(HI,xnγ)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 195,1 (2024)	19-Sep-2023

Additional information 1.

1987Mo21: ^{122}Sn(^{44}Ca,4nγ) reaction, with E(^{44}Ca)=195 MeV. Isotopically enriched (enrichment not given), self-supporting foils were stacked together to make a target having a total thickness of ≈1.5 mg/cm^2. The γ radiation was studied using the TESSA2 array, which consisted of six escape-suppressed Ge detectors and an inner ball of 50 BGO detectors. Measured γ singles, $\gamma\gamma$ coincidences and DCO ratios.

1980BeYG: ^{150}Sm(^{16}O,4nγ) reaction, with E(^{16}O)=83 MeV. Target thicknesses ranged from 1 to 3 mg/cm^2. When targets with backing were used, the backing material was ≈3 mg/cm^2 Bi. Measured excitation functions, γ singles, $\gamma\gamma$ coincidences and $\gamma(\theta)$ using a variety of Ge(Li) detectors. Conversion electrons were studied using Si(Li) detectors in a mini-orange magnet system. γce coincidences and α(K)exp were measured using this electron spectrometer and various Ge(Li) detectors.

1980Ri08: ^{149}Sm(^{16}O,3nγ) reaction. $\gamma\gamma$ coincidences and $\gamma(\theta)$ were measured using four Ge(Li) and three NaI(Tl) detectors.

1992Mc02: ^{116}Cd(^{50}Ti,4nγ), E(^{50}Ti)=215 MeV. Lifetimes measured using the recoil-distance Doppler-shift method. Note: the values reported by these authors are not level lifetimes, but are partial lifetimes. When only a single γ transition deexcites a given level, these two two quantities are the same. When a level is deexcited by two or two or more γ transitions, the reported (partial) lifetime may be be quite different from the level (total) lifetime.

2006Mc02: ^{116}Cd(^{50}Ti,4nγ), E(^{50}Ti)=200 MeV. Measured level lifetimes of yrast states using the recoil-distance Doppler-shift method with the SPEEDY array of eight Compton-suppressed HPGe Clover detectors. Lifetime analysis done using the differential decay-curve method.

2018Md01: ^{150}Sm(^{16}O,4nγ), E^{16}O=85 MeV beam at iThemba LABS on 95.59%-enriched ^{150}Sm target; used AFRODITE γ-ray spectrometer of seven HPGe clover detectors positioned at 90° and 135° relative to beam direction, with each clover composed of four Ge crystals. Measured γ, $\gamma\gamma$, DCO, polarization asymetry. Extended known bands and found three new positive-parity bands.

The level scheme is that of 1987Mo21 and 2018Md01, the γ data are from 2018Md01, 1987Mo21 and 1980BeYG, and the level half-lives are taken primarily from the data of 1992Mc02, although data from 1972Bo61 (the same as those in 1976Bo27) and 1978Ba16 are included. Another major study is that reported by 1980Ri08. Data from more recent 2018Md01 and 2006Mc02 references are included.

^{162}Yb Levels

Band structure from 2018Md01 is adopted.

E(level)	J$^{\pi}$[†]	T$_{1/2}$[‡#]	Comments
0[@]	0$^+$		
166.821[@] *20*	2$^+$	404 ps *13*	T$_{1/2}$: weighted average of: 439 ps *37* (1978Ba16); 401 ps *59* (1972Bo61); and 400 ps *13* (1992Mc02).
487.54[@] *4*	4$^+$	14.3 ps *6*	T$_{1/2}$: weighted average of: 14.1 ps *21* (1972Bo61); 16.4 ps *+15−25* (1992Mc02); and 14.2 ps *6* (2006Mc02).
798.44[d] *3*	2$^+$		
924.35[@] *4*	6$^+$	3.47 ps *21*	T$_{1/2}$: from 2006Mc02. Others: 3.2 ps *6* (1972Bo61); and 5.4 ps *8* (1992Mc02).
992.73[e] *17*	3$^+$		
1006?[c]	0$^+$		
1130?[c]	2$^+$		
1150.34[d] *15*	4$^+$		
1343.12[c] *18*	4$^+$		
1393.42[e] *20*	5$^+$		
1445.77[@] *5*	8$^+$	1.1 ps *3*	T$_{1/2}$: weighted average of: 1.4 ps *5* (1972Bo61); 1.7 ps *3* (1992Mc02); and 0.83 ps *21* (2006Mc02).
1484.09[a] *20*	5$^-$		
1573.46[d] *15*	6$^+$		

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(HI,xnγ) (continued)

^{162}Yb Levels (continued)

E(level)	J^{π}[†]	$T_{1/2}$[‡#]	Comments
1609.73[&] *20*	4^-		
1647.38[c] *9*	6^+		
1768.02[a] *13*	7^-		
1880.18[e] *21*	7^+		
1913.91[&] *19*	6^-		
1985.49[d] *7*	8^+	1.5 ps *2*	$T_{1/2}$: computed by the evaluator from τ=8.4 ps *27* and τ=5.1 ps *7* for the partial lifetimes of the 338.1 and 412.0 transitions, respectively, and B(E2)(W.u.)=0.78 *12* for the 1061.3 transition, all as reported by 1992Mc02, and the I(γ+ce) values of the γ′s deexciting this level.
2024.28[@] *6*	10^+	0.9 ps *3*	
2094.30[c] *20*	8^+		
2153.25[a] *12*	9^-	0.54 ps *5*	$T_{1/2}$: computed by the evaluator from τ=4.6 ps *7* for the partial lifetime of the 385.2 transition and B(E1)(W.u.)=0.0010 *1* for the 707.6 transition, both as given by 1992Mc02.
2280.68[&] *22*	8^-	2.3 ps *5*	$T_{1/2}$: computed by the evaluator from B(E1)(W.u.)=0.00010 *2* for the 835.2 transition (1992Mc02) and the I(γ+ce) values of the γ′s deexciting this level.
2424.73[d] *7*	10^+	1.3 ps *+3−1*	$T_{1/2}$: computed by the evaluator from τ=2.3 ps *+5−2* for the partial lifetime of the 439.2 transition (1992Mc02) and the I(γ+ce) values of the γ′s deexciting this level.
2429.18[e] *24*	9^+		
2573.00[&] *21*	10^-	9.6 ps *8*	$T_{1/2}$: computed by the evaluator from τ=32.6 ps *47* for the partial lifetime of the 292.3 transition and B(E1)(W.u.)=2.7×10^{-4} *4* for the 548.4 transition, both as reported by 1992Mc02, and the I(γ+ce) values of the γ′s deexciting this level.
2595.06[c] *19*	10^+		
2604.92[a] *8*	11^-	0.62 ps *5*	$T_{1/2}$: computed by the evaluator from τ=2.2 ps *3* for the partial lifetime of the 451.7 transition and B(E1)(W.u.)=0.0011 *1* for the 580.6 transition, both as reported by 1992Mc02.
2630.69[b] *22*	10^+		
2634.51[@] *7*	12^+	1.0 ps *+5−8*	
2806.49[b] *7*	12^+	4.4 ps *6*	$T_{1/2}$: computed by the evaluator from τ=8.4 ps *12* for the partial lifetime of the 381.7 transition and B(E2)(W.u.)=2.0 *8* for the 782.2 transition, both as reported by 1992Mc02.
2929.55[d] *22*	12^+		
2938.86[&] *22*	12^-	8.3 ps *19*	
2995.2[e] *4*	11^+		
3077.41[a] *8*	13^-		
3127.21[b] *8*	14^+	28 ps *10*	$T_{1/2}$: weighted average of: 37 ps *6* (1992Mc02); and 17 ps *7* (2006Mc02).
3129.10[c] *20*	12^+		
3257.57[@] *10*	14^+		
3417.35[&] *22*	14^-	1.8 ps *+4−13*	
3461.6[d] *4*	14^+		
3562.1[e] *5*	13^+		
3578.97[b] *13*	16^+	3.3 ps *2*	$T_{1/2}$: weighted average of: 3.1 ps *5* (1992Mc02); and 3.3 ps *2* (2006Mc02).
3597.27[a] *12*	15^-		
3878.85[@] *14*	16^+		
3972.78[&] *23*	16^-	0.8 ps *3*	
4138.0[e] *6*	15^+		
4149.36[b] *14*	18^+	1.9 ps *3*	
4185.67[a] *15*	17^-		
4495.50[@] *16*	18^+		

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(HI,xnγ) (continued)

^{162}Yb Levels (continued)

E(level)	Jπ†	T1/2‡#	E(level)	Jπ†
4562.68& *24*	18−		7488.0@	26+
4821.57a *17*	19−	0.38 ps *+16−31*	7755.5a *20*	27−
4822.49b *16*	20+		8188.0& *15*	28−
5146.6@ *11*	20+		8234.9b *18*	28+
5170.1& *3*	20−		8323.9?@	(28+)
5482.5a *11*	21−		8661.1a *23*	29−
5584.97b *24*	22+		9125.1& *18*	30−
5816.9& *3*	22−		9153.7b *21*	(30+)
5862.2@ *15*	22+		9606.6a *25*	31−
6174.7a *15*	23−		10067.3& *21*	32−
6423.3b *11*	24+		10503a *3*	(33−)
6529.4& *4*	24−		10969.8& *23*	(34−)
6652.1@ *18*	24+		11420a *3*	(35−)
6926.1a *18*	25−		11917.8?&	(36−)
7314.0b *15*	26+		12392.?a	(37−)
7319.4& *11*	26−			

† From 2018Md01 based on adopted multipolarity lalues.

‡ The values are those reported by 1992Mc02, unless noted otherwise. 1992Mc02 used the Doppler-shift recoil-distance method to measure their lifetime values and used the ^{116}Cd(^{50}Ti,4n) reaction, with E(Ti)=215 MeV, to populate the ^{162}Yb levels. It should be carefully noted that these authors report partial lifetimes, not level lifetimes (even though the latter seems to be implied in their table captions). Where a given level is deexcited by only one γ transition, these two quantities are the same. Where the level deexcitation takes place via two or more transitions, however, these two quantities may be quite different.

1972Bo61 report level half-lives for the 2^+ through the 8^+ members of the g.s. band. They used the ^{126}Te(^{40}Ar,4n) reaction to populate the levels and the Doppler-shift recoil-distance method to determine the half-lives. The values given in 1972Bo61 appear also in 1976Bo27. Thus, in citing these data, reference is made to 1972Bo61 only. Using the ^{152}Sm(^{16}O,6n) reaction and the "recoil shadow" method, 1978Ba16 measured the half-life of the first excited 2^+ state. These authors measured conversion electrons from the recoiling nuclei as a function of distance from the target using a Si(Li) detector.

@ Band(A): $K^\pi=0^+$ ground-state band.

& Band(B): Negative-parity, even-spin band.

a Band(C): Negative-parity, odd-spin band.

b Band(D): Positive-parity, even-spin band.

c Band(E): Second $K^\pi=0^+$ band.

d Band(F): Even γ band.

e Band(G): Odd γ band.

$\gamma(^{162}$Yb)

The α(K)exp values reported by 1980BeYG were obtained by comparison of conversion-electron intensities and γ-ray intensities in the respective spectra. 1980BeYG state that the normalization of these spectra was done by requiring that the α(K)exp values of several well established E2 transitions be made to agree with the theoretical α(K) values calculated by 1978Ro21, but just which transitions were actually used to do this were not identified.

Given in comments are the values of DCO ratios, R_{DCO}, and polarization asymmetries, A_P, measured by 2018Md01. For gates set on quadrupole transitions, the typical R_{DCO} values for stretched dipole are ≈0.55 and for stretched quadrupole transitions are ≈1.01. Also, for stretched transitions positive A_P values are for electric transitions, and negative A_P values are for magnetic transitions, respectively.

E_γ[†‡]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	α[&]	$I_{(\gamma+ce)}$[#]	Comments
124[d]		1130?	2^+	1006?	0^+				
166.82 *2*	73 *13*	166.821	2^+	0	0^+	E2	0.497	109 *20*	R_{DCO}=0.943 *10* (2018Md01).
176.2 *3*		2806.49	12^+	2630.69	10^+	E2			R_{DCO}=1.054 *92* (2018Md01).
211.8 *3*		2806.49	12^+	2595.06	10^+	E2			R_{DCO}=1.092 *122* (2018Md01).
213[d]		1343.12	4^+	1130?	2^+				
284.3 *3*		1768.02	7^-	1484.09	5^-				
292.33 *5*	7.9 *2*	2573.00	10^-	2280.68	8^-	E2	0.0800	8.5 *2*	R_{DCO}=1.052 *16*, A_P=0.218 *21* (2018Md01).
304.4[a] *3*		1647.38	6^+	1343.12	4^+	E2			R_{DCO}=0.948 *81*, A_P=0.188 *79* (2018Md01).
304.4[a] *3*		1913.91	6^-	1609.73	4^-	E2			R_{DCO}=0.948 *81*, A_P=0.188 *79* (2018Md01).
[x]315.72 *17*									
320.72[c] *3*	102[c]	487.54	4^+	166.821	2^+	E2	0.0606	108	$I_{(\gamma+ce)}$: the split in the intensity of this doubly placed transition is that given by 1992Mc02. 1987Mo21 report I(γ+ce)=152 for the doublet. R_{DCO}=1.009 *6*, A_P=0.119 *10* (2018Md01). Mult.: from 1980BeYG, $\gamma(\theta)$, mult=Q; E2 from 2018Md01.
320.72[c] *3*	41[c]	3127.21	14^+	2806.49	12^+	E2	0.0606	44	Mult.: from $\gamma(\theta)$ (1980BeYG), mult=Q. The evaluator has regarded M2 as unlikely. See the comment for the other member of this doublet (the 4^+ to 2^+ transition within the g.s. band). $I_{(\gamma+ce)}$: the split in intensity of this doubly placed transition is that given by 1992Mc02. 1987Mo21 report I(γ+ce)=152 for the doublet.
[x]325.6 *3*									
[x]330.4 *3*									
338.12 *7*	6.6 *2*	1985.49	8^+	1647.38	6^+	E2	0.0519	6.9 *2*	R_{DCO}=0.843 *82*, A_P=0.193 *60* (2018Md01).
[x]339.83 *15*									
352.0 *3*		1150.34	4^+	798.44	2^+	E2			R_{DCO}=1.159 *78* (2018Md01).
365.86 *4*	20.4 *3*	2938.86	12^-	2573.00	10^-	E2	0.0416	21.2 *3*	R_{DCO}=1.119 *15*, A_P=0.196 *55* (2018Md01).
367.2 *3*		2280.68	8^-	1913.91	6^-	E2			R_{DCO}=1.004 *31* (2018Md01).
[x]367.22 *16*									
[x]375.37 *6*									
381.76 *3*	23.9 *4*	2806.49	12^+	2424.73	10^+	E2	0.0367	24.8 *4*	R_{DCO}=0.974 *43*, A_P=0.183 *27* (2018Md01).

$^{162}_{70}$Yb$_{92}$-4

E_γ †‡	I_γ #	E_i(level)	J^π_i	E_f	J^π_f	Mult. @	α &	$I_{(\gamma+ce)}$ #	Comments
385.25 *6*	3.0 *2*	2153.25	9⁻	1768.02	7⁻	E2	0.0357	3.1 *2*	R_{DCO}=1.016 *53*, A_P=0.047 *79* (2018Md01).
400.51 *8*	4.0 *3*	2424.73	10⁺	2024.28	10⁺	M1	0.0730	4.2 *3*	R_{DCO}=0.944 *26*, A_P=0.195 *68* (2018Md01). Mult.: from α(K)exp>0.06 (1980BeYG). α(K)=0.0084 for E1 and α(K)=0.0245 for E2. From DCO, 1987Mo21 report mult=E2/M1. 2018Md01 also reported M1, although based on their R_{DCO} and A_P values this would be rather an E2 transition.
400.7 *3*		1393.42	5⁺	992.73	3⁺	E2			R_{DCO}=1.041 *156*, A_P=0.033 *248* (2018Md01).
412.01 *19*	11.1 *3*	1985.49	8⁺	1573.46	6⁺	E2	0.0297	11.4 *3*	R_{DCO}=1.053 *10*, A_P=0.191 *59* (2018Md01).
419.48 *25*	7.2 *3*	2573.00	10⁻	2153.25	9⁻	M1	0.0646	7.7 *3*	R_{DCO}=0.734 *19*, A_P=−0.036 *38* (2018Md01).
423.12 *6*	5.2 *3*	1573.46	6⁺	1150.34	4⁺	E2	0.0276	5.3 *3*	R_{DCO}=1.070 *19*, A_P=0.190 *43* (2018Md01).
429.8 *3*		1913.91	6⁻	1484.09	5⁻	M1			R_{DCO}=0.740 *40*, A_P=−0.152 *74* (2018Md01).
ˣ435.42 *25*									
436.80 *2*	97.5	924.35	6⁺	487.54	4⁺	E2	0.0254	100	R_{DCO}=1.089 *7*, A_P=0.149 *10* (2018Md01).
439.23 *2*	21.5 *7*	2424.73	10⁺	1985.49	8⁺	E2	0.0250	22.0 *7*	R_{DCO}=1.103 *11*, A_P=0.199 *27* (2018Md01). Mult.: from α(L)exp=0.0044 *4* (1980BeYG).
ˣ442.76 *19*									
ˣ444.97 *15*									
447.0 *3*		2094.30	8⁺	1647.38	6⁺				
451.76[c] *10*	10.2[c]	2604.92	11⁻	2153.25	9⁻	E2	0.0232	10.4	R_{DCO}=1.010 *13*, A_P=0.068 *32* (2018Md01). Mult.: 1980BeYG report α(K)exp=0.021 *1* for this doublet. α(K)=0.0180 and 0.0458 for E2 and M1, respectively. 1987Mo21 conclude that both members of the doublet are E2; and the α(K)exp value is consistent with this, although some admixture of M1 is not excluded by the data. E2 is confirmed by 2018Md01. $I_{(\gamma+ce)}$: the split in intensity of this doubly placed transition is that given by 1992Mc02. 1987Mo21 report I(γ+ce)=46.5 *9* for the doublet.
451.76[c] *10*	35[c]	3578.97	16⁺	3127.21	14⁺	E2	0.0232	36	R_{DCO}=1.102 *12*, A_P=0.184 *58* (2018Md01). Mult.: 1980BeYG report α(K)exp=0.021 *1* for this doublet. α(K)=0.0180 and 0.0458 for E2 and M1, respectively. 1987Mo21 conclude that both members of the doublet are E2; and the α(K)exp value is consistent with this, although some admixture of M1 is not excluded by the data. E2 is confirmed by 2018Md01. $I_{(\gamma+ce)}$: the split in intensity of this doubly placed transition is that given by 1992Mc02. 1987Mo21 report I(γ+ce)=46.5 *9* for the doublet.
472.49 *3*	19.5 *5*	3077.41	13⁻	2604.92	11⁻	E2	0.0206	19.9 *5*	A_P=0.036 *36* (2018Md01). Mult.: from α(K)exp=0.015 *1* (1980BeYG); electric character confirmed by (2018Md01).
478.49 *4*	18.9 *5*	3417.35	14⁻	2938.86	12⁻	E2	0.0200	19.3 *5*	R_{DCO}=0.853 *13*, A_P=0.166 *14* (2018Md01).
486.8 *3*		1880.18	7⁺	1393.42	5⁺	E2			R_{DCO}=1.037 *90*, A_P=0.204 *202* (2018Md01).
ˣ489.16 *7*									
501.0 *3*		2595.06	10⁺	2094.30	8⁺	E2			R_{DCO}=1.068 *34* (2018Md01).
505.0 *3*		2929.55	12⁺	2424.73	10⁺	E2			R_{DCO}=1.282 *27* (2018Md01).

(HI,xnγ) (continued)

γ(^{162}Yb) (continued)

E_γ [†‡]	I_γ [#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [@]	α [&]	$I_{(\gamma+ce)}$ [#]	Comments
505.2 *3*		992.73	3+	487.54	4+				
512.1	3.8 *3*	2280.68	8−	1768.02	7−	M1	0.0385	4.0 *3*	R_{DCO}=0.683 *48*, A_P=−0.061 *44* (2018Md01).
519.86 *9*	20	3597.27	15−	3077.41	13−	E2	0.01616	20	R_{DCO}=1.011 *6*, A_P=0.054 *12* (2018Md01). $I_{(\gamma+ce)}$: 1987Mo21 report I(γ+ce)=108 for the 519.8, 521.4 pair of γ rays. The split in intensity between these two γ's is that given by 1992Mc02.
521.42 *2*	87	1445.77	8+	924.35	6+	E2	0.01604	88	R_{DCO}=1.084 *7*, A_P=0.134 *10* (2018Md01). Mult.: from α(K)exp, mult=E2 for the 519.8, 521.4 doublet (1980BeYG), confirmed by 2018Md01. $I_{(\gamma+ce)}$: 1987Mo21 report I(γ+ce)=108 for the 519.8, 521.4 pair of γ rays. The split in intensity between these two γ's is that given by 1992Mc02.
^{x}531.80 *7*									
532.0 *3*		3461.6	14+	2929.55	12+	E2			R_{DCO}=1.053 *102* (2018Md01).
^{x}533.45 *17*									
534.04 *3*		3129.10	12+	2595.06	10+				
539.66 *6*	4.6 *3*	1985.49	8+	1445.77	8+	M1	0.0336	4.7 *3*	R_{DCO}=0.947 *48*, A_P=0.171 *114* (2018Md01). Mult.: from α(K)exp=0.042 *2* (1980BeYG), confirmed by 2018Md01.
548.4	3.8 *3*	2573.00	10−	2024.28	10+	(E1)	0.00496	3.8 *3*	R_{DCO}=0.904 *42*, A_P=−0.040 *45* (2018Md01).
549.0 *3*		2429.18	9+	1880.18	7+	E2			R_{DCO}=1.214 *96*, A_P=0.104 *123* (2018Md01).
555.43 *6*	18.2 *5*	3972.78	16−	3417.35	14−	E2	0.01372	18.5 *5*	R_{DCO}=1.017 *23*, A_P=0.194 *18* (2018Md01). Mult.: from α(K)exp=0.010 *1* (1980BeYG), confirmed by 2018Md01.
566.0 *3*		2995.2	11+	2429.18	9+	E2			R_{DCO}=0.973 *55* (2018Md01).
566.9 *3*		3562.1	13+	2995.2	11+				
570.38 *4*	28.8 *8*	4149.36	18+	3578.97	16+	E2	0.01286	29.2 *8*	R_{DCO}=1.112 *10*, A_P=0.199 *68* (2018Md01). Mult.: from α(K)exp=0.012 *4* (1980BeYG), confirmed by 2018Md01.
575.9 *3*		4138.0	15+	3562.1	13+				
578.50 *3*	54.2 *13*	2024.28	10+	1445.77	8+	E2	0.01243	54.9 *13*	R_{DCO}=0.915 *19*, A_P=0.164 *13* (2018Md01). Mult.: from α(K)exp (1980BeYG), confirmed by 2018Md01. 1980BeYG report α(K)exp=0.095 *3*, which the evaluator assumes is a misprint and should be 0.0095 *3*. For mult=E2, α(K)=0.0100, for mult=M1, α(K)=0.0243 and for mult=M2, α(K)=0.0695. From $\gamma(\theta)$ given by 1980BeYG, mult can be Q.
580.62 *5*	13.2 *6*	2604.92	11−	2024.28	10+	E1	0.00439	13.3 *6*	A_P=0.054 *16* (2018Md01). Mult.: from α(K)exp=0.0050 *5* (1980BeYG), confirmed by 2018Md01.
588.40 *9*	18.6 *26*	4185.67	17−	3597.27	15−	E2	0.01193	18.8 *26*	R_{DCO}=1.073 *38*, A_P=0.075 *23* (2018Md01). Mult.: α(K)exp=0.0089 *4* for the 588.4,589.9 doublet (1980BeYG) is consistent with mult=E2 for both transitions. DCO and $\gamma(\theta)$ for each transition indicate mult=Q. E2 is confirmed by 2018Md01.
589.90 *8*	14.9 *5*	4562.68	18−	3972.78	16−	E2	0.01186	15.1 *5*	R_{DCO}=0.930 *10*, A_P=0.185 *65* (2018Md01). Mult.: α(K)exp=0.0089 *4* for the 588.4,589.9 doublet (1980BeYG) is consistent with mult=E2 for both transitions. DCO and $\gamma(\theta)$ for each transition indicate mult=Q. E2 is confirmed by 2018Md01.

$^{162}_{70}\mathrm{Yb}_{92}$-6

(HI,xnγ) (continued)

γ(^{162}Yb) (continued)

E_γ †‡	I_γ #	E_i(level)	J_i^π	E_f	J_f^π	Mult. @	α &	$I_{(\gamma+ce)}$ #	Comments
607.40 9	12.8 3	5170.1	20⁻	4562.68	18⁻	E2	0.01106	12.9 3	R_{DCO}=1.062 19, A_P=0.058 32 (2018Md01).
610.23 4	26.7 9	2634.51	12⁺	2024.28	10⁺	E2	0.01094	27.0 9	R_{DCO}=1.089 10, A_P=0.112 17 (2018Md01). Mult.: γ(θ) (1980BeYG) indicates mult=Q. α(K)exp=0.005 for the 607.4,610.2 pair of transitions (1980BeYG) rules out M2. E2 is confirmed by 2018Md01.
616.65 8	12.4 4	4495.50	18⁺	3878.85	16⁺	E2	0.01067	12.5 4	R_{DCO}=0.932 48, A_P=0.103 37 (2018Md01).
617.1 3		1609.73	4⁻	992.73	3⁺	D			R_{DCO}=0.589 86 (2018Md01).
621.28 10	14.1 25	3878.85	16⁺	3257.57	14⁺	E2	0.01048	14.2 25	R_{DCO}=1.184 17, A_P=0.136 20 (2018Md01). Mult.: γ(θ) indicates mult=Q for the 621.2, 623.0 doublet (1980BeYG). Both 1980BeYG and 1987Mo21 assign both transitions as E2, confirmed by 2018Md01.
623.06 7	18.9 25	3257.57	14⁺	2634.51	12⁺	E2	0.01041	19.1 25	R_{DCO}=1.115 12, A_P=0.151 28 (2018Md01). Mult.: γ(θ) indicates mult=Q for the 621.2, 623.0 doublet (1980BeYG). Both 1980BeYG and 1987Mo21 assign both transitions as E2, which is confirmed by 2018Md01.
635.89 8	17.8 15	4821.57	19⁻	4185.67	17⁻	E2	0.00993	18.0 15	R_{DCO}=1.025 36, A_P=0.146 37 (2018Md01). Mult.: from α(K)exp=0.0090 15 (1980BeYG), confirmed by 2018Md01.
646.85 11	10.5 3	5816.9	22⁻	5170.1	20⁻	E2	0.00954	10.6 3	R_{DCO}=1.089 22, A_P=0.069 48 (2018Md01). Mult.: DCO ratio indicates mult=Q. α(K)exp=0.0096 1 for the 646.8, 649.4 pair of γ′s (1980BeYG) makes M2 unlikely. E2 is confirmed by 2018Md01.
648.7	3.6 6	1573.46	6⁺	924.35	6⁺	E2,M1	0.015 6	3.7 6	R_{DCO}=1.025 26, A_P=0.072 28 (2018Md01).
ˣ649.46 7									
651.1	11.1 3	5146.6	20⁺	4495.50	18⁺	E2	0.00940	11.2 3	R_{DCO}=1.115 142, A_P=0.197 83 (2018Md01).
660.9	15.0 5	5482.5	21⁻	4821.57	19⁻	E2	0.00908	15.1 5	R_{DCO}=1.055 30, A_P=0.199 120 (2018Md01).
662.8	4.5 13	1150.34	4⁺	487.54	4⁺	E2,M1	0.014 6	4.6 13	R_{DCO}=1.083 34, A_P=0.063 40 (2018Md01).
673.13 8	23.7 7	4822.49	20⁺	4149.36	18⁺	E2	0.00870	23.9 7	R_{DCO}=1.110 16, A_P=0.175 71 (2018Md01). Mult.: from α(K)exp=0.0083 10 (1980BeYG), confirmed by 2018Md01.
692.2	11.4 4	6174.7	23⁻	5482.5	21⁻	E2	0.00817	11.5 4	R_{DCO}=0.785 69, A_P=0.174 94 (2018Md01).
707.6 4	14.8 4	2153.25	9⁻	1445.77	8⁺	E1	0.00292	14.8 4	R_{DCO}=0.567 35, A_P=0.061 59 (2018Md01). Mult.: from α(K)exp=0.0025 2 (1980BeYG), confirmed by 2018Md01.
712.50 15	9.0 2	6529.4	24⁻	5816.9	22⁻	E2	0.00765	9.1 2	Mult.: from α(K)exp=0.0053 15 (1980BeYG). R_{DCO}=1.063 61, A_P=0.165 162 (2018Md01).
715.6	9.3 3	5862.2	22⁺	5146.6	20⁺	E2	0.00757	9.4 3	R_{DCO}=1.026 33, A_P=0.112 62 (2018Md01).
ˣ724.98 20									
ˣ736.97 12									
751.4	8.1 4	6926.1	25⁻	6174.7	23⁻	E2	0.00680	8.2 4	
762.48 18	17.7 3	5584.97	22⁺	4822.49	20⁺	E2	0.00658	17.8 3	R_{DCO}=1.056 23, A_P=0.162 27 (2018Md01).
782.2	7.9 6	2806.49	12⁺	2024.28	10⁺	E2	0.00622	7.9 6	R_{DCO}=0.725 134, A_P=0.105 18 (2018Md01).
789.9	8.4 3	6652.1	24⁺	5862.2	22⁺	E2	0.00609	8.5 3	R_{DCO}=1.010 35, A_P=0.173 138 (2018Md01).
790.0	7.1 2	7319.4	26⁻	6529.4	24⁻	E2	0.00609	7.1 2	R_{DCO}=1.107 91 (2018Md01).
798.44 3		798.44	2⁺	0	0⁺				

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(HI,xnγ) (continued)

γ(^{162}Yb) (continued)

E_γ [†‡]	I_γ [#]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [@]	α [&]	$I_{(\gamma+ce)}$ [#]	Comments
826.0 *3*		992.73	3^+	166.821	2^+				
829.4	6.1 *4*	7755.5	27^-	6926.1	25^-	E2	0.00548	6.1 *4*	
835.2	5.8 *19*	2280.68	8^-	1445.77	8^+	(E1)	0.00210	5.8 *19*	R_{DCO}=0.819 *61*, A_P=−0.148 *58* (2018Md01).
835.9 [bd]	9.9 [b]	7488.0	26^+	6652.1	24^+	E2	0.00539	10.0	R_{DCO}=1.056 *74*, A_P=0.220 *114* (2018Md01).
835.9 [bd]	9.9 [b]	8323.9?	(28^+)	7488.0	26^+	E2	0.0054	10.0	
838.3	12.4 *6*	6423.3	24^+	5584.97	22^+	E2	0.00536	12.5 *6*	R_{DCO}=0.851 *38*, A_P=0.120 *44* (2018Md01).
843.3	8.9 *10*	1768.02	7^-	924.35	6^+	E1	0.00207	8.9 *10*	R_{DCO}=0.463 *244*, A_P=0.193 *31* (2018Md01).
855.6 *3*		1343.12	4^+	487.54	4^+				
868.6	5.4 *2*	8188.0	28^-	7319.4	26^-	E2	0.00497	5.4 *2*	
890.7	7.4 *7*	7314.0	26^+	6423.3	24^+	E2	0.00471	7.4 *7*	R_{DCO}=1.108 *217* (2018Md01).
896.1	2.1 *3*	10503	(33^-)	9606.6	31^-	(E2)	0.00465	2.1 *3*	
902.4	1.1 *2*	10969.8	(34^-)	10067.3	32^-	E2	0.00458	1.1 *2*	
905.1 *3*		2929.55	12^+	2024.28	10^+				
905.6	4.3 *3*	8661.1	29^-	7755.5	27^-	E2	0.00455	4.3 *3*	
905.9 *3*		1393.42	5^+	487.54	4^+	M1(+E2)			R_{DCO}=0.660 *62*, A_P=−0.130 *48* (2018Md01).
917.2	1.5 *1*	11420	(35^-)	10503	(33^-)	(E2)	0.00443	1.5 *1*	
918.8	2.3 *3*	9153.7	(30^+)	8234.9	28^+	(E2)	0.00442	2.3 *3*	
920.9	4.3 *3*	8234.9	28^+	7314.0	26^+	E2	0.00439	4.3 *3*	
937.1	3.3 *2*	9125.1	30^-	8188.0	28^-	E2	0.00424	3.3 *2*	
942.2	1.5 *1*	10067.3	32^-	9125.1	30^-	E2	0.00419	1.5 *1*	
945.5	2.4 *2*	9606.6	31^-	8661.1	29^-	E2	0.00416	2.4 *2*	
948.4 [d]	0.6 *1*	11917.8?	(36^-)	10969.8	(34^-)	(E2)	0.00413	0.6 *1*	
955.8 *3*		1880.18	7^+	924.35	6^+				
972.3 [d]	1.1 *2*	12392.?	(37^-)	11420	(35^-)	(E2)	0.00393	1.1 *2*	
978.5 *3*		2424.73	10^+	1445.77	8^+	E2			R_{DCO}=0.878 *216*, A_P=0.207 *56* (2018Md01).
983.4 *3*		1150.34	4^+	166.821	2^+	E2			R_{DCO}=1.229 *267* (2018Md01).
983.4 *3*		2429.18	9^+	1445.77	8^+				
989.8 *3*		1913.91	6^-	924.35	6^+	(E1)			R_{DCO}=0.868 *92*, A_P=−0.221 *128* (2018Md01).
996.9 *3*		1484.09	5^-	487.54	4^+	E1			R_{DCO}=0.518 *105*, A_P=0.216 *122* (2018Md01).
1061.3 *3*	3.9 *2*	1985.49	8^+	924.35	6^+	E2	0.00329	3.9 *2*	R_{DCO}=0.878 *57*, A_P=0.050 *39* (2018Md01).
1122.3 *3*		1609.73	4^-	487.54	4^+	E1			R_{DCO}=0.937 *195*, A_P=−0.019 *105* (2018Md01).
1149.4 *3*		2595.06	10^+	1445.77	8^+	E2			R_{DCO}=1.042 *226* (2018Md01).
1160.2 *4*	3.2 *2*	1647.38	6^+	487.54	4^+	E2			R_{DCO}=0.862 *48*, A_P=0.065 *191* (2018Md01).
1170.1 *3*		2094.30	8^+	924.35	6^+				
1176.4 *3*		1343.12	4^+	166.821	2^+				
1185.3 *3*		2630.69	10^+	1445.77	8^+				

† Values are from 1980BeYG where they are available, since these values are more precise and have uncertainties; the other values are from 1987Mo21 and 2018Md01 (bands E,F and G are exclusively from the latter reference). There are several cases where the Eγ values of 1980BeYG are used even though the γ placements differ

$^{162}_{70}Yb_{92}$-8

(HI,xnγ) (continued)

γ(^{162}Yb) (continued)

from those of 1980BeYG, so there is some chance of an error by the evaluator. Another set of values is given by 1980Ri08, as well as a small set by 1974Ba07. Finally, the most recent reference, 2018Md01, was used as final decision on placements and band structures.

‡ The unplaced γ's are from 1980BeYG; other references do not give such information. Several of these γ's are placed in 1980BeYG, but these placements have not been included here.

I(γ+ce) published by 1987Mo21 (^{122}Sn(^{44}Ca,4nγ) with E(^{44}Ca)=195 MeV reaction), with Iγ's deduced by evaluator using α conversion coefficients. For other reations see 1974Ba07, 1976Zo02, 1980Ri08, and 1980BeYG.

@ From DCO ratios (1987Mo21, 2018Md01), $\gamma(\theta)$ data (1980BeYG), and polarization asymmetries (2018Md01), unless noted otherwise.

& 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.

[b] Multiply placed with undivided intensity.

[c] Multiply placed with intensity suitably divided.

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

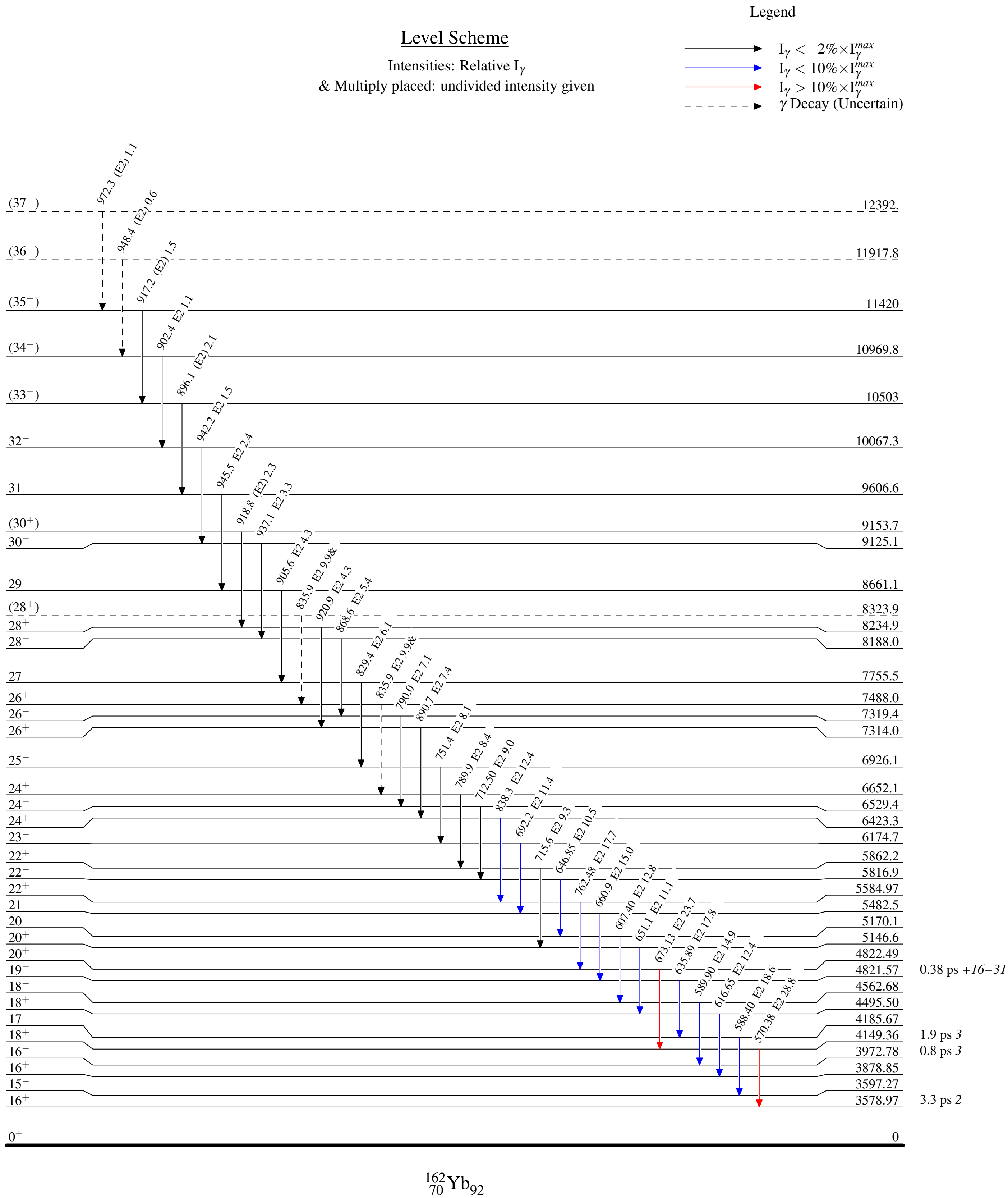
[x] γ ray not placed in level scheme.

(HI,xnγ)

Level Scheme

Intensities: Relative I_γ

& Multiply placed: undivided intensity given



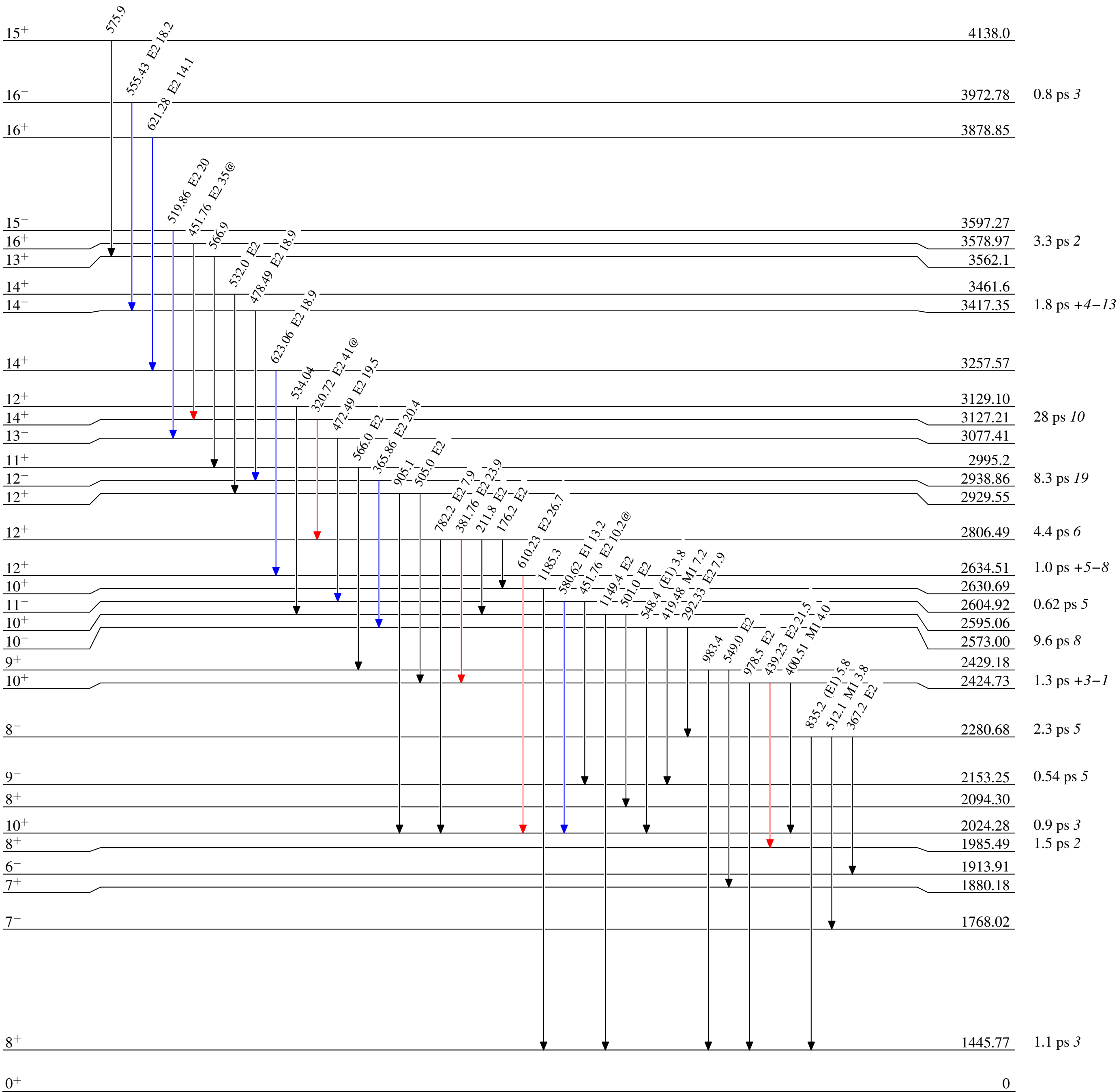
(HI,xnγ)

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{162}_{70}Yb_{92}$

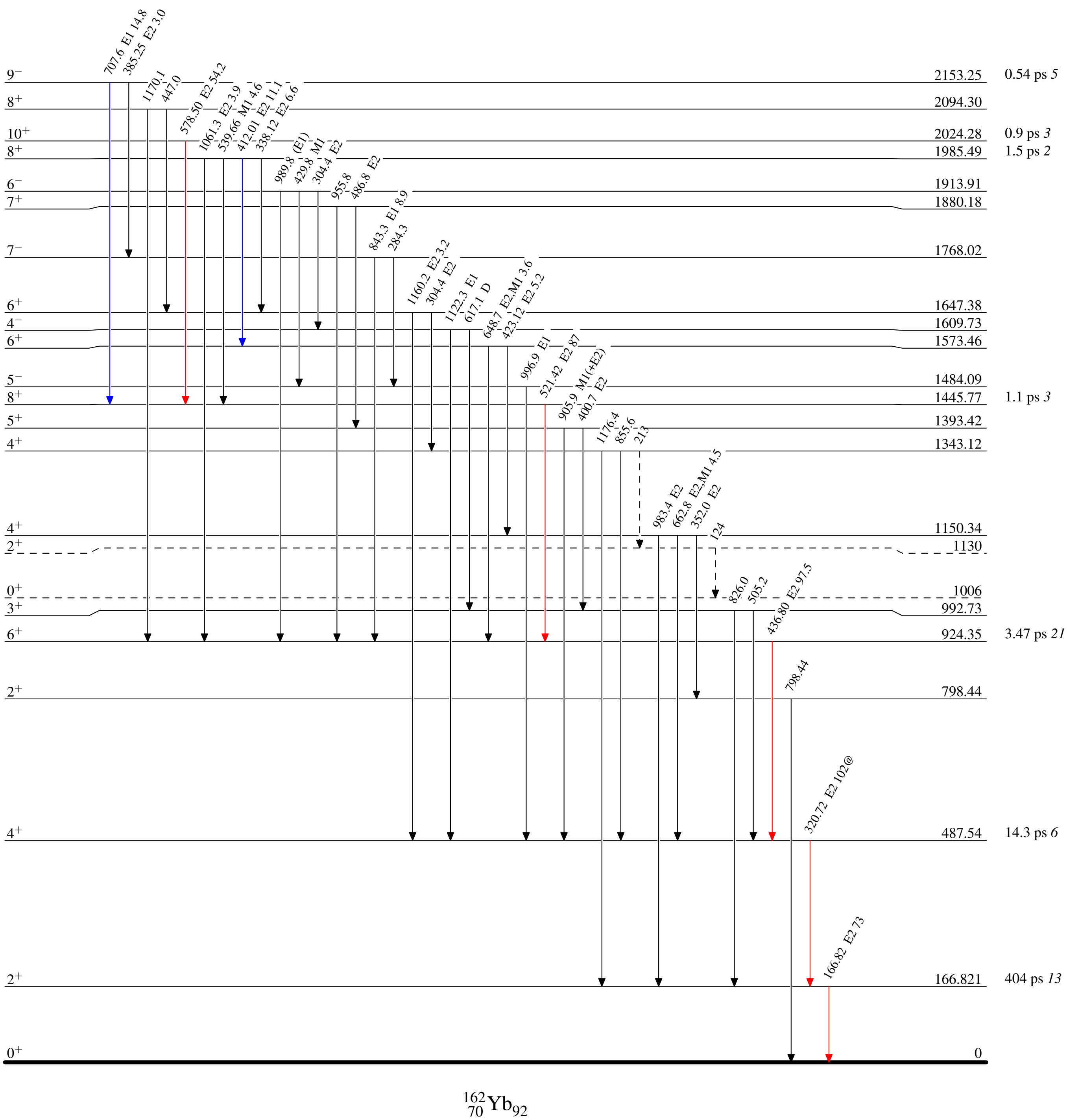
(HI,xnγ)

Level Scheme (continued)

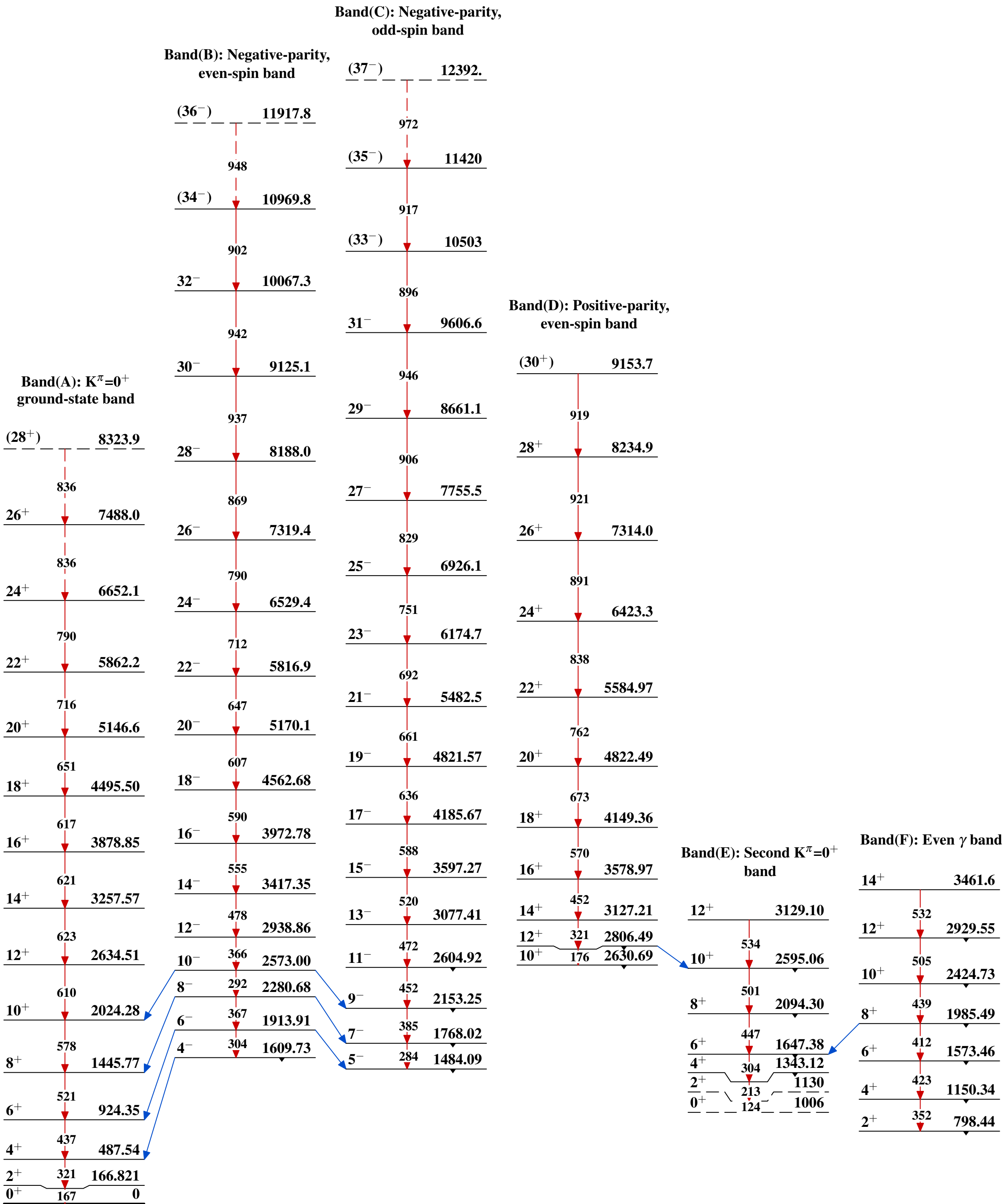
Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

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)



(HI,xnγ)



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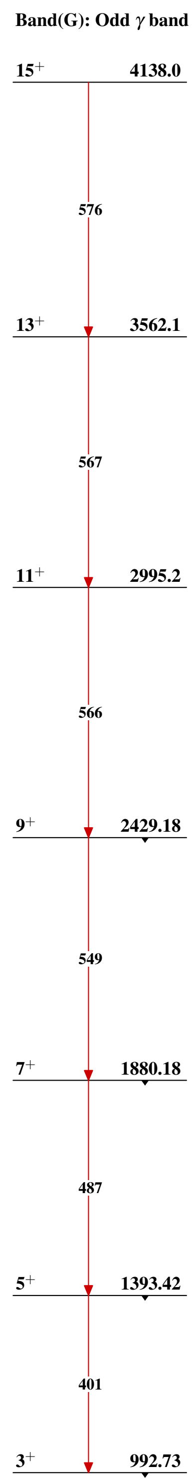
(HI,xnγ) (continued)



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