^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	S. -c. Wu	NDS 106, 367 (2005)	31-Aug-2005

1998Dr09: ^{176}Yb(^{11}B,α2nγ), E=55 MeV; Target: 4.6 mg/cm^2 of ^{176}Yb enriched to 97%; Detectors: CAESAR detector array with six Compton-suppressed Ge detectors. Measured Eγ, Iγ, $\gamma\gamma$ and lifetimes.

1998Sa60: ^{176}Yb(^{11}B,α2nγ), E=52, 57 MeV. Detectors: NORDBALL array (at E(^{11}B)=57 MeV) of 18 Compton-suppressed HPGe detectors and two planar Ge detectors, and PEX array (at E(^{11}B)=52 MeV) of four EUROBALL cluster detectors and one clover detector. Measured Eγ, Iγ, $\gamma\gamma$, and lifetimes.

^{181}Ta Levels

The level diagrams from 1998Dr09 and 1998Sa60 agree well in general. The level structure presented here is the combination from both. For the high energy part of the 9/2[514] band, the evaluator has adopted the data from 1998Sa60.

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0[e]	7/2$^+$		
6.240[d] *20*	9/2$^-$		
136.32[f] *21*	9/2$^+$		
158.50[c] *23*	11/2$^-$		
301.57[e] *23*	11/2$^+$		
337.58[d] *23*	13/2$^-$		
482.21[g] *24*	5/2$^+$	7.6 ns	T$_{1/2}$: 10.9 *6* ns from 1998Sa60.
495.2[f] *3*	13/2$^+$		
542.5[c] *3*	15/2$^-$		
590.1[h] *4*	7/2$^+$		
716.6[e] *3*	15/2$^+$		
727.3[g] *4*	9/2$^+$		
773.0[d] *3*	17/2$^-$		
892.9[h] *4*	11/2$^+$		
964.9[f] *4*	17/2$^+$		
993.7[j] *4*			
994.2[ik] *10*	(5/2$^-$)		
1022.5[ik] *11*	(9/2$^-$)		
1027.9[c] *4*	19/2$^-$		
1085.6[g] *4*	13/2$^+$		
1156.6[j] *5*			
1163.5[ik] *15*	(13/2$^-$)		
1239.5[e] *4*	19/2$^+$		
1304.8[h] *5*	15/2$^+$		
1307.3[d] *4*	21/2$^-$		
1403.3[j] *3*	(17/2)		E(level): The level at 1403.9 keV deexcites by emitting γ's of similar energies but very different branching ratios compared with this state; hence identified as two levels by 1998Dr09. T$_{1/2}$: 3.3 ns for 1403.3 or 1403.9 (1998Dr09).
1403.4[ak] *6*	15/2$^-$		E(level): Level observed in 1998Sa60, deexcites by emitting 861, 1066 and 1244 keV γ's to the 9/2$^-$ band, is identified (by the evaluator) as a different state from the levels at 1403 and 1404 keV by 1998Dr09 However, there might be some chance that this level is actually the doublet of 1403.3+1403.9 from 1998Dr09. In this case, one might attribute the level 1403.4+x as the 1472.9 state from 1998Dr09 with x=69.0.
1403.9[j] *3*	(15/2)		See comments on 1403.3.

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^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60 (continued)

^{181}Ta Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
1419.5[ik] *18*	(17/2$^-$)		
1472.9[j] *5*	(17/2)		
1483.4[j] *4*	(21/2$^-$)	23 μs *+6−2*	$T_{1/2}$: from decay curve of chopped beam experiment (1998Dr09).
1539.3[f] *4*	21/2$^+$		
1548.4[g] *5*	17/2$^+$		
1584.3[bk] *9*	17/2$^-$		
1591.8[j] *11*	(19/2)		
1608.9[c] *4*	23/2$^-$		
1685.3[j] *6*	(19/2)		
1786.5[ik] *21*	(21/2$^-$)		
1788.0[ak] *9*	19/2$^-$		
1803.6[j] *11*	(21/2)		
1819.0[h] *5*	(19/2$^+$)		
1863.1[e] *5*	23/2$^+$		
1932.9[d] *5*	25/2$^-$		
2015.1[bk] *11*	21/2$^-$		
2122.4[gj] *5*	(21/2$^+$)		
2210.1[f] *5*	25/2$^+$		
2227.9[j] *11*			$T_{1/2}$: Possibly many μs, from chopped beam experiment (1998Dr09).
2260.5[ik] *23*	(25/2$^-$)		
2263.0[ak] *12*	23/2$^-$		
2276.4[c] *8*	27/2$^-$		E(level): Ex=2287 from 1998Dr09, depopulated by 678.0 keV γ.
2534.1[bk] *15*	25/2$^-$		
2580.1[e] *5*	(27/2$^+$)		
2642.9[dk] *11*	29/2$^-$		
2968.1[fk] *12*	(29/2$^+$)		
3021.4[ck] *13*	31/2$^-$		
1402.4+x[@k]	(19/2$^+$)	140 ns *36*	Additional information 1. $T_{1/2}$: from time difference spectra between γ-rays above and below the level (1998Sa60). This level feeds 1403.4 level through, as yet unidentified, transitions of Eγ<50. See comments on 1403.4 level.
1615.7+x[&k] *8*	(21/2$^+$)		
1852.1+x[@k] *8*	(23/2$^+$)		
2111.7+x[&k] *10*	(25/2$^+$)		
2392.4+x[@k] *11*	(27/2$^+$)		

[†] From least-squares fit (by evaluator) to Eγ's, assuming Δ(Eγ)=0.3 keV for those from 1998Dr09, and Δ(Eγ)=1 keV for those from 1998Sa60.
[‡] From $\gamma\gamma$-coin. and band structure.
[#] From $\gamma\gamma$-matrices gated on γ-rays, with different time conditions (1998Dr09), except for the state at 1483 keV.
[@] Band(A): K^π=(19/2$^+$), π9/2[514]ν(1/2[510]9/2[624]) band. α=−1/2.
[&] Band(a): K^π=(19/2$^+$), π9/2[514]ν(1/2[510]9/2[624]) band. α=+1/2.
[a] Band(B): K^π=15/2$^-$, π7/2[404]ν(1/2[510]9/2[624]) band. α=−1/2.
[b] Band(b): K^π=15/2$^-$, π7/2[404]ν(1/2[510]9/2[624]) band. α=+1/2.
[c] Band(C): 9/2[514], α=−1/2.

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^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60 (continued)

^{181}Ta Levels (continued)

[d] Band(c): 9/2[514], α=+1/2.
[e] Band(D): 7/2[404], α=−1/2.
[f] Band(d): 7/2[404], α=+1/2.
[g] Band(E): 5/2[402], α=+1/2.
[h] Band(e): 5/2[402], α=−1/2.
[i] Band(F): 1/2[541].
[j] From 1998Dr09 only.
[k] From 1998Sa60 only.

γ(^{181}Ta)

Eγ's from 1998Dr09 and 1998Sa60 agree in general. The evaluator has adopted the values from 1998Dr09, except for those noted at the individual γ-energy.

E$_\gamma$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.	Comments
6.24 *2*	6.240	9/2$^-$	0.0	7/2$^+$		E$_\gamma$: From adopted gammas.
69.0[†]	1472.9	(17/2)	1403.9	(15/2)		
107.9	590.1	7/2$^+$	482.21	5/2$^+$		
136.3	136.32	9/2$^+$	0.0	7/2$^+$		
137.1	727.3	9/2$^+$	590.1	7/2$^+$		
141[‡]	1163.5	(13/2$^-$)	1022.5	(9/2$^-$)	[E2]	
152.3	158.50	11/2$^-$	6.240	9/2$^-$	D+Q	Mult.: from DCO ratio (1998Sa60), value not given.
162.9[†]	1156.6		993.7			
165.2	301.57	11/2$^+$	136.32	9/2$^+$		
165.5	892.9	11/2$^+$	727.3	9/2$^+$		
179.0	337.58	13/2$^-$	158.50	11/2$^-$		
181[‡]	1584.3	17/2$^-$	1403.9	(15/2)		
188.5[†]	1591.8	(19/2)	1403.3	(17/2)		
192.6	1085.6	13/2$^+$	892.9	11/2$^+$		
193.6	495.2	13/2$^+$	301.57	11/2$^+$		
204[‡]	1788.0	19/2$^-$	1584.3	17/2$^-$		
205.0	542.5	15/2$^-$	337.58	13/2$^-$		
211.8[†]	1803.6	(21/2)	1591.8	(19/2)		
212.4[†]	1685.3	(19/2)	1472.9	(17/2)		
213[‡]	1615.7+x	(21/2$^+$)	1402.4+x	(19/2$^+$)		E$_\gamma$: This transition could be the same as the 212.4γ deexciting the 1685.3 level identified by 1998Dr09.
219.2	1304.8	15/2$^+$	1085.6	13/2$^+$		
221.3	716.6	15/2$^+$	495.2	13/2$^+$		
227[‡]	2015.1	21/2$^-$	1788.0	19/2$^-$		
230.5	773.0	17/2$^-$	542.5	15/2$^-$		
236[‡]	1852.1+x	(23/2$^+$)	1615.7+x	(21/2$^+$)		
243.7	1548.4	17/2$^+$	1304.8	15/2$^+$		
245.0[†]	727.3	9/2$^+$	482.21	5/2$^+$		
248[‡]	2263.0	23/2$^-$	2015.1	21/2$^-$		
248.3	964.9	17/2$^+$	716.6	15/2$^+$		
255.0	1027.9	19/2$^-$	773.0	17/2$^-$		
256[‡]	1419.5	(17/2$^-$)	1163.5	(13/2$^-$)	[E2]	
260[‡]	2111.7+x	(25/2$^+$)	1852.1+x	(23/2$^+$)		
270.2	1819.0	(19/2$^+$)	1548.4	17/2$^+$		E$_\gamma$: from 1998Dr09, Eγ=268 from 1998Sa60.

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^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60 (continued)

$\gamma(^{181}Ta)$ (continued)

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
274.5	1239.5	$19/2^+$	964.9	$17/2^+$		
279.3	1307.3	$21/2^-$	1027.9	$19/2^-$		
281‡	2392.4+x	$(27/2^+)$	2111.7+x	$(25/2^+)$		
295†	2227.9		1932.9	$25/2^-$		
299.9†	1539.3	$21/2^+$	1239.5	$19/2^+$		
301.5	1608.9	$23/2^-$	1307.3	$21/2^-$		
301.6	301.57	$11/2^+$	0.0	$7/2^+$		
303.0	892.9	$11/2^+$	590.1	$7/2^+$		
303.0†	2122.4	$(21/2^+)$	1819.0	$(19/2^+)$		
324.0†	1863.1	$23/2^+$	1539.3	$21/2^+$		
324.0	1932.9	$25/2^-$	1608.9	$23/2^-$		
331.3†	337.58	$13/2^-$	6.240	$9/2^-$		
343‡	2276.4	$27/2^-$	1932.9	$25/2^-$		
345.9	482.21	$5/2^+$	136.32	$9/2^+$		
358.3	1085.6	$13/2^+$	727.3	$9/2^+$		
358.9	495.2	$13/2^+$	136.32	$9/2^+$		
367‡	1786.5	$(21/2^-)$	1419.5	$(17/2^-)$	[E2]	
384.0	542.5	$15/2^-$	158.50	$11/2^-$		
384‡	1788.0	$19/2^-$	1403.4	$15/2^-$		
412.0	1304.8	$15/2^+$	892.9	$11/2^+$		
415.0	716.6	$15/2^+$	301.57	$11/2^+$		
431‡	2015.1	$21/2^-$	1584.3	$17/2^-$		
435.4	773.0	$17/2^-$	337.58	$13/2^-$		
450‡	1852.1+x	$(23/2^+)$	1402.4+x	$(19/2^+)$		
455.3†	1483.4	$(21/2^-)$	1027.9	$19/2^-$		
462.6	1548.4	$17/2^+$	1085.6	$13/2^+$		
469.8	964.9	$17/2^+$	495.2	$13/2^+$		
474‡	2260.5	$(25/2^-)$	1786.5	$(21/2^-)$	[E2]	
475‡	2263.0	$23/2^-$	1788.0	$19/2^-$		
482.2	482.21	$5/2^+$	0.0	$7/2^+$		
485.4	1027.9	$19/2^-$	542.5	$15/2^-$		
496‡	2111.7+x	$(25/2^+)$	1615.7+x	$(21/2^+)$		
511.5†	993.7		482.21	$5/2^+$		
514.3	1819.0	$(19/2^+)$	1304.8	$15/2^+$		E_γ: from 1998Dr09, Eγ=511 from 1998Sa60.
519‡	2534.1	$25/2^-$	2015.1	$21/2^-$		
522.8	1239.5	$19/2^+$	716.6	$15/2^+$		
534.0	1307.3	$21/2^-$	773.0	$17/2^-$		
540‡	2392.4+x	$(27/2^+)$	1852.1+x	$(23/2^+)$		
574.5	1539.3	$21/2^+$	964.9	$17/2^+$		
574.5†	2122.4	$(21/2^+)$	1548.4	$17/2^+$		
581.3	1608.9	$23/2^-$	1027.9	$19/2^-$		E_γ: from 1998Dr09, Eγ=580 from 1998Sa60.
623.4	1863.1	$23/2^+$	1239.5	$19/2^+$		
625.5	1932.9	$25/2^-$	1307.3	$21/2^-$		
668	2276.4	$27/2^-$	1608.9	$23/2^-$		E_γ: from 1998Sa60; Eγ=678.0 from 1998Dr09.
670.8	2210.1	$25/2^+$	1539.3	$21/2^+$		
710‡	2642.9	$29/2^-$	1932.9	$25/2^-$		
710.6†	1483.4	$(21/2^-)$	773.0	$17/2^-$		
717.0	2580.1	$(27/2^+)$	1863.1	$23/2^+$		
745‡	3021.4	$31/2^-$	2276.4	$27/2^-$		
758‡	2968.1	$(29/2^+)$	2210.1	$25/2^+$		

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^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60 (continued)

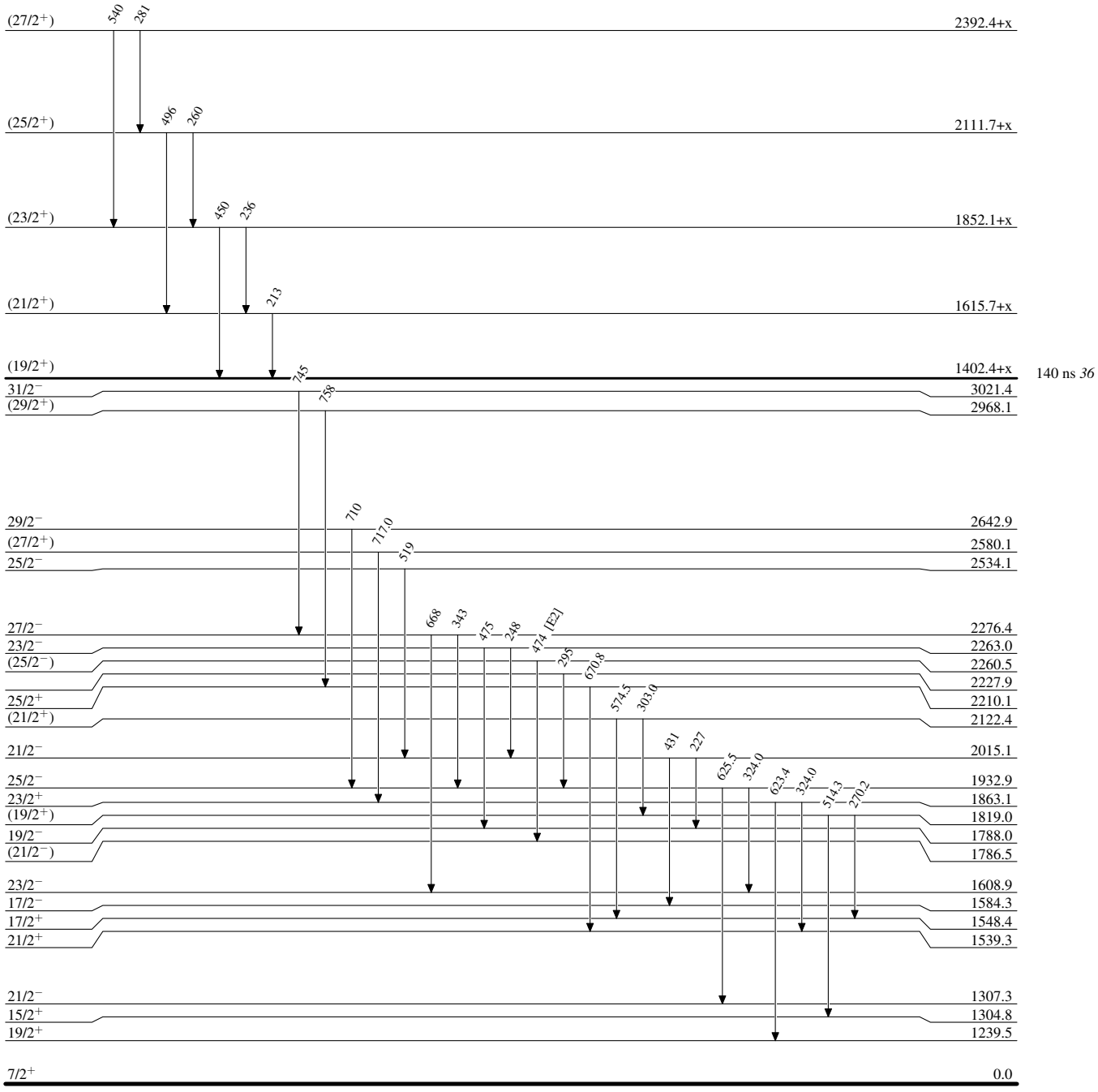
$\gamma(^{181}Ta)$ (continued)

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
861‡	1403.4	15/2$^-$	542.5	15/2$^-$		
864‡	1022.5	(9/2$^-$)	158.50	11/2$^-$		
988‡	994.2	(5/2$^-$)	6.240	9/2$^-$		
1065.7†	1403.3	(17/2)	337.58	13/2$^-$		
1066‡	1403.4	15/2$^-$	337.58	13/2$^-$		
1066.2†	1403.9	(15/2)	337.58	13/2$^-$		
1244‡	1403.4	15/2$^-$	158.50	11/2$^-$	Q	Mult.: DCO=1.23 *30*, in agreement with the value for stretched E2 (1998Sa60).
1244.9†	1403.3	(17/2)	158.50	11/2$^-$		
1245.5†	1403.9	(15/2)	158.50	11/2$^-$		

† From 1998Dr09 only.
‡ From 1998Sa60 only.

^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60

Level Scheme



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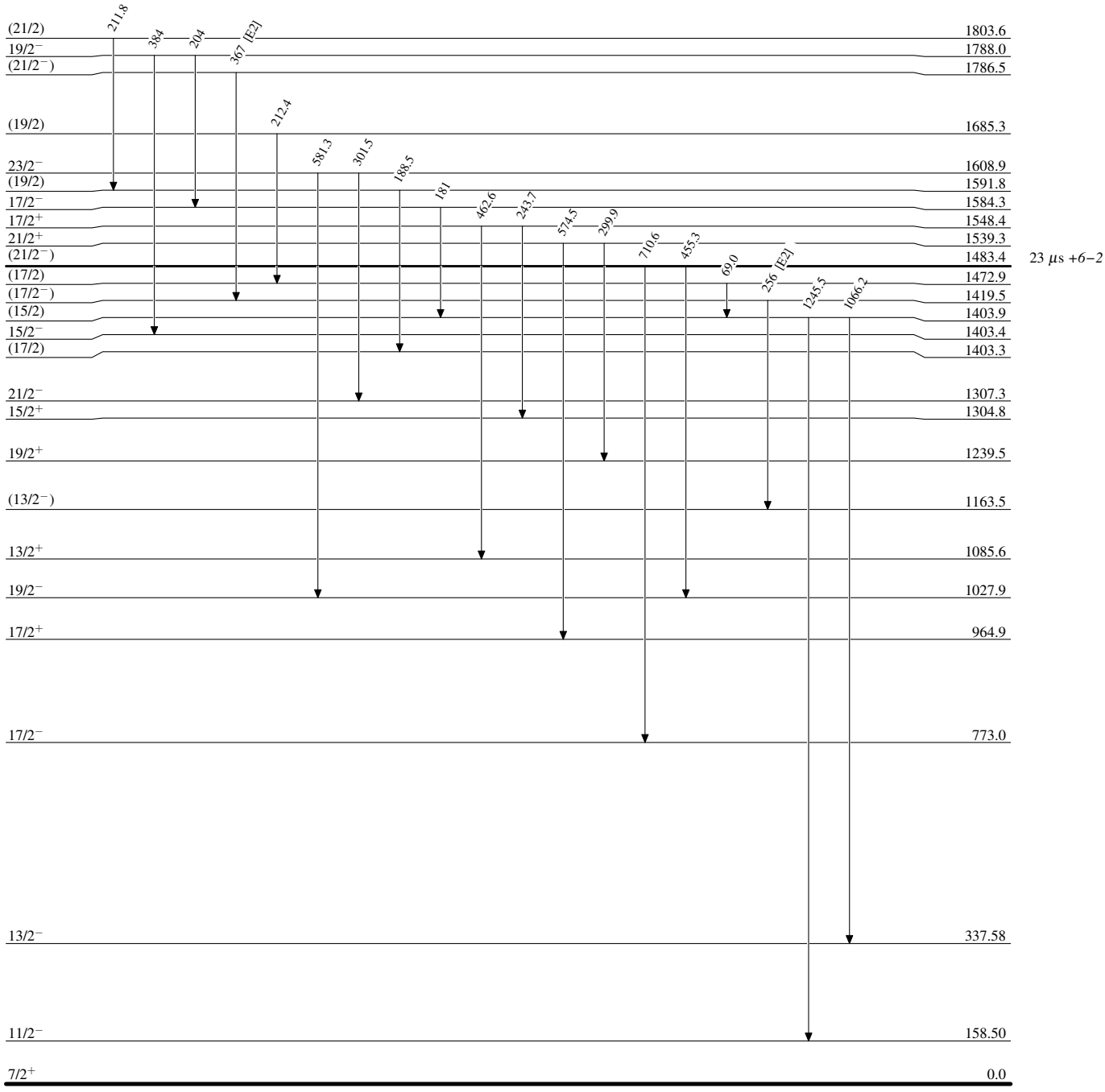
^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60

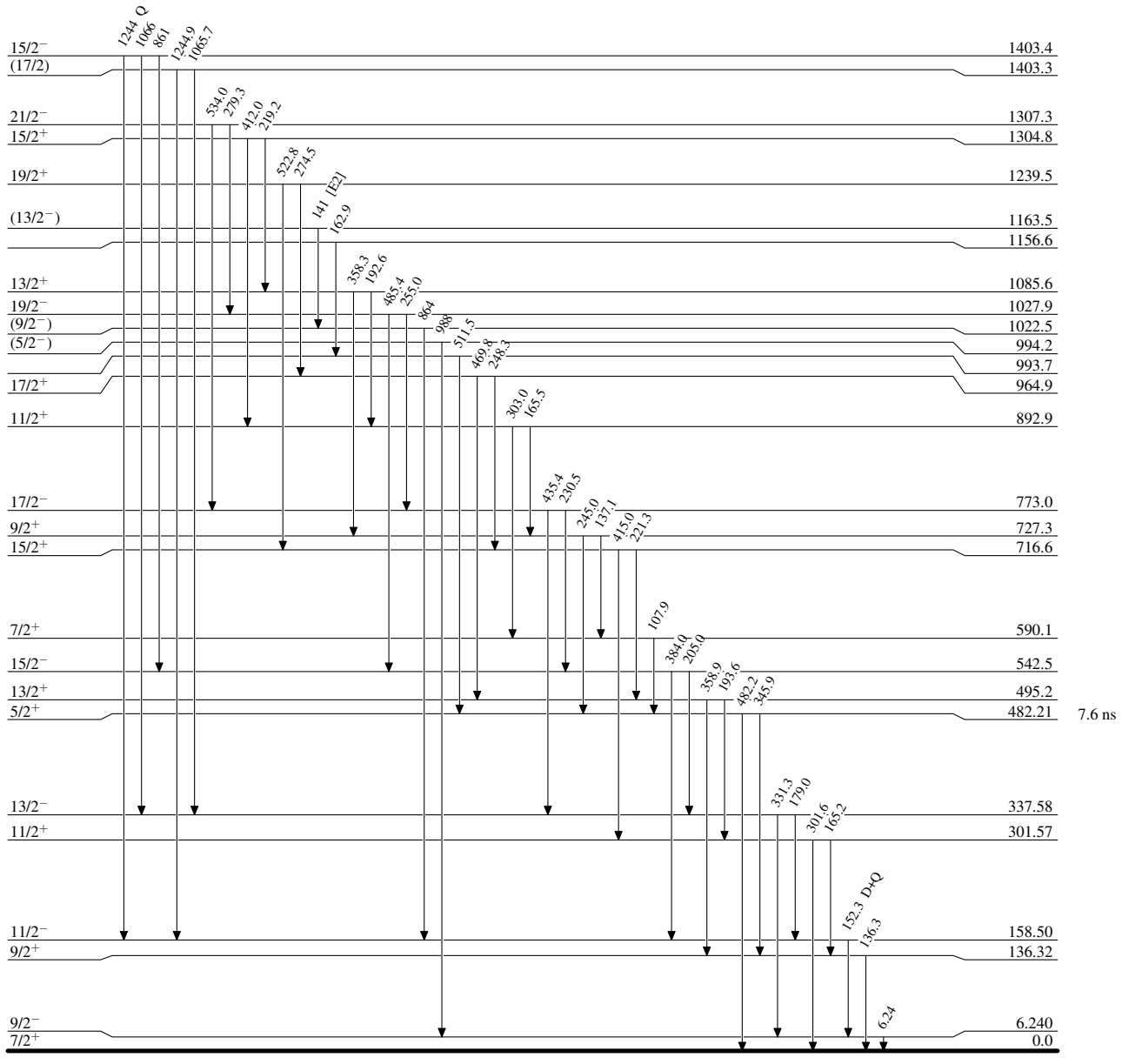
Level Scheme (continued)



$^{181}_{73}Ta_{108}$

^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60

Level Scheme (continued)



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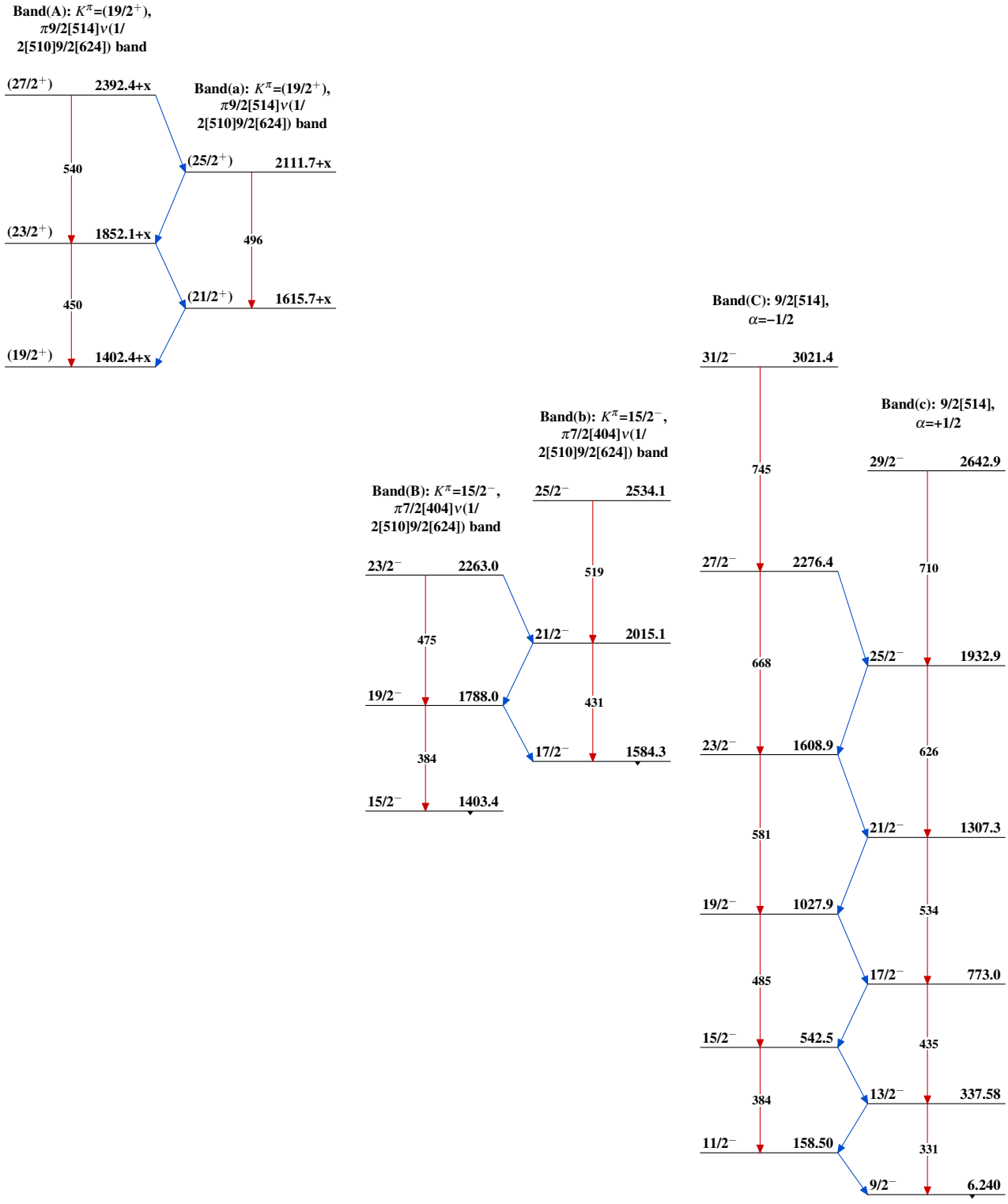
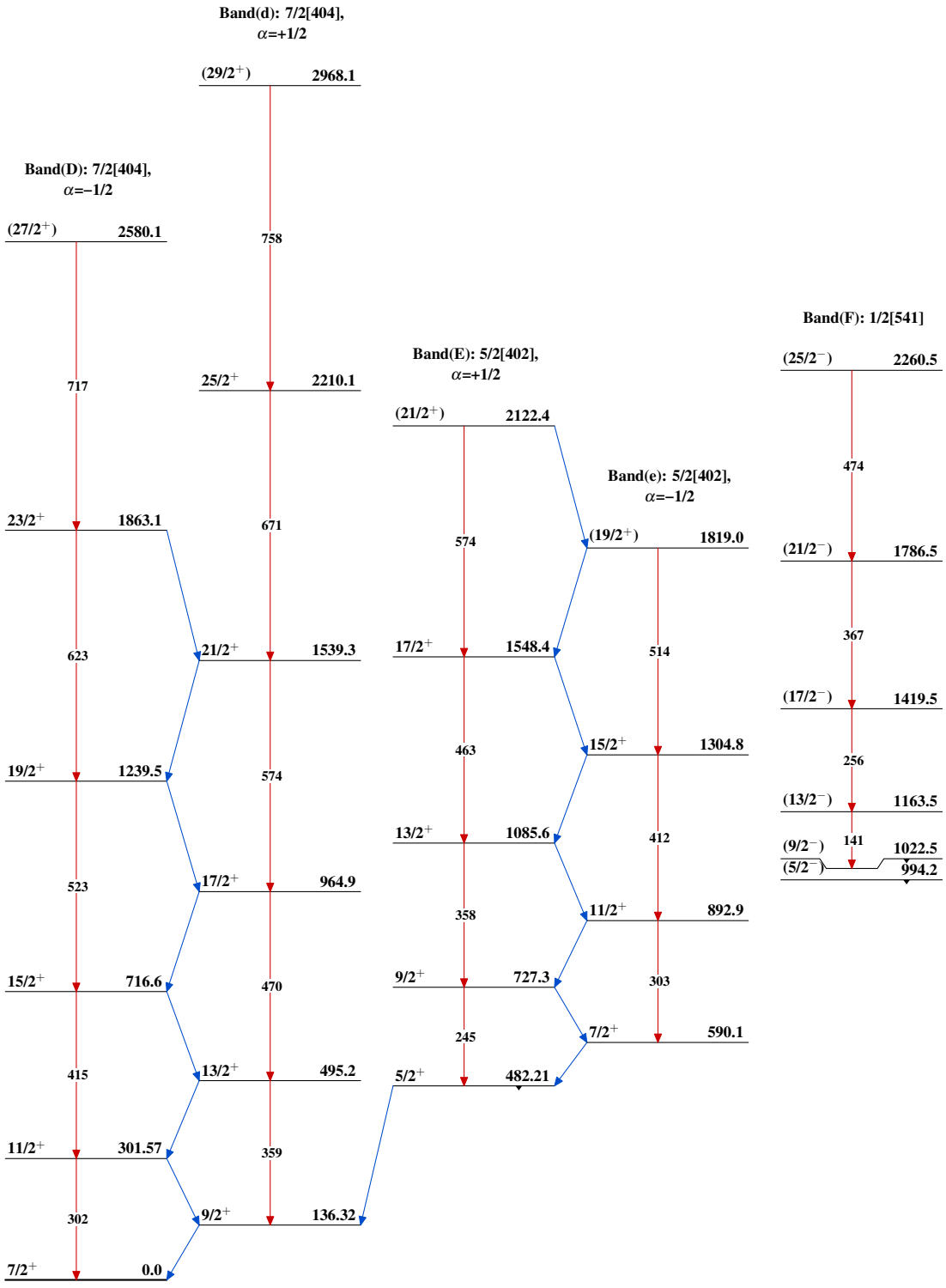


$^{181}_{73}Ta_{108}$

^{176}Yb(^{11}B,α2nγ) 1998Dr09,1998Sa60 (continued)



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