527.5[b] *6*	(31/2⁻)		B	Jπ: ΔJ=2 γ to (27/2⁻), ΔJ=1, E1(+M2) γ to (29/2⁺).
2570.1[&] *6*	(31/2⁺)		B	Jπ: ΔJ=2, E2 γ to (27/2⁺).
2797.7[a] *6*	(33/2⁻)		B	Jπ: ΔJ=(2) γ to (29/2⁻), ΔJ=1 γ to (31/2⁺).
3023.2[b] *6*	(35/2⁻)		B	Jπ: ΔJ=2, E2 γ to (31/2⁻), ΔJ=1, E1(+M2) γ to (33/2⁺).
3044.6[@] *7*	(37/2⁺)	0.24 ps *+16−10*	B	Jπ: ΔJ=2, E2 γ to (33/2⁺).
3074.7[c] *7*	(33/2⁻)		B	Jπ: ΔJ=(2) γ to (29/2⁻).
3266.1[&] *6*	(35/2⁺)		B	Jπ: ΔJ=(2) γ to (31/2⁺).
3368.0[a] *6*	(37/2⁻)		B	Jπ: ΔJ=(2) γ to (33/2⁻).
3614.0[b] *7*	(39/2⁻)		B	Jπ: ΔJ=2 γ to (35/2⁻).
3679.7[c] *7*	(37/2⁻)		B	Jπ: ΔJ=(2) γ to (33/2⁻).
3751.1[@] *7*	(41/2⁺)	0.17 ps *+9−6*	B	Jπ: ΔJ=2, E2 γ to (37/2⁺).
3990.2[&] *7*	(39/2⁺)		B	Jπ: ΔJ=(2) γ to (35/2⁺).
4001.0[a] *7*	(41/2⁻)		B	Jπ: ΔJ=2 γ to (37/2⁻).
4295.0[b] *7*	(43/2⁻)		B	Jπ: γ to (39/2⁻).
4476.8[@] *8*	(45/2⁺)	0.17 ps *+5−9*	B	Jπ: ΔJ=2, E2 γ to (41/2⁺).
4703.0[a] *8*	(45/2⁻)		B	Jπ: ΔJ=(2) γ to (41/2⁻).
5047.7[b] *8*	(47/2⁻)		B	Jπ: ΔJ=(2) γ to (43/2⁻).
5246.4[@] *9*	(49/2⁺)	0.17 ps *+18−9*	B	Jπ: ΔJ=(2), (E2) γ to (45/2⁺).
6081[@] *1*	(53/2⁺)		B	Jπ: ΔJ=(2) γ to (49/2⁺).

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Adopted Levels, Gammas (continued)

^{163}Yb Levels (continued)

† From least-squares fit to Eγ′s.

‡ From recoil-distance method (1992Mc02) for levels between 370 and 2365, and from Doppler-shift attenuation method (1992ScZL) for levels above 2365.

For high-spin states (J≥9/2) populated in (HI,xnγ), the assignments are based on γ(θ), ce data for selected transitions, decay pattern of levels, and band associations. An ascending order of spins with excitation energy is assumed in such reactions.

@ Band(A): $i_{13/2}$ band (π=+,α=+1/2). Favored band (1983Ko05,1979Ri06,1977Ri13) suggested by strong signature splitting. From DSAM, 2002Sc11 deduce Q_t=4.9 *+13−4* for this band (for a description of this experiment, see the ^{163}Lu data set). From lifetime data, 1992Mc02 deduce Q_t for $17/2^+$, $21/2^+$, $25/2^+$, $29/2^+$ and $33/2^+$ levels. For an assumed K=5/2, Q_t ranges from 5.3 to 6.7.

& Band(B): $i_{13/2}$ band (π=+,α=−1/2). Unfavored band (1983Ko05,1979Ri06,1977Ri13). See also comment for α=+1/2 signature partner.

a Band(C): ν3/2[521] band (π=−,α=+1/2). ν3/2[521] assignment by 1983Ko05. 1979Ri06 (1977Ri13) propose it as a ν5/2[523] band.

b Band(D): ν3/2[521] band (π=−,α=−1/2). Band assignment by 1983Ko05.

c Band(E): (π=−,α=+1/2) band.

$\gamma(^{163}Yb)$

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.‡	δ‡	α#	Comments
53.88	5/2⁻	54.00 10	100	0.0	3/2⁻	M1+E2	≈−1.5	≈29.5	B(M1)(W.u.)≈3.6×10⁻⁴; B(E2)(W.u.)≈137
58.1	(3/2⁻,5/2,7/2⁻)	4.2		53.88	5/2⁻				
		58		0.0	3/2⁻				
99.2	(5/2⁺)	41.0	≈100	58.1	(3/2⁻,5/2,7/2⁻)				
		45.3	≈23	53.88	5/2⁻	[E1]		0.538	
124.0	(9/2⁺)	(24.7)	100	99.2	(5/2⁺)	[E2]		1.94×10³	B(E2)(W.u.)≈58
133.06	7/2⁻	75.00 10	58 19	58.1	(3/2⁻,5/2,7/2⁻)				
		79.19 5	100 19	53.88	5/2⁻	M1(+E2)	+0.03	6.61	
156.21		98.11 5	100	58.1	(3/2⁻,5/2,7/2⁻)				
167.6	(13/2⁺)	43.6	100	124.0	(9/2⁺)	[E2]		116.8	B(E2)(W.u.)=240 30
221.12	≤7/2	163.08 5	100 10	58.1	(3/2⁻,5/2,7/2⁻)				
		167.26 5	22 3	53.88	5/2⁻				
		220.93 10	18 4	0.0	3/2⁻				
234.8	9/2⁻	102.0	74	133.06	7/2⁻	(M1+E2)	−0.4	3.16	
		180.6	100	53.88	5/2⁻	E2			
263.9	(11/2⁺)	96.3	100	167.6	(13/2⁺)	(M1+E2)	+0.4	3.75	
		139.9	100	124.0	(9/2⁺)	(M1+E2)	+1.2	1.076	
370.6	(17/2⁺)	203.0	100	167.6	(13/2⁺)	E2		0.256	B(E2)(W.u.)=237 11
371.81	≤7/2	150.74 5	73 8	221.12	≤7/2				
		313.83 15	39 5	58.1	(3/2⁻,5/2,7/2⁻)				
		318.0 3	10 3	53.88	5/2⁻				
		371.73 10	100 16	0.0	3/2⁻				
394.4	(11/2⁻)	159.5	100	234.8	9/2⁻	(D)			
		261.5	54	133.06	7/2⁻	Q			
450.01	≤9/2	391.10 20	100 15	58.1	(3/2⁻,5/2,7/2⁻)				E_γ: level-energy difference=391.9.
		396.34@ 10	≤315@	53.88	5/2⁻				
465.05		93.33 10	87 16	371.81	≤7/2				
		243.91 15	100 24	221.12	≤7/2				
474.23	≤7/2	102.50 10	62 13	371.81	≤7/2				
		253.00 10	59 13	221.12	≤7/2				
		474.8 4	100 34	0.0	3/2⁻				
483.9	(15/2⁺)	113.3	64	370.6	(17/2⁺)	(M1+E2)	−0.5	2.29	
		220.0	64	263.9	(11/2⁺)	(Q)			
		316.3	100	167.6	(13/2⁺)	M1+E2	+0.65	0.1147	
514.6	≤9/2	381[a]	63	133.06	7/2⁻				
		456.6 4	69 19	58.1	(3/2⁻,5/2,7/2⁻)				
		460.7 4	100 19	53.88	5/2⁻				
527.8	(13/2⁻)	133.5	30	394.4	(11/2⁻)	D+Q			
		263.8	≤36	263.9	(11/2⁺)	D+Q			
		293.0	100	234.8	9/2⁻	Q			
537.91	≤7/2	317.00 20	34 10	221.12	≤7/2				

$\gamma(^{163}Yb)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[‡]	α[#]	Comments
537.91	≤7/2	483.50[&] *20*	100[&] *19*	53.88	5/2⁻				
		537.5 *5*	16 *6*	0.0	3/2⁻				
578.50		206.69 *15*	100	371.81	≤7/2				
620.6		562.5 *4*	100 *19*	58.1	(3/2⁻,5/2,7/2⁻)				
		566.4[@a] *5*	≤69[@]	53.88	5/2⁻				
674.27	≤9/2	209.40 *15*	9.3 *29*	465.05					
		302.90 *15*	100 *14*	371.81	≤7/2				
		453.5 *3*	61 *11*	221.12	≤7/2				
		621.0[a] *5*	57 *14*	53.88	5/2⁻				
715.6	(21/2⁺)	345.0	100	370.6	(17/2⁺)	E2		0.0489	B(E2)(W.u.)=250 *30*
749		695	100	53.88	5/2⁻				
768.37		94.17 *5*	100 *18*	674.27	≤9/2				
		396.34[@] *10*	≤525[@]	371.81	≤7/2				
854.2	(19/2⁺)	138.6	8	715.6	(21/2⁺)	[M1,E2]		1.14 *19*	
		370.3	100	483.9	(15/2⁺)	Q			
		483.6	23	370.6	(17/2⁺)	M1+E2	+0.51	0.0394	
855.30		483.50[&] *20*	57[&] *14*	371.81	≤7/2				
		634.1 *5*	100 *29*	221.12	≤7/2				
870.64	≤7/2	498.9 *3*	100 *33*	371.81	≤7/2				
		870.5 *4*	100 *27*	0.0	3/2⁻				
913.4	(17/2⁻)	385.6	100	527.8	(13/2⁻)	Q			
		429.4	16	483.9	(15/2⁺)	D			
938.60		170.26 *5*	9.4 *31*	768.37					
		400.30 *20*	100 *12*	537.91	≤7/2				
		566.4[@a] *5*	69[@] *12*	371.81	≤7/2				
1178.6	(25/2⁺)	463.0	100	715.6	(21/2⁺)	E2		0.0217	B(E2)(W.u.)=210 *50*
1343.5	(23/2⁺)	489.3	100	854.2	(19/2⁺)	E2		0.0188	
1358.4	(21/2⁻)	445.0	100	913.4	(17/2⁻)	Q			
		504.1	17	854.2	(19/2⁺)	(D)			
1641.6	(23/2⁻)	926.0	100	715.6	(21/2⁺)	D			
1735.7	(29/2⁺)	557.1	100	1178.6	(25/2⁺)	E2		0.01362	B(E2)(W.u.)=180 *70*
1818.5	(25/2⁻)	460.2	100	1358.4	(21/2⁻)	E2		0.0221	
		475.0	37	1343.5	(23/2⁺)	D			
1923.0	(27/2⁺)	579.5	100	1343.5	(23/2⁺)	Q			
2028.2	(25/2⁻)	669.8	100	1358.4	(21/2⁻)	(Q)			
2114.4	(27/2⁻)	378.7	≈30	1735.7	(29/2⁺)	D			
		472.8	≈47	1641.6	(23/2⁻)				
		935.8	100	1178.6	(25/2⁺)	D(+Q)	<−0.07		
2286.1	(29/2⁻)	363.1	21	1923.0	(27/2⁺)	D+Q			
		467.6	100	1818.5	(25/2⁻)	Q			

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

$\gamma(^{163}$Yb) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
2365.0	(33/2+)	629.3	100	1735.7	(29/2+)	E2		0.01017	B(E2)(W.u.)=260 *90*
2524.5	(29/2−)	496.3	100	2028.2	(25/2−)	(Q)			
2527.5	(31/2−)	162.5[a]	≈5	2365.0	(33/2+)				
		413.1	33	2114.4	(27/2−)	Q			
		791.8	100	1735.7	(29/2+)	E1(+M2)	<−0.05		
2570.1	(31/2+)	647.1	100	1923.0	(27/2+)	E2			
2797.7	(33/2−)	227.6	18	2570.1	(31/2+)	D+Q			
		511.6	100	2286.1	(29/2−)	(Q)			
3023.2	(35/2−)	495.7	100	2527.5	(31/2−)	E2		0.0182	
		658.2	95	2365.0	(33/2+)	E1(+M2)	<−0.6		
3044.6	(37/2+)	679.6	100	2365.0	(33/2+)	E2		0.00851	B(E2)(W.u.)=310 *210*
3074.7	(33/2−)	550.2	100	2524.5	(29/2−)	(Q)			
3266.1	(35/2+)	696.0	100	2570.1	(31/2+)	(Q)			
3368.0	(37/2−)	570.2	100	2797.7	(33/2−)	(Q)			
3614.0	(39/2−)	590.8	100	3023.2	(35/2−)	Q			
3679.7	(37/2−)	605.0	100	3074.7	(33/2−)	(Q)			
3751.1	(41/2+)	706.5	100	3044.6	(37/2+)	E2		0.00780	B(E2)(W.u.)=360 *190*
3990.2	(39/2+)	724.0	100	3266.1	(35/2+)	(Q)			
4001.0	(41/2−)	633.0	100	3368.0	(37/2−)	Q			
4295.0	(43/2−)	681.0	100	3614.0	(39/2−)				
4476.8	(45/2+)	725.7	100	3751.1	(41/2+)	E2		0.00734	B(E2)(W.u.)=310 *100*
4703.0	(45/2−)	702.0	100	4001.0	(41/2−)	(Q)			
5047.7	(47/2−)	752.7	100	4295.0	(43/2−)	(Q)			
5246.4	(49/2+)	769.6	100	4476.8	(45/2+)	(E2)		0.00645	B(E2)(W.u.)=230 *+260−120*
6081	(53/2+)	835	100	5246.4	(49/2+)	(Q)			

[†] From ε decay, when a level is reported in both data sets.
[‡] From $\gamma(\theta)$ and ce data in (HI,xnγ). Comparison with RUL for M2 and higher multipolarities suggests that the transition is M1, M1+E2, E1 or E2 when no data exist to determine multipolarity.
[#] 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.
[@] Multiply placed with undivided intensity.
[&] Multiply placed with intensity suitably divided.
[a] Placement of transition in the level scheme is uncertain.

$^{163}_{70}$Yb$_{93}$-6

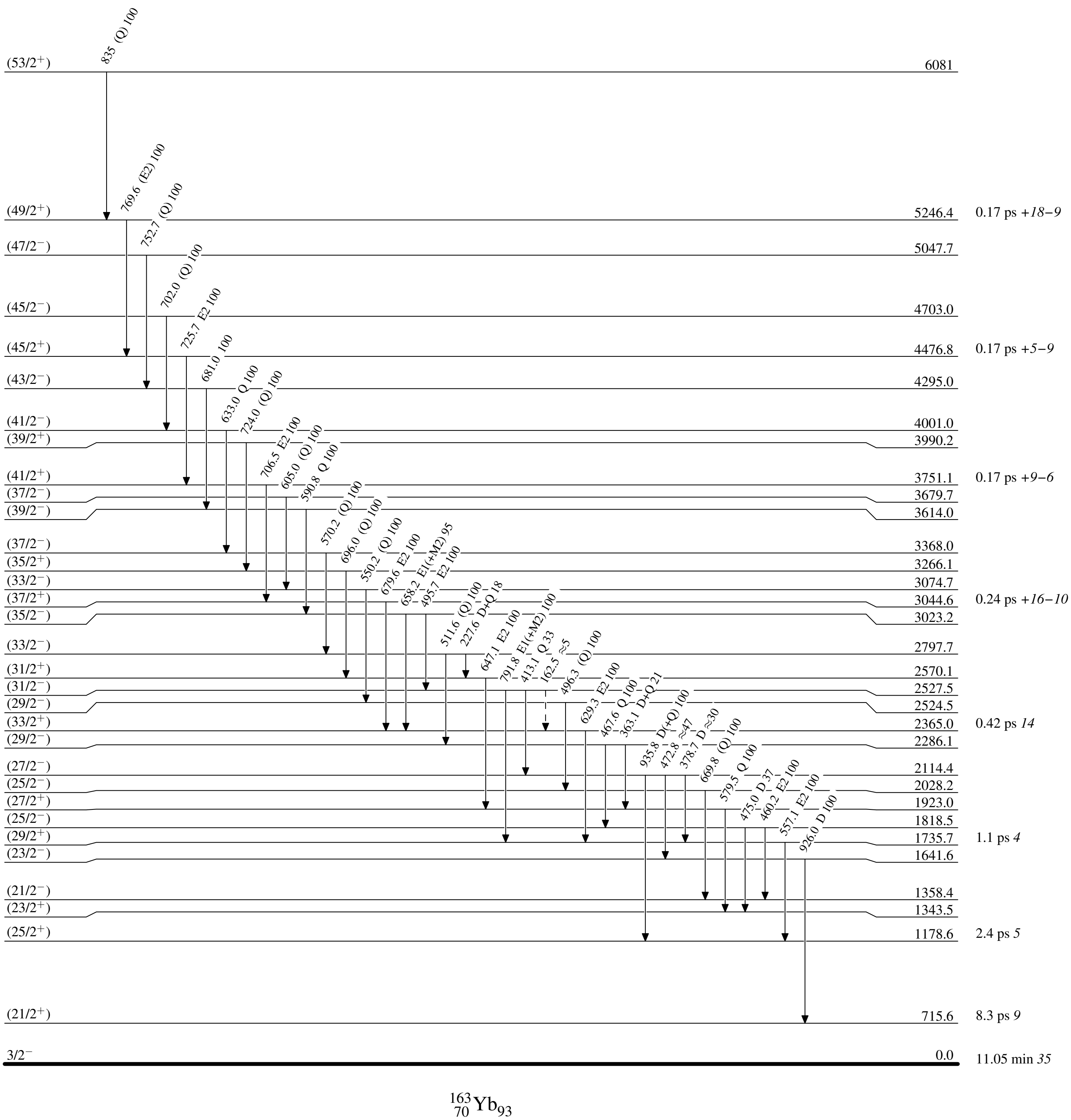
Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

Legend

γ Decay (Uncertain)



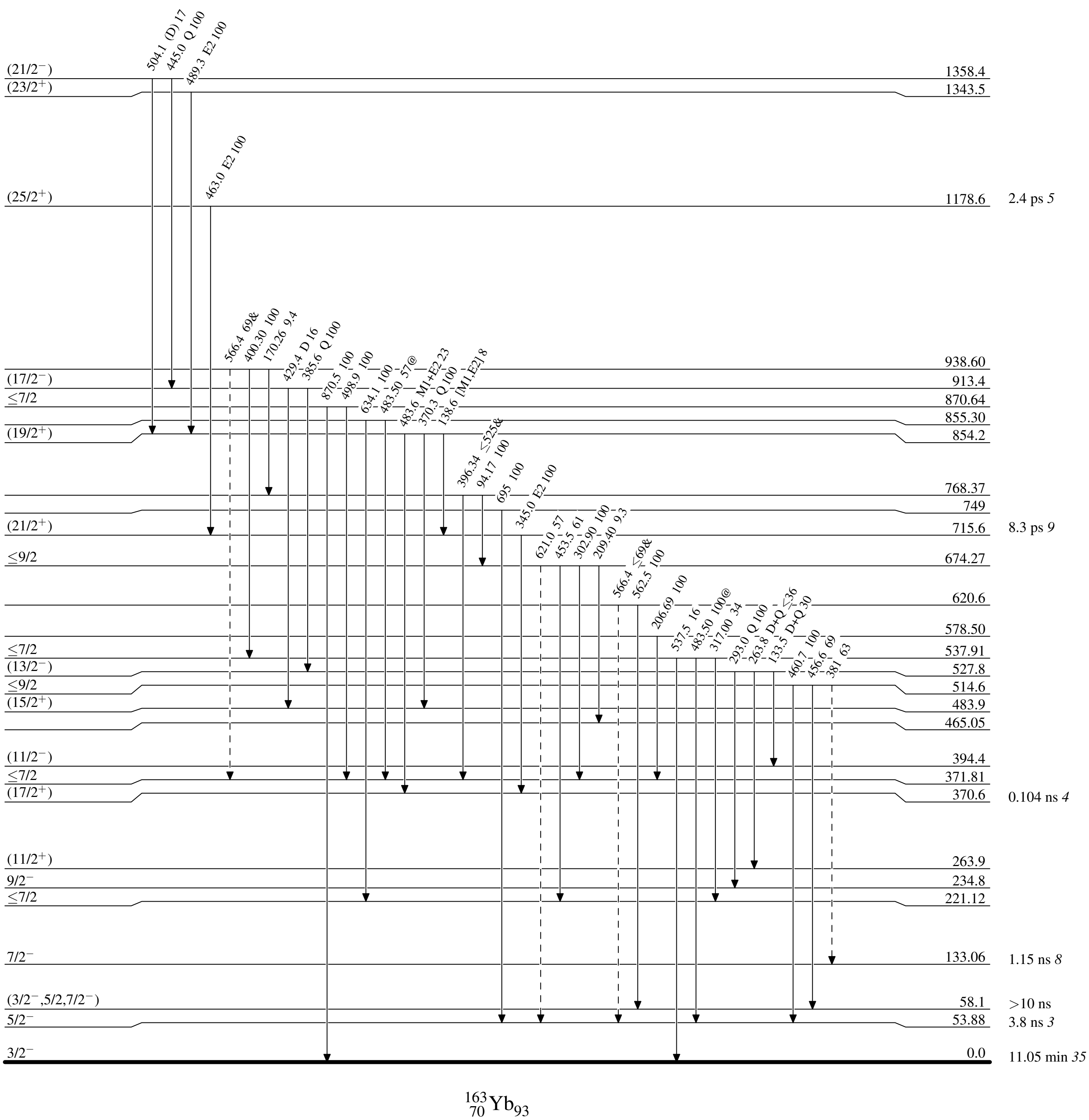
Adopted Levels, Gammas

Level Scheme (continued)

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

Legend

γ Decay (Uncertain)

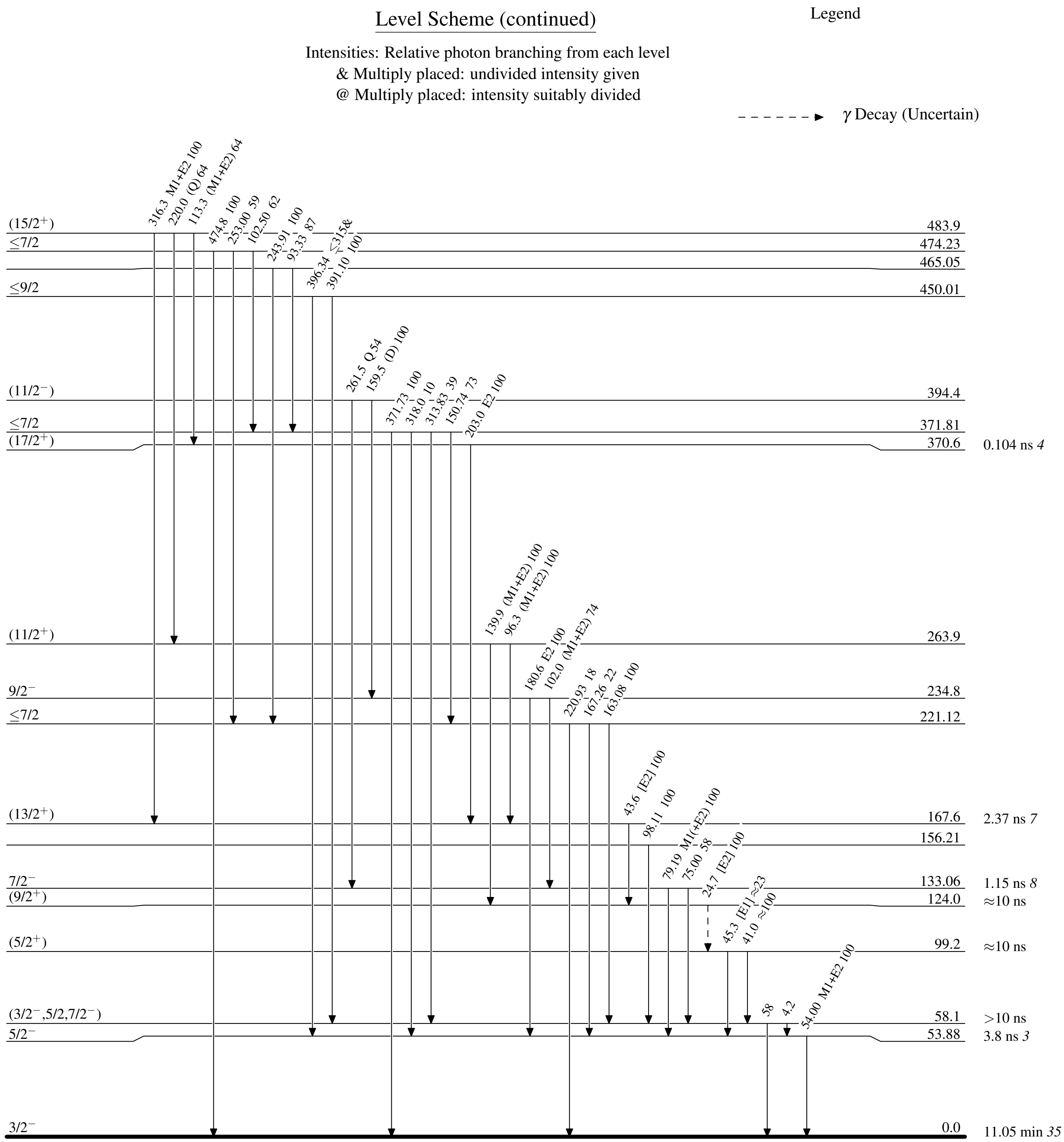


$^{163}_{70}Yb_{93}$

Adopted Levels, Gammas

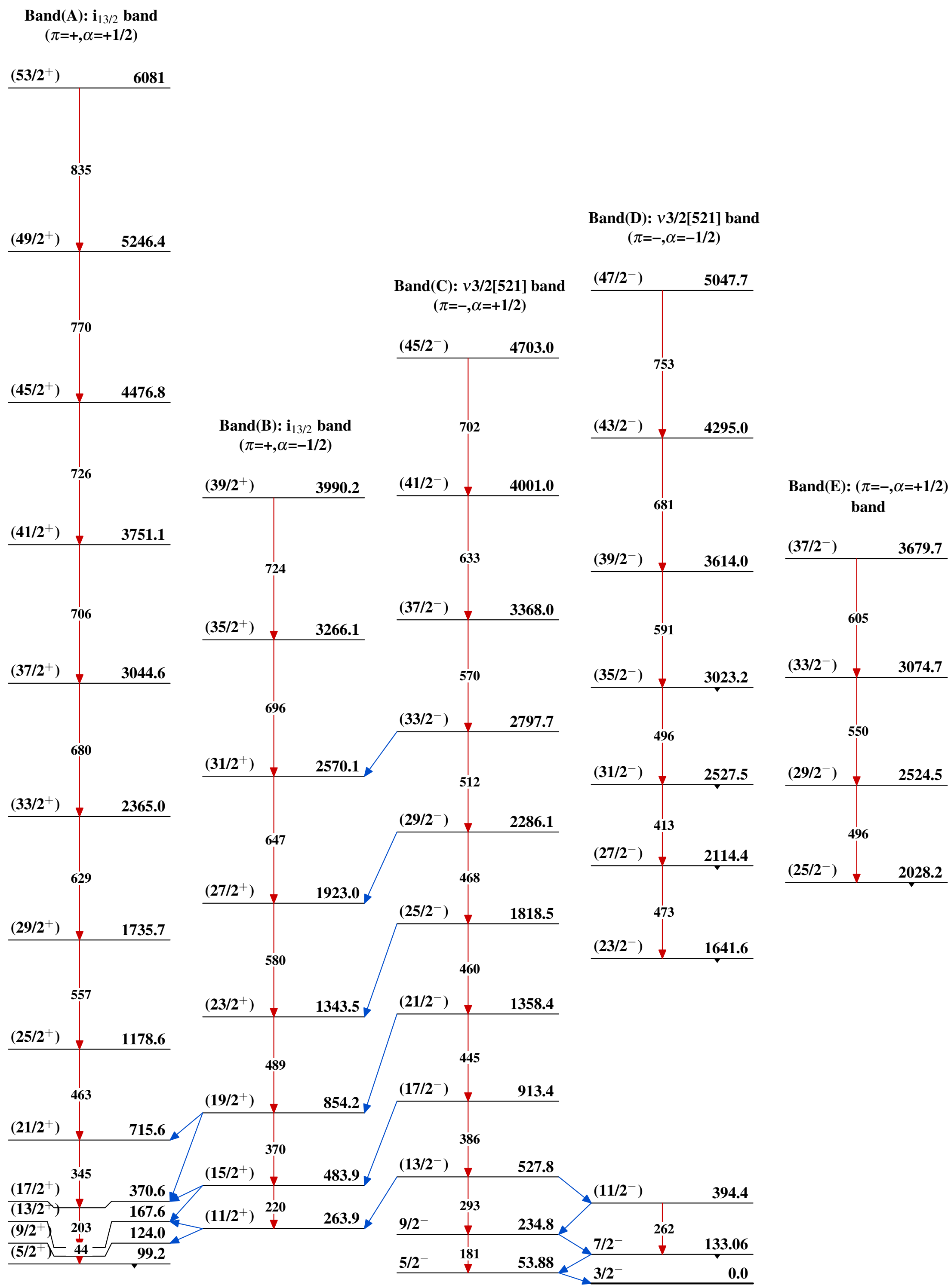
Level Scheme (continued)

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



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

Adopted Levels, Gammas



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