^{176}Yb(^{9}Be,xnγ) 1998Mu14

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 159, 1 (2019)	30-Aug-2019

1998Mu14: Produced using the ^{176}Yb(^{9}Be,α4n) reaction. Projectile: ^{9}Be, E=70 MeV. Target: ^{176}Yb, 4.6 mg/cm^2 thick and enriched to 96%. Detectors: six HPGe Compton-suppressed detectors and one (unsuppressed) planar germanium detector (LEPS), charged particle detector array consisting of 14 fast-slow plastic scintillators. Measured: Eγ, Iγ, $\gamma\gamma$ coin, particle-$\gamma\gamma$ coin, γ(t), $\gamma\gamma$(t), $\gamma(\theta)$, DCO ratios and ce. Deduced: level scheme, lifetimes, transition multipolarities, J^π, K^π, and configurations.
Additional information 1.

^{177}Hf Levels

E(level)†	J$^\pi$‡	T$_{1/2}$#	Comments
0.0@	7/2$^-$	stable	
112.87@ *21*	9/2$^-$		
249.58@ *21*	11/2$^-$		
321.16& *21*	9/2$^+$		
409.23@ *23*	13/2$^-$		
426.46& *25*	11/2$^+$		
508.1a *3*	5/2$^-$		
555.00& *23*	13/2$^+$		
560b	1/2$^-$		E(level),J$^\pi$: From Adopted Levels.
567c	(1/2$^-$)		E(level),J$^\pi$: From Adopted Levels.
591.2@ *3*	15/2$^-$		
604.2a *4*	7/2$^-$		
608c	(3/2$^-$)		E(level): From Adopted Levels.
624b	(3/2$^-$)		Additional information 2. E(level): From Adopted Levels.
652b	(5/2$^-$)		Additional information 3. E(level): From Adopted Levels.
665c	(5/2$^-$)		Additional information 4. E(level): From Adopted Levels.
708.1& *3*	15/2$^+$		
726.9a *4*	9/2$^-$		
794.2@ *3*	17/2$^-$		
840.1b *3*	(7/2$^-$)		
841.5c *3*	(9/2$^-$)		
845.6b *3*	(9/2$^-$)		
882.5& *3*	17/2$^+$		
1017.5@ *4*	19/2$^-$		
1086.5& *4*	19/2$^+$		
1113.5c *5*	(13/2$^-$)		
1143.3b *5*	(13/2$^-$)		
1157.9b *5*	(11/2$^-$)		
1259.9@ *5*	21/2$^-$		
1300.9& *4*	21/2$^+$		
1315.0e *4*	23/2$^+$	1.09 s *5*	J$^\pi$: From Adopted Levels.
1342.2d *5*	(19/2$^-$)	55.9 μs *12*	J$^\pi$: From Adopted Levels.
1477.2c *6*	(17/2$^-$)		
1520.4@ *5*	23/2$^-$		

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^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

^{177}Hf Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[#]	Comments
1534.9[b] 6	(17/2$^-$)		
1560.8[&] 4	23/2$^+$		
1565.6[b] 6	(15/2$^-$)		
1582.7[d] 5	21/2$^-$		
1592.3[e] 4	25/2$^+$		
1712.7[g] 4	25/2$^-$	<1 ns	T$_{1/2}$: From $\gamma\gamma$(t) in 1998Mu14.
1797.8[@] 6	25/2$^-$		
1802.5[&] 4	25/2$^+$		
1845.7[d] 5	23/2$^-$		
1887.3[e] 4	27/2$^+$		
1925.3[c] 6	(21/2$^-$)		
1967.5[g] 5	27/2$^-$		
2005.1[b] 6	(21/2$^-$)		
2049.2[b] 6	(19/2$^-$)		
2069.8[h] 5	(23/2$^-$)		
2090.8[@] 6	27/2$^-$		
2123.7[d] 5	25/2$^-$		
2128.0[&] 5	27/2$^+$		
2198.7[e] 5	29/2$^+$		
2248.9[g] 5	29/2$^-$		
2335.4[h] 5	(25/2$^-$)		
2377.5[&] 5	29/2$^+$		
2398.7[@] 6	29/2$^-$		
2409.1[i] 5	(27/2$^-$)		
2416.3[d] 6	27/2$^-$		
2417.5 5	(27/2$^-$)		
2451.4[c] 7	(25/2$^-$)		
2525.1[e] 5	31/2$^+$		
2539.1[b] 7	(25/2$^-$)		
2554.2[g] 5	31/2$^-$		
2590.8[b] 7	(23/2$^-$)		
2614.9[h] 5	(27/2$^-$)		
2699.7[i] 5	(29/2$^-$)		
2719.7[@] 7	31/2$^-$		
2724.2[d] 6	29/2$^-$		
2739.1[k] 5	37/2$^-$	51.4 min 5	J$^{\pi}$: From Adopted Levels.
2782.6[&] 6	31/2$^+$		
2865.0[e] 5	33/2$^+$		
2872.9[f] 5	(29/2$^+$)		
2881.5[g] 5	33/2$^-$		
2896.3[j] 6	(31/2$^-$)		
2908.5[h] 6	(29/2$^-$)		
2935.6[m] 6	(33/2$^-$)		
3015.3[&] 6	33/2$^+$		
3047.1[d] 6	(31/2$^-$)		
3053.3[@] 7	33/2$^-$		
3104.8[l] 6	39/2$^+$	<1 ns	T$_{1/2}$: From 1998Mu14.

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^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

^{177}Hf Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
3133.5[b] 8	(29/2⁻)	3302.1[m] 7	(35/2⁻)	3592.9[g] 6	37/2⁻	4120.7[@] 8	39/2⁻
3140.7[k] 6	39/2⁻	3398.5[@] 7	35/2⁻	3685.4[m] 7	(37/2⁻)	4231.0[l] 7	45/2⁺
3216.9[e] 5	35/2⁺	3464.6[l] 6	41/2⁺	3702.9[&] 7	37/2⁺	4459.1[k] 6	45/2⁻
3217.1[h] 6	(31/2⁻)	3517.3[&] 6	35/2⁺	3753.3[@] 8	37/2⁻	4497.4[@] 8	41/2⁻
3221.5[f] 6	(31/2⁺)	3561.8[k] 6	41/2⁻	3839.7[l] 6	43/2⁺	4639.4[l] 7	(47/2⁺)
3228.4[g] 6	35/2⁻	3578.6[e] 5	37/2⁺	3948.0[e] 6	39/2⁺	5063.7[l] 7	49/2⁺
3236.9[j] 7	(33/2⁻)	3581.6[f] 7	(33/2⁺)	4001.4[k] 6	43/2⁻		

† From a least-squares fit to Eγ, unless otherwise stated.
‡ From 1998Mu14, based on the measured angular distributions and DCO data, the apparent band structures with both cascade (ΔJ=1) and crossover (ΔJ=2) transitions, and the complex γ-ray decay pattern.
# From Adopted Levels, unless otherwise stated.
@ Band(A): $K^{\pi}=7/2^{-}$, ν7/2[514] band.
& Band(B): $K^{\pi}=9/2^{+}$, ν9/2[624] band.
a Band(C): $K^{\pi}=5/2^{-}$, ν5/2[512] band. The assignment is tentative.
b Band(D): $K^{\pi}=1/2^{-}$, ν1/2[521] band.
c Band(E): $K^{\pi}=(1/2^{-})$, ν1/2[510] band.
d Band(F): $K^{\pi}=19/2^{-}$, ν(7/2[514])⊗π^2(5/2[402],7/2[404]).
e Band(G): $K^{\pi}=23/2^{+}$, ν(7/2[514])⊗π^2(7/2[404],9/2[514]).
f Band(H): $K^{\pi}=(29/2^{+})$, ν(7/2[514])⊗π^4(1/2[411],5/2[402],7/2[404],9/2[514]).
g Band(I): $K^{\pi}=25/2^{-}$, ν(9/2[624])⊗π^2(7/2[404],9/2[514]).
h Band(J): $K^{\pi}=(23/2^{-})$. See 1998Mu14 for details.
i Band at 2409 keV.
j Band at 2896 keV.
k Band(K): $K^{\pi}=37/2^{-}$, ν^3(5/2[512],7/2[514],9/2[624])⊗ π^2(7/2[404],9/2[514]).
l Band(L): $K^{\pi}=39/2^{+}$, ν^3(7/2[514],7/2[633],9/2[624])⊗ π^2(7/2[404],9/2[514]).
m Band(M): $K^{\pi}=(33/2^{-})$, ν^3(1/2[521],7/2[514],9/2[624])⊗ π^2(7/2[404],9/2[514]).

γ(^{177}Hf)

Mixing ratios were deduced using the branching ratio data and the rotational model, and by assuming a pure K. The sign of delta is determined from γ(θ). It is assumed that the sign of δ does not change within a given band.

Eγ†	Iγ†	Ei(level)	J_i^{π}	E_f	J_f^{π}	Mult.‡	Comments
74.3 3	3.7 4	2409.1	(27/2⁻)	2335.4	(25/2⁻)		
82.2 3	10.7 8	2417.5	(27/2⁻)	2335.4	(25/2⁻)		
96.4 3	3.6 10	604.2	7/2⁻	508.1	5/2⁻		
105.3 3	105 4	426.46	11/2⁺	321.16	9/2⁺	M1+E2	Mult.: A_2=−0.25 2; DCO(ΔJ=2)=0.40 6; DCO(ΔJ=1)=0.40 4.
112.9 3	995 24	112.87	9/2⁻	0.0	7/2⁻	M1+E2	Mult.: A_2=−0.13 1, DCO(ΔJ=2)=0.55 7 and DCO(ΔJ=1)=0.67 11.
116.5 3	1.9 6	708.1	15/2⁺	591.2	15/2⁻		
120.4 3	389 13	1712.7	25/2⁻	1592.3	25/2⁺	E1	Mult.: A_2=+0.31 1; DCO(ΔJ=1)=0.97 3.
123.1 3	2.2 8	726.9	9/2⁻	604.2	7/2⁻		
128.4 3	126 4	555.00	13/2⁺	426.46	11/2⁺	M1+E2	δ: −0.38 1, assuming K=9/2.

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^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
							Mult.: A_2=−0.53 *2*; DCO(ΔJ=2)=0.63 *7*; DCO(ΔJ=1)=0.50 *5*.
136.6 *3*	78 *4*	249.58	11/2$^-$	112.87	9/2$^-$	M1+E2	δ: −2.30 *21*, assuming K=7/2. Mult.: A_2=−0.41 *2*; DCO(ΔJ=2)=0.46 *6*; DCO(ΔJ=1)=0.81 *10*.
145.7693 *7*	1.5 *8*	555.00	13/2$^+$	409.23	13/2$^-$		E_γ: From adopted gammas. Note, that Eγ=153.3 keV is reported by 1998Mu14, but it does not fit the level scheme.
153.1 *3*	120 *4*	708.1	15/2$^+$	555.00	13/2$^+$	M1+E2	δ: −0.38 *1*, assuming K=9/2. Mult.: A_2=−0.52 *2*; DCO(ΔJ=2)=0.35 *10*; DCO(ΔJ=1)=0.50 *3*.
159.6 *3*	26.8 *13*	409.23	13/2$^-$	249.58	11/2$^-$	M1+E2	δ: −2.79 *18*, assuming K=7/2. Mult.: A_2=−0.12 *4*; DCO(ΔJ=2)=0.71 *9*.
174.3 *3*	94 *3*	882.5	17/2$^+$	708.1	15/2$^+$	M1+E2	δ: −0.36 *1*, assuming K=9/2. Mult.: A_2=−0.47 *3*; DCO(ΔJ=2)=0.53 *9*; DCO(ΔJ=1)=0.46 *3*.
176.5 *3*	27.7 *19*	841.5	(9/2$^-$)	665	(5/2$^-$)		
176.9 *3*	34.8 *16*	426.46	11/2$^+$	249.58	11/2$^-$		
181.8 *3*	16.3 *10*	591.2	15/2$^-$	409.23	13/2$^-$	M1+E2	δ: −4.02 *29*, assuming K=7/2. Mult.: DCO(ΔJ=2)=0.51 *13*.
193.6 *3*	24.0 *19*	845.6	(9/2$^-$)	652	(5/2$^-$)		
196.5 *3*	12.9 *22*	2935.6	(33/2$^-$)	2739.1	37/2$^-$		
196.6 *3*	52.8 *19*	2896.3	(31/2$^-$)	2699.7	(29/2$^-$)	M1(+E2)	Mult.: A_2=−0.28 *2*; DCO(ΔJ=1)=0.64 *6*.
203.0 *3*	10.1 *9*	794.2	17/2$^-$	591.2	15/2$^-$	[M1+E2]	δ: −14.9 *14*, assuming K=7/2.
204.0 *3*	68.6 *24*	1086.5	19/2$^+$	882.5	17/2$^+$	M1+E2	δ: −0.40 *1*, assuming K=9/2. Mult.: A_2=−0.48 *3*; DCO(ΔJ=2)=0.54 *7*; DCO(ΔJ=1)=0.42 *4*.
208.3 *3*	608 *21*	321.16	9/2$^+$	112.87	9/2$^-$	E1	Mult.: A_2=+0.26 *1*; DCO(ΔJ=2)=0.96 *12*; DCO(ΔJ=1)=1.10 *7*.
214.0 *1*		2739.1	37/2$^-$	2525.1	31/2$^+$	E3	E_γ,Mult.: From adopted gammas.
214.3 *3*	42.9 *18*	1300.9	21/2$^+$	1086.5	19/2$^+$	M1+E2	δ: −0.35 *1*, assuming K=9/2. Mult.: DCO(ΔJ=2)=0.53 *14*; DCO(ΔJ=1)=0.34 *6*.
216.1 *3*	16.0 *10*	840.1	(7/2$^-$)	624	(3/2$^-$)		
218.5 *3*	3.3 *12*	726.9	9/2$^-$	508.1	5/2$^-$		
223.3 *3*	6.0 *7*	1017.5	19/2$^-$	794.2	17/2$^-$	[M1+E2]	δ: −5.1 *6*, assuming K=7/2.
228.4838 *6*		1315.0	23/2$^+$	1086.5	19/2$^+$		E_γ: From adopted gammas.
233.8 *3*	48.4 *20*	555.00	13/2$^+$	321.16	9/2$^+$	(E2)	Mult.: A_2=+0.03 *2*. Value in disagreement with that expected for a stretched E2 transition. DCO(ΔJ=2)=1.2 *3*.
240.6 *3*	63 *3*	1582.7	21/2$^-$	1342.2	(19/2$^-$)		
241.8 *3*	10.3 *17*	1802.5	25/2$^+$	1560.8	23/2$^+$		δ: −0.40 *2*, assuming K=9/2. I_γ: From Iγ(242γ)/Iγ(502γ)=8.1 *7* and Iγ(502γ)=83 *3* (1998Mu14).
249.4 *3*	4.8 *9*	2377.5	29/2$^+$	2128.0	27/2$^+$	[M1+E2]	δ: −0.27 *2*, assuming K=9/2. I_γ: From Iγ(249γ)/Iγ(575γ)=9.7 *17* and Iγ(515γ)=46.7 *21* (1998Mu14).
249.6 *3*	412 *28*	249.58	11/2$^-$	0.0	7/2$^-$	E2	Mult.: A_2=+0.14 *1*; DCO(ΔJ=2)=0.94 *6*.
254.8 *3*	291 *9*	1967.5	27/2$^-$	1712.7	25/2$^-$	M1+E2	Mult.: A_2=+0.25 *1*; DCO(ΔJ=1)=0.95 *8*.
260.0 *3*	17.8 *10*	1560.8	23/2$^+$	1300.9	21/2$^+$	M1+E2	δ: −0.50 *2*, assuming K=9/2. Mult.: DCO(ΔJ=2)=0.46 *11*.
263.0 *3*	53 *3*	1845.7	23/2$^-$	1582.7	21/2$^-$	[M1+E2]	δ: 0.30 *6*, assuming K=19/2.
266.0[#] *3*		2335.4	(25/2$^-$)	2069.8	(23/2$^-$)		
272.0 *3*	27.7 *19*	1113.5	(13/2$^-$)	841.5	(9/2$^-$)		
277.3 *3*	637 *15*	1592.3	25/2$^+$	1315.0	23/2$^+$	M1+E2	Mult.: A_2=+0.16 *1*; DCO(ΔJ=1)=0.88 *7*.
278.2 *3*	25.8 *22*	2123.7	25/2$^-$	1845.7	23/2$^-$	[M1+E2]	δ: 0.36 *3*, assuming K=19/2.
280.0[#] *3*		2614.9	(27/2$^-$)	2335.4	(25/2$^-$)		

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^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
281.4 *3*	152 *5*	2248.9	29/2$^-$	1967.5	27/2$^-$	M1+E2	δ: +0.47 *2*, assuming K=25/2. Mult.: A_2=+0.20 *4*; DCO(ΔJ=1)=0.90 *5*.
281.8 *3*	103 *4*	708.1	15/2$^+$	426.46	11/2$^+$	E2	Mult.: A_2=+0.30 *2*; DCO(ΔJ=1)=1.14 *22*.
282.3 *3*	3.9 *9*	2699.7	(29/2$^-$)	2417.5	(27/2$^-$)		
290.8 *3*	42.8 *18*	2699.7	(29/2$^-$)	2409.1	(27/2$^-$)	M1(+E2)	Mult.: DCO(ΔJ=1)=0.75 *13*.
292.6 *3*	12.4 *14*	2416.3	27/2$^-$	2123.7	25/2$^-$	[M1+E2]	δ: 0.41 *4*, assuming K=19/2.
293.0[#] *3*		2908.5	(29/2$^-$)	2614.9	(27/2$^-$)		
295.1 *3*	204 *8*	1887.3	27/2$^+$	1592.3	25/2$^+$	M1+E2	δ: +0.31 *2*, assuming K=23/2. Mult.: A_2=+0.18 *3*; DCO(ΔJ=1)=0.77 *4*.
296.5 *3*	309 *12*	409.23	13/2$^-$	112.87	9/2$^-$	E2	Mult.: A_2=+0.25 *2*; DCO(ΔJ=2)=0.95 *4*; DCO(ΔJ=1)=1.01 *9*.
297.7 *3*	24.4 *19*	1143.3	(13/2$^-$)	845.6	(9/2$^-$)		
305.4 *3*	72 *3*	2554.2	31/2$^-$	2248.9	29/2$^-$	M1+E2	δ: +0.43 *2*, assuming K=25/2. Mult.: DCO(ΔJ=1)=0.90 *6*.
308.1 *3*	11.9 *13*	2724.2	29/2$^-$	2416.3	27/2$^-$	[M1+E2]	δ: 0.41 *4*, assuming K=19/2.
308.6[#] *3*	1.4 *7*	3217.1	(31/2$^-$)	2908.5	(29/2$^-$)		
311.5 *3*	128 *5*	2198.7	29/2$^+$	1887.3	27/2$^+$	M1+E2	δ: +0.36 *2*, assuming K=23/2. Mult.: DCO(ΔJ=1)=0.74 *5*.
317.8 *3*	15.6 *17*	1157.9	(11/2$^-$)	840.1	(7/2$^-$)		
321.1 *3*	16 *6*	321.16	9/2$^+$	0.0	7/2$^-$	[E1]	Mult.: A_2=+0.47 *7*. Value in disagreement with that expected for a pure J to J-1 E1 transition.
323.2 *3*	5.7 *10*	3047.1	(31/2$^-$)	2724.2	29/2$^-$	[M1+E2]	δ: 0.33 *5*, assuming K=19/2.
325.4 *3*	6.1 *12*	2128.0	27/2$^+$	1802.5	25/2$^+$	[M1+E2]	δ: −0.61 *7*, assuming K=9/2. I_γ: From Iγ(325γ)/Iγ(567γ)=8.2 *16* and Iγ(567γ)=50.0 *21* (1998Mu14).
326.5 *3*	79 *3*	2525.1	31/2$^+$	2198.7	29/2$^+$	M1+E2	δ: +0.30 *1*, assuming K=23/2. Mult.: DCO(ΔJ=1)=0.78 *6*.
327.3 *3*	31.3 *16*	2881.5	33/2$^-$	2554.2	31/2$^-$	M1+E2	δ: +0.50 *2*, assuming K=25/2. Mult.: DCO(ΔJ=1)=0.85 *14*.
327.7 *3*	133 *5*	882.5	17/2$^+$	555.00	13/2$^+$	E2	Mult.: A_2=+0.18 *2*; DCO(ΔJ=2)=0.84 *22*; DCO(ΔJ=1)=1.26 *14*.
339.4 *3*	8.2 *9*	2409.1	(27/2$^-$)	2069.8	(23/2$^-$)		
340.1 *3*	40.4 *20*	2865.0	33/2$^+$	2525.1	31/2$^+$	M1+E2	δ: +0.26 *1*, assuming K=23/2. Mult.: DCO(ΔJ=1)=0.96 *10*.
340.6 *3*	12.3 *11*	3236.9	(33/2$^-$)	2896.3	(31/2$^-$)		
341.6 *3*	300 *10*	591.2	15/2$^-$	249.58	11/2$^-$	E2	Mult.: A_2=+0.29 *2*; DCO(ΔJ=2)=0.96 *6*; DCO(ΔJ=1)=0.83 *8*.
346.9 *3*	12.8 *9*	3228.4	35/2$^-$	2881.5	33/2$^-$	M1+E2	δ: +0.51 *3*, assuming K=25/2. Mult.: A_2=+0.46 *11*; DCO(ΔJ=1)=0.89 *22*.
348.6 *3*	9.8 *12*	3221.5	(31/2$^+$)	2872.9	(29/2$^+$)		
351.9 *3*	25.7 *15*	3216.9	35/2$^+$	2865.0	33/2$^+$	M1+E2	δ: +0.21 *1*, assuming K=23/2. Mult.: DCO(ΔJ=1)=0.82 *15*.
357.1 *3*	32.2 *20*	2069.8	(23/2$^-$)	1712.7	25/2$^-$		
359.8 *3*	77 *4*	3464.6	41/2$^+$	3104.8	39/2$^+$	M1+E2	Mult.: A_2=+0.17 *8*; DCO(ΔJ=1)=1.14 *20*.
360.1 *3*	5.8 *9*	3581.6	(33/2$^+$)	3221.5	(31/2$^+$)	[M1+E2]	δ: 0.6 *4*, assuming K=29/2.
361.7 *3*	14.1 *10*	3578.6	37/2$^+$	3216.9	35/2$^+$	M1+E2	δ: +0.18 *2*, assuming K=23/2. Mult.: A_2=+0.40 *12*.
363.7 *3*	13.6 *12*	1477.2	(17/2$^-$)	1113.5	(13/2$^-$)		
364.0 *3*	16.9 *11*	2699.7	(29/2$^-$)	2335.4	(25/2$^-$)		
364.6 *3*	7.9 *10*	3592.9	37/2$^-$	3228.4	35/2$^-$	[M1+E2]	δ: +0.43 *4*, assuming K=25/2.
365.7 *3*	85 *4*	3104.8	39/2$^+$	2739.1	37/2$^-$	E1	Mult.: A_2=−0.06 *3*; DCO(ΔJ=1)=0.55 *6*.
366.2 *3*	28.9 *16*	2614.9	(27/2$^-$)	2248.9	29/2$^-$		
366.5 *3*	11.8 *18*	3302.1	(35/2$^-$)	2935.6	(33/2$^-$)		
368.0 *3*	67 *3*	2335.4	(25/2$^-$)	1967.5	27/2$^-$	M1(+E2)	Mult.: A_2=+0.32 *6*; DCO(ΔJ=1)=0.89 *9*.
369.4 *3*	8.5 *9*	3948.0	39/2$^+$	3578.6	37/2$^+$	[M1+E2]	δ: +0.20 *2*, assuming K=23/2.

Continued on next page (footnotes at end of table)

^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

$\gamma(^{177}Hf)$ (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult. ‡	Comments
375.1 *3*	37.0 *19*	3839.7	43/2$^+$	3464.6	41/2$^+$	M1+E2	δ: +0.63 *7*, assuming K=39/2. Mult.: A_2=+0.25 *3*; DCO(ΔJ=1)=0.95 *14*.
378.4 *3*	153 *5*	1086.5	19/2$^+$	708.1	15/2$^+$		
383.3 *3*	6.5 *10*	3685.4	(37/2$^-$)	3302.1	(35/2$^-$)	[M1+E2]	δ: 0.5 *3*, assuming K=33/2.
384.9 *3*	262 *9*	794.2	17/2$^-$	409.23	13/2$^-$	E2	Mult.: A_2=+0.25 *2*; DCO(ΔJ=2)=0.95 *7*; DCO(ΔJ=1)=0.97 *9*.
391.3 *3*	17.0 *12*	4231.0	45/2$^+$	3839.7	43/2$^+$	M1+E2	δ: +0.68 *7*, assuming K=39/2. Mult.: DCO(ΔJ=1)=1.23 *25*.
391.6 *3*	22.6 *15*	1534.9	(17/2$^-$)	1143.3	(13/2$^-$)		
397.7 *3*	37.7 *25*	1712.7	25/2$^-$	1315.0	23/2$^+$	E1	Mult.: A_2=−0.06 *5*; DCO(ΔJ=1)=0.60 *10*.
401.3 *3*	46 *3*	3140.7	39/2$^-$	2739.1	37/2$^-$	M1+E2	Mult.: DCO(ΔJ=1)=1.10 *22*.
407.7 *3*	16.0 *13*	1565.6	(15/2$^-$)	1157.9	(11/2$^-$)		
408.1 *3*	8.2 *9*	4639.4	(47/2$^+$)	4231.0	45/2$^+$	[M1+E2]	δ: +0.58 *9*, assuming K=39/2.
418.3 *3*	134 *5*	1300.9	21/2$^+$	882.5	17/2$^+$	E2	Mult.: A_2=+0.19 *3*; DCO(ΔJ=2)=0.93 *13*; DCO(ΔJ=1)=1.15 *13*.
420.9 *3*	38 *3*	3561.8	41/2$^-$	3140.7	39/2$^-$	M1+E2	δ: 0.74 *23*, assuming K=37/2. Mult.: DCO(ΔJ=1)=1.22 *25*.
424.0 *3*	0.9 *7*	5063.7	49/2$^+$	4639.4	(47/2$^+$)		
426.3 *3*	227 *8*	1017.5	19/2$^-$	591.2	15/2$^-$	E2	Mult.: DCO(ΔJ=2)=0.89 *5*; DCO(ΔJ=1)=1.07 *15*.
440.0 *3*	13.5 *19*	4001.4	43/2$^-$	3561.8	41/2$^-$	M1+E2	δ: 0.74 *16*, assuming K=37/2. Mult.: DCO(ΔJ=1)=1.1 *3*.
441.6 *3*	16.8 *13*	2409.1	(27/2$^-$)	1967.5	27/2$^-$		
448.1 *3*	7.4 *9*	1925.3	(21/2$^-$)	1477.2	(17/2$^-$)		
450.8 *3*	5.6 *11*	2699.7	(29/2$^-$)	2248.9	29/2$^-$		
458.0 *3*	3.2 *11*	4459.1	45/2$^-$	4001.4	43/2$^-$		
465.7 *3*	181 *6*	1259.9	21/2$^-$	794.2	17/2$^-$	E2	Mult.: A_2=+0.15 *3*; DCO(ΔJ=2)=0.81 *5*; DCO(ΔJ=1)=1.01 *13*.
470.2 *3*	17.2 *12*	2005.1	(21/2$^-$)	1534.9	(17/2$^-$)		
474.4 *3*	92 *3*	1560.8	23/2$^+$	1086.5	19/2$^+$	E2	Mult.: A_2=+0.15 *3*; DCO(ΔJ=2)=1.03 *14*; DCO(ΔJ=1)=1.26 *16*.
483.6 *3*	16.9 *12*	2049.2	(19/2$^-$)	1565.6	(15/2$^-$)		
501.6 *3*	83 *3*	1802.5	25/2$^+$	1300.9	21/2$^+$	E2	Mult.: DCO(ΔJ=2)=0.83 *12*; DCO(ΔJ=1)=0.95 *14*.
502.9 *3*	156 *6*	1520.4	23/2$^-$	1017.5	19/2$^-$	E2	Mult.: DCO(ΔJ=2)=0.87 *5*.
503.4 *3*	7 *4*	1845.7	23/2$^-$	1342.2	(19/2$^-$)		
508.1 *3*	6.9 *16*	508.1	5/2$^-$	0.0	7/2$^-$		
526.1 *3*	4.0 *7*	2451.4	(25/2$^-$)	1925.3	(21/2$^-$)		
534.0 *3*	8.4 *9*	2539.1	(25/2$^-$)	2005.1	(21/2$^-$)		
536.3 *3*	21.1 *16*	2248.9	29/2$^-$	1712.7	25/2$^-$		
537.9 *3*	112 *4*	1797.8	25/2$^-$	1259.9	21/2$^-$	E2	Mult.: A_2=+0.27 *3*; DCO(ΔJ=2)=0.95 *7*; DCO(ΔJ=1)=0.86 *22*.
541.0 *3*	10.6 *18*	2123.7	25/2$^-$	1582.7	21/2$^-$		
541.6 *3*	7.1 *9*	2590.8	(23/2$^-$)	2049.2	(19/2$^-$)		
548.0 *3*		1342.2	(19/2$^-$)	794.2	17/2$^-$		E_γ: From adopted gammas.
567.1 *3*	50.0 *21*	2128.0	27/2$^+$	1560.8	23/2$^+$		
570.4 *3*	86 *3*	2090.8	27/2$^-$	1520.4	23/2$^-$	E2	Mult.: DCO(ΔJ=2)=1.02 *7*.
570.5 *3*	10.5 *16*	2416.3	27/2$^-$	1845.7	23/2$^-$		
572.3 *3*	26 *3*	1887.3	27/2$^+$	1315.0	23/2$^+$		
575.0 *3*	46.7 *21*	2377.5	29/2$^+$	1802.5	25/2$^+$	E2	Mult.: DCO(ΔJ=2)=0.9 *3*; DCO(ΔJ=1)=0.73 *16*.
586.7 *3*	27.7 *17*	2554.2	31/2$^-$	1967.5	27/2$^-$	E2	Mult.: DCO(ΔJ=1)=0.72 *17*.
594.4 *3*	4.0 *7*	3133.5	(29/2$^-$)	2539.1	(25/2$^-$)		
600.5 *3*	13.7 *17*	2724.2	29/2$^-$	2123.7	25/2$^-$		
600.9 *3*	71 *3*	2398.7	29/2$^-$	1797.8	25/2$^-$	E2	Mult.: DCO(ΔJ=2)=1.17 *10*.
606.3 *3*	44 *3*	2198.7	29/2$^+$	1592.3	25/2$^+$		
623.1 *3*	19.7 *16*	2335.4	(25/2$^-$)	1712.7	25/2$^-$		
628.9 *3*	40.0 *19*	2719.7	31/2$^-$	2090.8	27/2$^-$	E2	Mult.: DCO(ΔJ=2)=1.41 *16*.
630.5 *3*	5.7 *13*	3047.1	(31/2$^-$)	2416.3	27/2$^-$		

Continued on next page (footnotes at end of table)

^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)

γ(^{177}Hf) (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
632.6 *3*	25.2 *15*	2881.5	33/2$^-$	2248.9	29/2$^-$	E2	Mult.: DCO(ΔJ=1)=0.77 *17*.
637.8 *3*	30.1 *22*	2525.1	31/2$^+$	1887.3	27/2$^+$		
637.8 *3*	20.9 *13*	3015.3	33/2$^+$	2377.5	29/2$^+$	E2	Mult.: DCO(ΔJ=2)=1.3 *3*; DCO(ΔJ=1)=1.1 *4*.
647.1 *3*	17.7 *15*	2614.9	(27/2$^-$)	1967.5	27/2$^-$		
654.6 *3*	14.6 *12*	2782.6	31/2$^+$	2128.0	27/2$^+$	E2	Mult.: DCO(ΔJ=2)=0.95 *17*.
654.6 *3*	22.7 *14*	3053.3	33/2$^-$	2398.7	29/2$^-$	E2	Mult.: DCO(ΔJ=2)=0.71 *20*; DCO(ΔJ=1)=0.9 *4*.
659.6 *3*	7.7 *11*	2908.5	(29/2$^-$)	2248.9	29/2$^-$		
662.9 *3*	9.8 *10*	3217.1	(31/2$^-$)	2554.2	31/2$^-$		
666.2 *3*	16.9 *15*	2865.0	33/2$^+$	2198.7	29/2$^+$	E2	Mult.: DCO(ΔJ=1)=1.36 *42*.
674.2 *3*	5.4 *12*	2872.9	(29/2$^+$)	2198.7	29/2$^+$		
674.2 *3*	14.9 *11*	3228.4	35/2$^-$	2554.2	31/2$^-$	E2	Mult.: DCO(ΔJ=1)=0.70 *14*.
678.8 *3*	13.5 *11*	3398.5	35/2$^-$	2719.7	31/2$^-$	E2	Mult.: DCO(ΔJ=2)=1.04 *19*.
687.6 *3*	4.7 *8*	3702.9	37/2$^+$	3015.3	33/2$^+$	E2	Mult.: DCO(ΔJ=2)=1.2 *4*.
691.8 *3*	9.4 *12*	3216.9	35/2$^+$	2525.1	31/2$^+$	E2	Mult.: DCO(ΔJ=1)=0.77 *21*.
696.0 *3*	10.8 *13*	2409.1	(27/2$^-$)	1712.7	25/2$^-$		
700.0 *3*	8.2 *9*	3753.3	37/2$^-$	3053.3	33/2$^-$	E2	Mult.: DCO(ΔJ=2)=0.77 *23*.
709.6# *3*	<2	3581.6	(33/2$^+$)	2872.9	(29/2$^+$)		
711.2 *3*	9.1 *10*	3592.9	37/2$^-$	2881.5	33/2$^-$	E2	Mult.: DCO(ΔJ=1)=1.2 *3*.
713.6 *3*	4.9 *10*	3578.6	37/2$^+$	2865.0	33/2$^+$		
722.2 *3*	2.0 *7*	4120.7	39/2$^-$	3398.5	35/2$^-$		
730.7# *3*	4.2 *9*	3948.0	39/2$^+$	3216.9	35/2$^+$		
732 *1*		2699.7	(29/2$^-$)	1967.5	27/2$^-$		
734.7 *3*	2.2 *8*	3517.3	35/2$^+$	2782.6	31/2$^+$	E2	Mult.: DCO(ΔJ=2)=1.1 *5*.
734.9 *3*	8.6 *16*	3839.7	43/2$^+$	3104.8	39/2$^+$		
744.1 *3*	0.8 *6*	4497.4	41/2$^-$	3753.3	37/2$^-$		
753.4# *3*	<1.0	3685.4	(37/2$^-$)	2935.6	(33/2$^-$)	[E2]	
766.5 *3*	8.9 *13*	4231.0	45/2$^+$	3464.6	41/2$^+$		
799.6 *3*	5.3 *10*	4639.4	(47/2$^+$)	3839.7	43/2$^+$		
823.0 *3*	11 *6*	3561.8	41/2$^-$	2739.1	37/2$^-$		
833.1 *3*	3.3 *10*	5063.7	49/2$^+$	4231.0	45/2$^+$		
860.5 *3*	8.4 *20*	4001.4	43/2$^-$	3140.7	39/2$^-$		
897.1 *3*	0.4 *4*	4459.1	45/2$^-$	3561.8	41/2$^-$		
985.6 *3*	13.9 *19*	2872.9	(29/2$^+$)	1887.3	27/2$^+$		

† From 1998Mu14. ΔEγ were estimated by the evaluator.

‡ From 1998Mu14, unless otherwise stated. The assignment is based on the measured angular distributions and DCO ratios, the apparent band structures with both cascade (ΔJ) and crossover (ΔJ=2) transitions, and the complex γ-ray decay pattern. When gated on ΔJ=1 orΔJ=2 transition the DCO ratios is labeled as DCO(ΔJ=1) or DCO(ΔJ=2), respectively.

Placement of transition in the level scheme is uncertain.

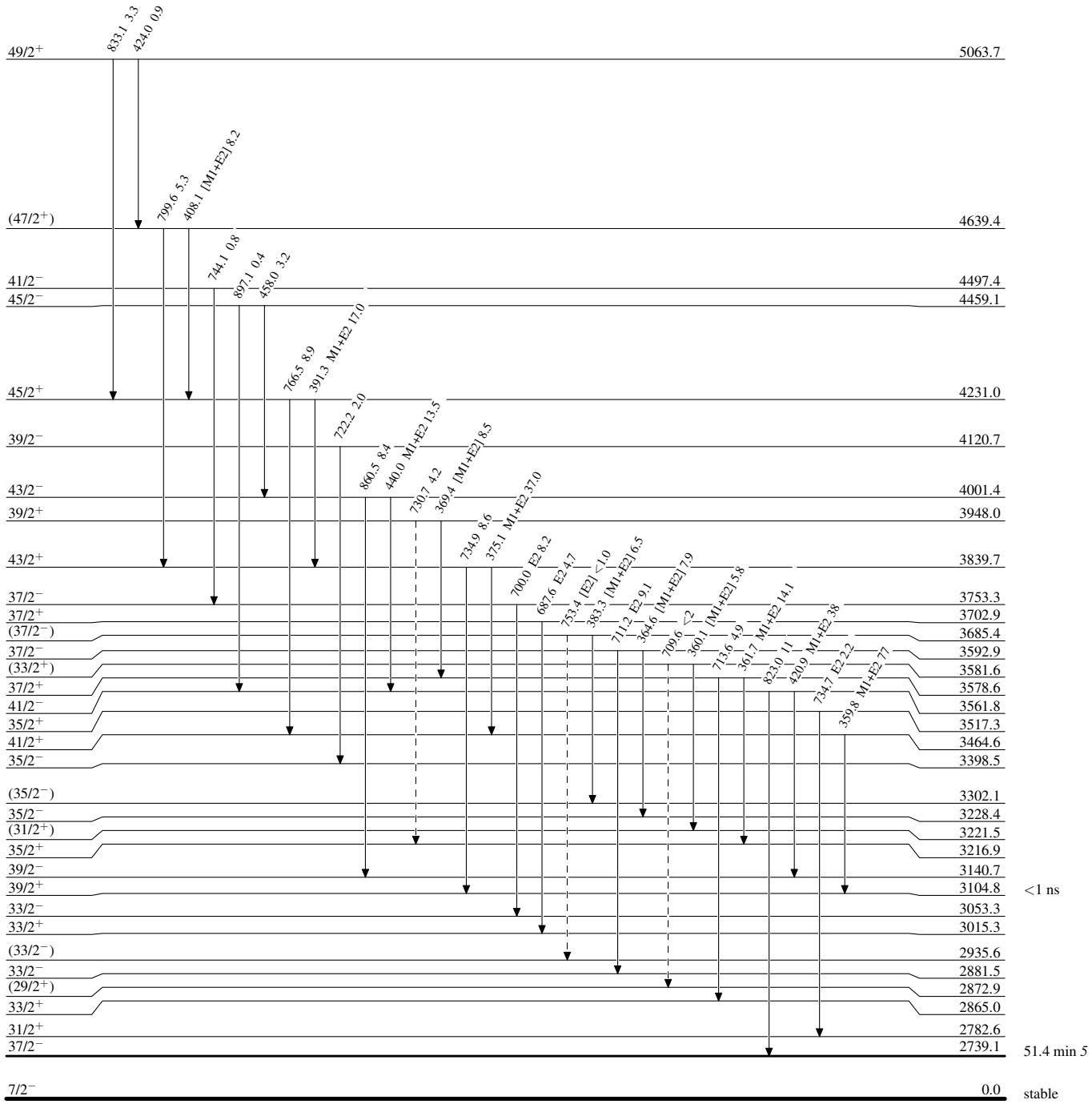
^{176}Yb(^{9}Be,xnγ) 1998Mu14

Level Scheme

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)



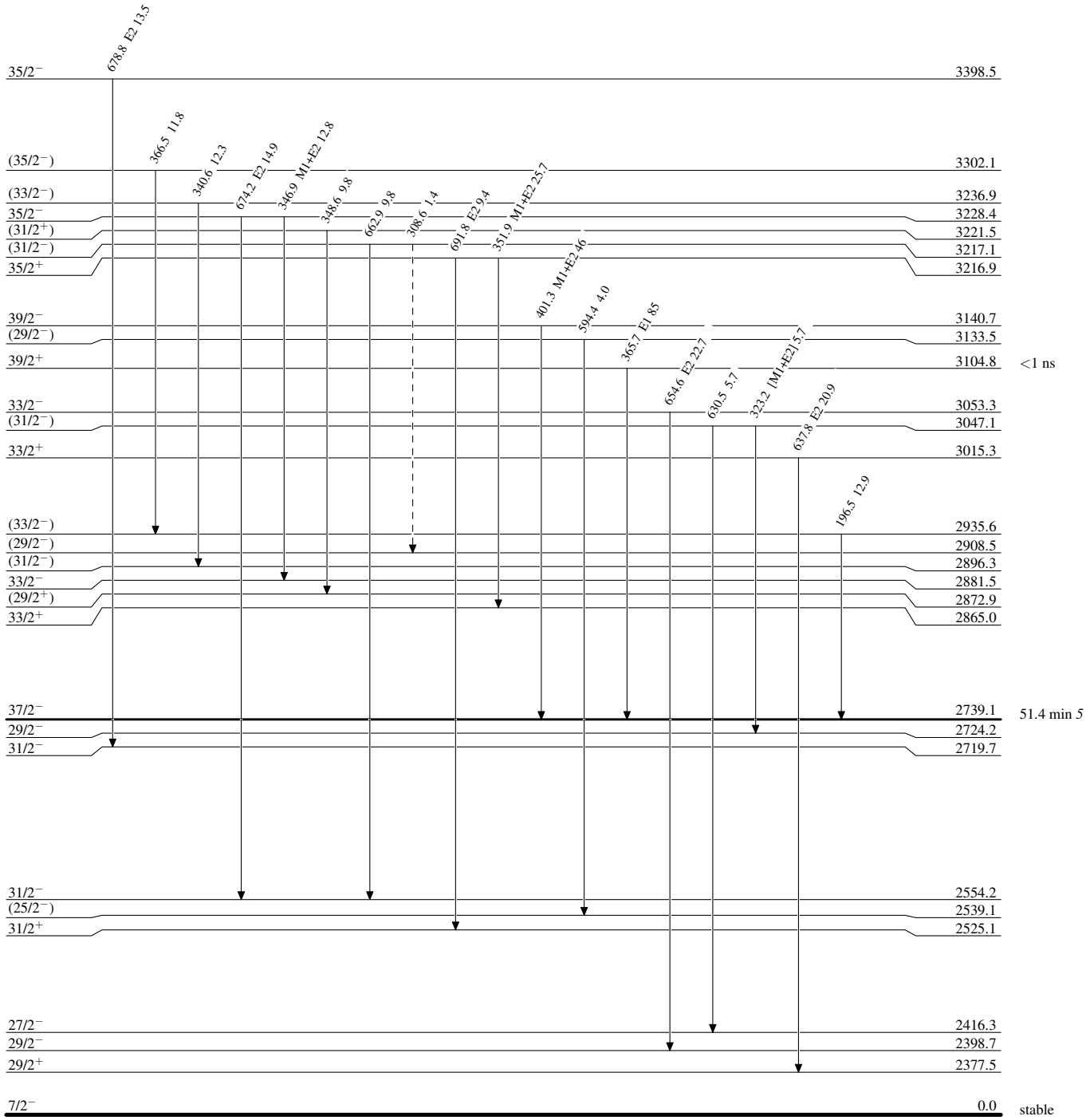
$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14

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)

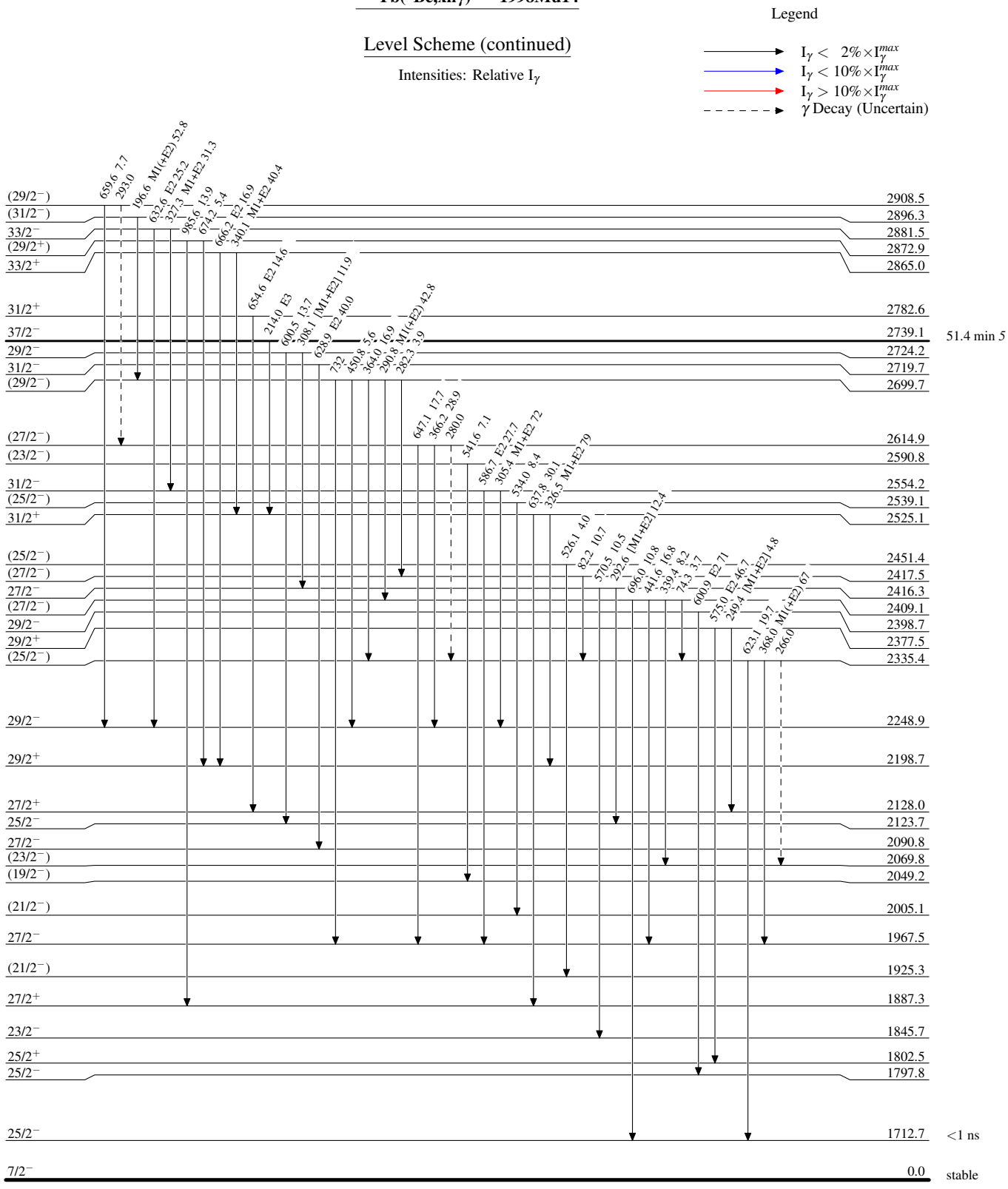


$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14

Level Scheme (continued)

Intensities: Relative I_γ

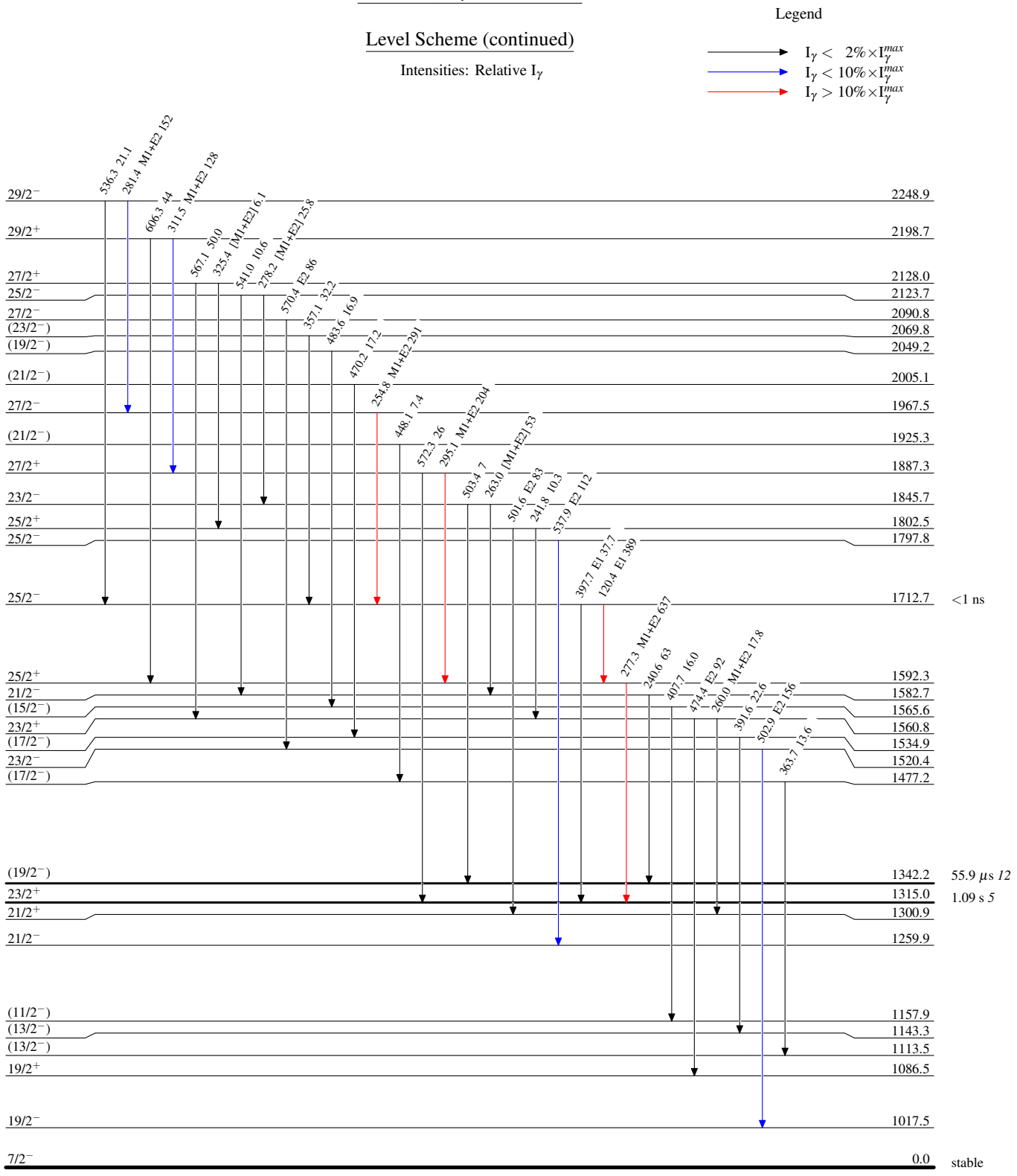


$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14

Level Scheme (continued)

Intensities: Relative I_γ



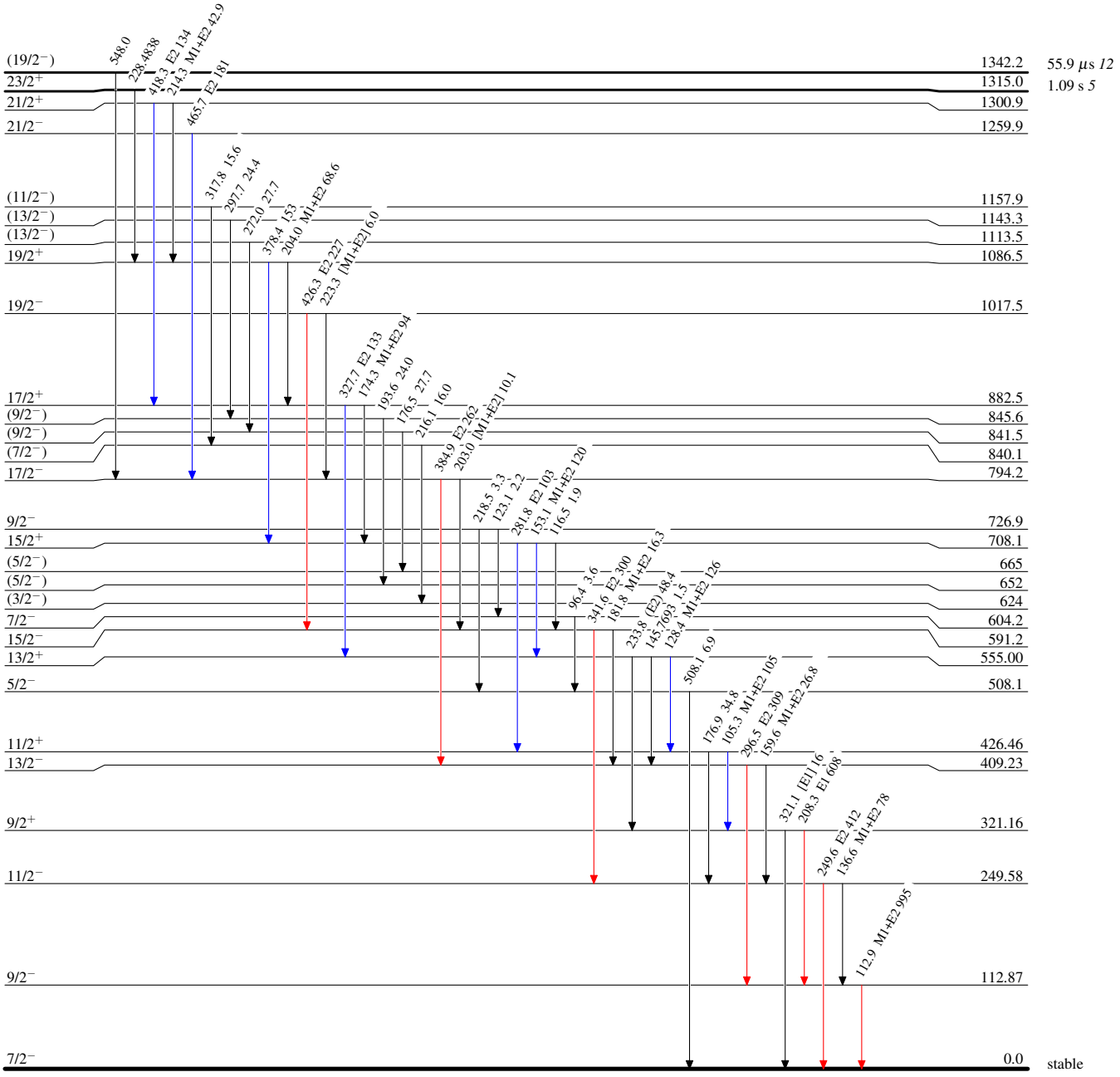
$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14

Level Scheme (continued)

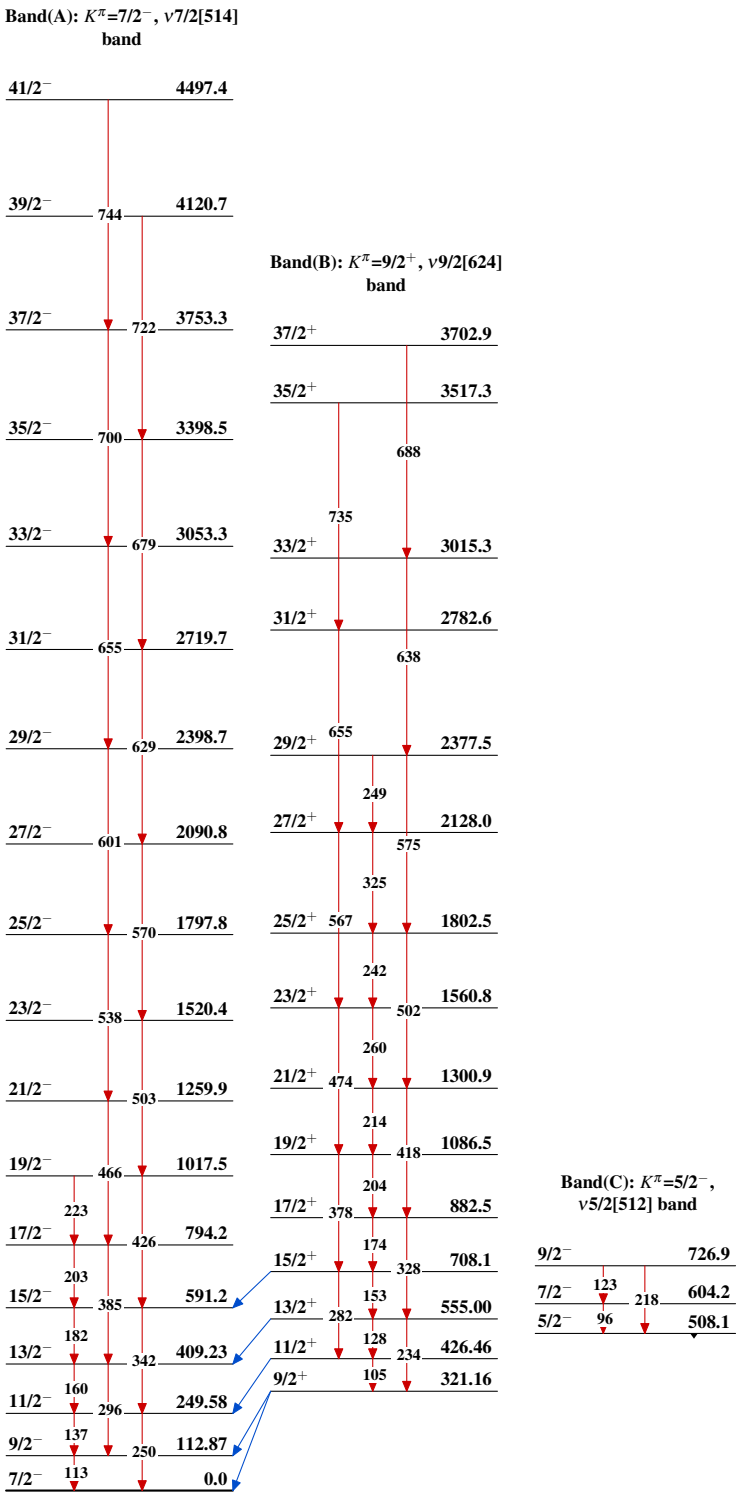
Intensities: Relative I_γ

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



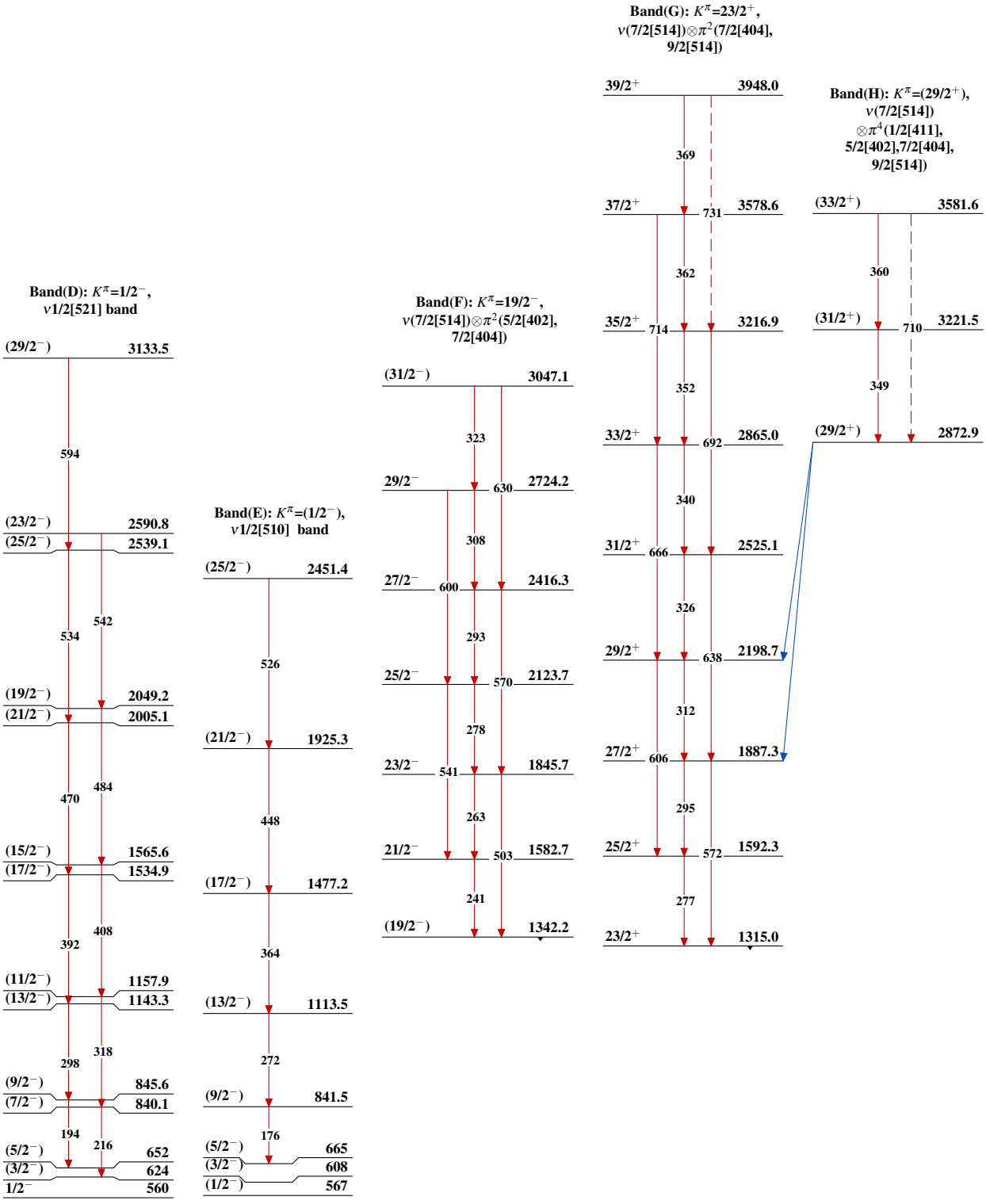
$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14



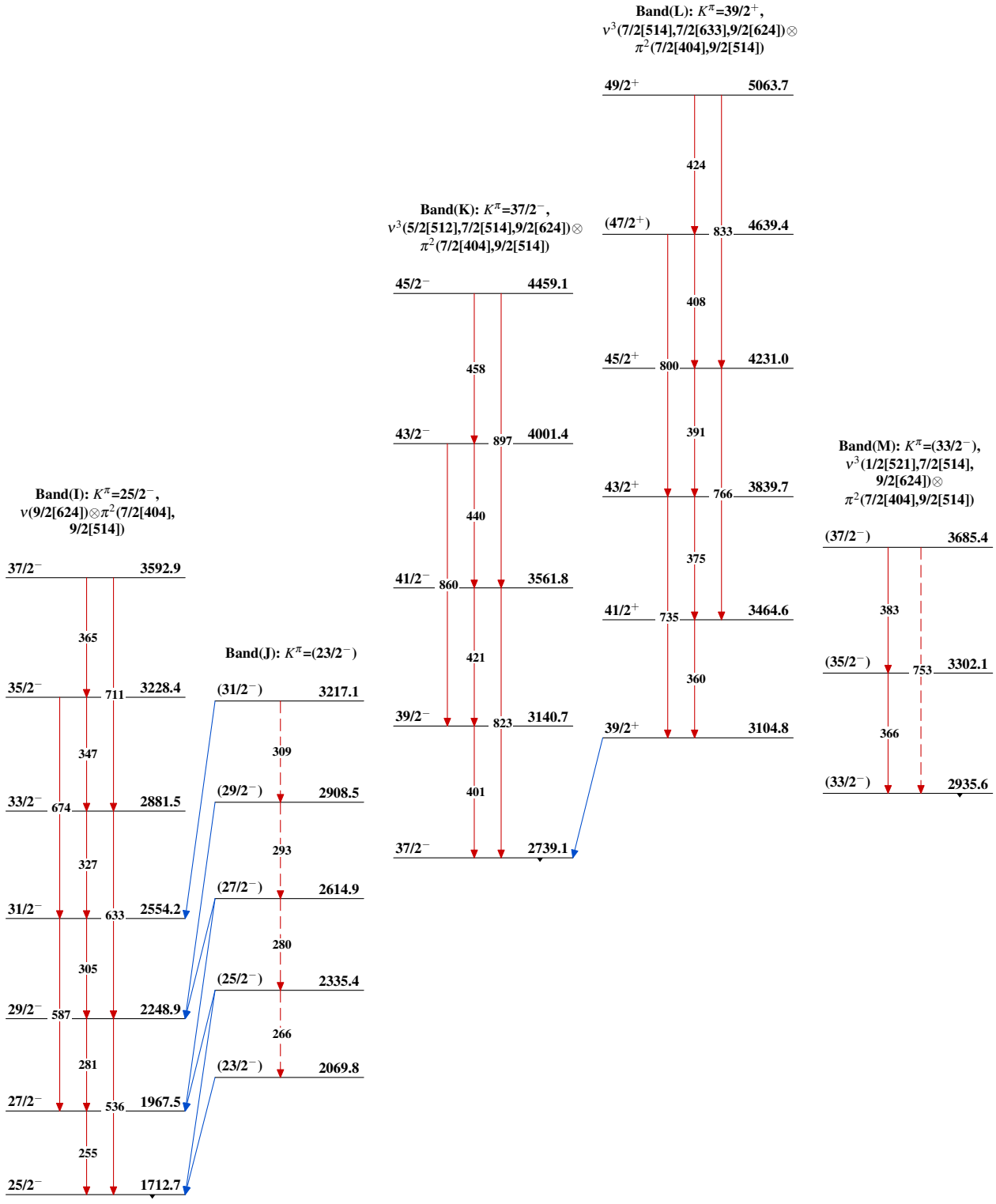
$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)



$^{177}_{72}Hf_{105}$

^{176}Yb(^{9}Be,xnγ) 1998Mu14 (continued)



$^{177}_{72}Hf_{105}$