^{178}Re ε decay 2001Ki10,1970Go20

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Achterberg, O. A. Capurro, G. V. Marti	NDS 110, 1473 (2009)	31-May-2008

Parent: ^{178}Re: E=0; J^π=(3$^+$); $T_{1/2}$=13.2 min *2*; Q(ε)=4.76×10^3 *3*; %ε+%$β^+$ decay=100.0

^{178}Re-$T_{1/2}$ from 2003Au02, Q($β^+$) from 2003Au03.

2001Ki10: ^{178}Re isotope formed in the ^{173}Yb(^{11}B,6n) reaction at E=73 MeV, and also obtained from the decay chain of ^{178}Ir isotope formed in the ^{164}Er(^{19}F,5n) reaction at E=110 MeV. Measured Eγ, Iγ, γγ, γγ(t), γγ(θ), ce using the CAESAR array consisting of six Compton-suppressed Ge detectors, and a superconducting solenoid spectrometer for electrons.

1970Go20: Sources of ^{178}Re produced by the ^{181}Ta(^{3}He,xn) and W(p,xn) reactions at E=72 and 54 MeV, respectively. Measured Eγ, Iγ, γγ coin, βγ coin, E(ce), Ice. Detectors: Ge(Li), scin, Si(Li).

^{178}W Levels

E(level)[†]	J^π	Comments
0.0[‡]	0$^+$	
106.03[‡] *11*	2$^+$	
343.01[‡] *12*	4$^+$	
694.58[‡] *15*	6$^+$	
1044.82[&] *17*	2$^-$	
1082.62[@] *14*	2$^+$	J^π: From E0 component in 976-keV γ-ray to J^π=2$^+$ 106-keV level.
1110.65[#] *13*	2$^+$	J^π: From E0 component in 1004.6 γ-ray to J^π=2$^+$ 106-keV level.
1120.54[&] *17*	3$^-$	
1225.70[&] *19*	4$^-$	
1236.70[#] *16*	3$^+$	
1275.39[@] *15*	4$^+$	J^π: From E0 component in 932-keV γ-ray to J^π=4$^+$ 342-keV level.
1294.57[a] *15*	0$^+$	J^π: From decay by E0 1294-keV γ-ray to J^π=0$^+$ g.s.
1345.01[&] *17*	5$^-$	
1380.41[#] *16*	4$^+$	J^π: From E0 component in 1037-keV γ-ray to J^π=4$^+$ 342-keV level.
1417.79[a] *14*	2$^+$	J^π: From E0 component in 1311-keV γ-ray to J^π=2$^+$ 106-keV level.
1449.48 *14*	2$^+$	
1545.8 *3*		
1556.28[@] *20*	6$^+$	
1572.75[#] *19*	5$^+$	
1598.02[a] *18*	4$^+$	J^π: From E0 component in 1255-keV γ-ray to J^π=4$^+$ 342-keV level.
1641.68 *19*		
1703.94 *16*	4$^+$	
1718.27 *15*	4$^+$	
1728.6 *3*		
1764.4 *3*		
1864.2 *4*	(4$^+$)	
1939.41 *24*		
1962.9 *3*		
1997.43 *18*		
2121.32 *24*		
3301.3 *4*		
3369.1 *3*	(2$^+$)	
3383.4 *5*		
3499.5 *4*		
3505.9 *5*		
3512.1 *4*		
3515.2 *5*	(2$^+$)	
3551.2 *4*		

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^{178}Re ε decay 2001Ki10,1970Go20 (continued)

^{178}W Levels (continued)

E(level)†	E(level)†	E(level)†
3580.4 *5*	3595.0 *5*	3706.5 *5*
3585.7 *5*	3634.6 *5*	3807.3 *4*
		3810.9 *5*

† From least-squares fit to Eγ′s.
‡ Band(A): g.s. band.
# Band(B): γ band.
@ Band(C): β band.
& Band(D): $K^{\pi}=2^{-}$ band.
a Band(E): $K^{\pi}=0^{+}$ band.

ε,β^+ radiations

I(ε+β^+) deduced by the evaluators from the total transition intensity balances at each level, using the intensity data from 2001Ki10, and those from 1970Go20, where no data from 2001Ki10 were available. No levels have been established in the region 2.1 to 3.3 MeV by these β decay studies. This suggests that the intensity balances, and consequent β feedings and deduced log *ft* values, should be regarded with caution, as there may be unobserved γ-ray intensity leading to changes in the β feedings listed below. However these unobserved intensities are assumed to be rather small, as all known levels in the mentioned gap have J values of 8 or higher (see Adopted Levels dataset), and therefore any β feeding can be expected to be very small.

E(decay)	E(level)	Iβ+ †‡	Iε†‡	Log *ft*	I(ε+β+)‡	Comments
(9.5×10^2 *3*)	3810.9		0.37 *12*	6.52 *15*	0.37 *12*	εK=0.8087 *7*; εL=0.1456 *5*; εM+=0.04563 *19*
(9.5×10^2 *3*)	3807.3		0.37 *12*	6.52 *15*	0.37 *12*	εK=0.8088 *7*; εL=0.1456 *5*; εM+=0.04561 *19*
(1.05×10^3 *3*)	3706.5		0.34 *8*	6.65 *11*	0.34 *8*	εK=0.8108 *6*; εL=0.1441 *4*; εM+=0.04507 *15*
(1.13×10^3 *3*)	3634.6		0.71 *15*	6.39 *10*	0.71 *15*	εK=0.8120 *5*; εL=0.1432 *4*; εM+=0.04474 *13*
(1.17×10^3 *3*)	3595.0		0.47 *15*	6.60 *14*	0.47 *15*	εK=0.8126 *5*; εL=0.1428 *4*; εM+=0.04458 *12*
(1.17×10^3 *3*)	3585.7		0.36 *12*	6.72 *15*	0.36 *12*	εK=0.8127 *5*; εL=0.1427 *4*; εM+=0.04455 *12*
(1.18×10^3 *3*)	3580.4		0.39 *10*	6.69 *12*	0.39 *10*	εK=0.8128 *5*; εL=0.1427 *4*; εM+=0.04453 *12*
(1.21×10^3 *3*)	3551.2		1.9 *2*	6.03 *6*	1.9 *2*	εK=0.8132 *4*; εL=0.1424 *3*; εM+=0.04442 *11*
(1.24×10^3 *3*)	3515.2		0.49 *15*	6.64 *14*	0.49 *15*	εK=0.8137 *4*; εL=0.1420 *3*; εM+=0.04429 *11*
(1.25×10^3 *3*)	3512.1		1.56 *25*	6.14 *8*	1.56 *25*	εK=0.8137 *4*; εL=0.1420 *3*; εM+=0.04428 *11*
(1.25×10^3 *3*)	3505.9		0.36 *10*	6.78 *13*	0.36 *10*	εK=0.8138 *4*; εL=0.1419 *3*; εM+=0.04426 *11*
(1.26×10^3 *3*)	3499.5		0.75 *19*	6.47 *12*	0.75 *19*	εK=0.8138 *4*; εL=0.1419 *3*; εM+=0.04424 *11*
(1.38×10^3 *3*)	3383.4		0.50 *14*	6.73 *13*	0.50 *14*	εK=0.8149 *3*; εL=0.14091 *24*; εM+=0.04388 *9*
(1.39×10^3 *3*)	3369.1		1.4 *3*	6.29 *10*	1.4 *3*	εK=0.8150 *3*; εL=0.14080 *24*; εM+=0.04384 *9*
(1.46×10^3 *3*)	3301.3		1.1 *3*	6.44 *12*	1.1 *3*	εK=0.8154 *2*; εL=0.14028 *23*; εM+=0.04365 *9*
(2.64×10^3 *3*)	2121.32	0.055 *11*	0.63 *12*	7.21 *9*	0.68 *13*	av Eβ=735 *14*; εK=0.756 *4*; εL=0.1253 *7*; εM+=0.03877 *21*
(2.76×10^3 *3*)	1997.43	0.08 *1*	0.7 *1*	7.19 *6*	0.8 *1*	av Eβ=790 *14*; εK=0.740 *4*; εL=0.1225 *8*; εM+=0.03789 *23*
(2.80×10^3 *3*)	1962.9	0.052 *10*	0.44 *8*	7.42 *8*	0.49 *9*	av Eβ=805 *14*; εK=0.735 *5*; εL=0.1217 *8*; εM+=0.03762 *24*
(2.82×10^3 *3*)	1939.41	0.024 *9*	0.20 *7*	7.78 *16*	0.22 *8*	av Eβ=816 *14*; εK=0.732 *5*; εL=0.1211 *8*; εM+=0.03744 *24*
(2.90×10^3 *3*)	1864.2	0.17 *6*	1.2 *4*	7.00 *16*	1.4 *5*	av Eβ=849 *14*; εK=0.721 *5*; εL=0.1192 *8*; εM+=0.03685 *25*
(3.00×10^3 *3*)	1764.4	0.08 *3*	0.50 *16*	7.42 *15*	0.58 *19*	av Eβ=893 *14*; εK=0.706 *5*; εL=0.1165 *9*; εM+=0.0360 *3*
(3.03×10^3 *3*)	1728.6	0.083 *12*	0.48 *7*	7.45 *7*	0.56 *8*	av Eβ=909 *14*; εK=0.701 *5*; εL=0.1155 *9*; εM+=0.0357 *3*

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^{178}Re ε decay 2001Ki10,1970Go20 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ †‡	Iε†‡	Log *ft*	I(ε+β+)‡	Comments
(3.04×10^3 *3*)	1718.27	0.35 *6*	2.0 *3*	6.84 *8*	2.3 *4*	av Eβ=914 *14*; εK=0.699 *5*; εL=0.1152 *9*; εM+=0.0356 *3*
(3.06×10^3 *3*)	1703.94	0.31 *6*	1.7 *3*	6.91 *9*	2.0 *4*	av Eβ=920 *14*; εK=0.697 *5*; εL=0.1148 *9*; εM+=0.0355 *3*
(3.12×10^3 *3*)	1641.68	0.18 *3*	0.92 *17*	7.19 *8*	1.1 *2*	av Eβ=948 *14*; εK=0.687 *5*; εL=0.1131 *9*; εM+=0.0349 *3*
(3.16×10^3 *3*)	1598.02	0.54 *7*	2.6 *3*	6.76 *6*	3.1 *4*	av Eβ=968 *14*; εK=0.679 *6*; εL=0.1118 *9*; εM+=0.0346 *3*
(3.19×10^3 *3*)	1572.75	0.14 *4*	0.7 *2*	7.36 *11*	0.8 *2*	av Eβ=979 *14*; εK=0.675 *6*; εL=0.1111 *9*; εM+=0.0343 *3*
(3.20×10^3 *3*)	1556.28	0.09 *2*	0.4 *1*	7.57 *9*	0.5 *1*	av Eβ=986 *14*; εK=0.672 *6*; εL=0.1106 *9*; εM+=0.0342 *3*
(3.21×10^3 *3*)	1545.8	0.28 *7*	1.2 *3*	7.10 *12*	1.5 *4*	av Eβ=991 *14*; εK=0.670 *6*; εL=0.1103 *9*; εM+=0.0341 *3*
(3.31×10^3 *3*)	1449.48	0.68 *11*	2.6 *4*	6.79 *7*	3.3 *5*	av Eβ=1034 *14*; εK=0.653 *6*; εL=0.1074 *10*; εM+=0.0332 *3*
(3.34×10^3 *3*)	1417.79	0.43 *7*	1.6 *2*	7.02 *7*	2.0 *3*	av Eβ=1048 *14*; εK=0.648 *6*; εL=0.1064 *10*; εM+=0.0329 *3*
(3.38×10^3 *3*)	1380.41	0.58 *9*	2.0 *3*	6.92 *7*	2.6 *4*	av Eβ=1065 *14*; εK=0.641 *6*; εL=0.1052 *10*; εM+=0.0325 *3*
(3.41×10^3 *3*)	1345.01	0.44 *7*	1.5 *2*	7.07 *7*	1.9 *3*	av Eβ=1081 *14*; εK=0.634 *6*; εL=0.1041 *10*; εM+=0.0322 *3*
(3.47×10^3 *3*)	1294.57	0.07 *2*	0.2 *1*	7.89 *15*	0.3 *1*	av Eβ=1104 *14*; εK=0.625 *6*; εL=0.1026 *10*; εM+=0.0317 *3*
(3.48×10^3 *3*)	1275.39	0.71 *12*	2.2 *4*	6.92 *8*	2.9 *5*	av Eβ=1112 *14*; εK=0.622 *6*; εL=0.1020 *10*; εM+=0.0315 *3*
(3.52×10^3 *3*)	1236.70	0.43 *10*	1.3 *3*	7.16 *11*	1.7 *4*	av Eβ=1130 *14*; εK=0.614 *6*; εL=0.1007 *10*; εM+=0.0311 *3*
(3.53×10^3 *3*)	1225.70	0.2 *1*	0.5 *2*	7.55 *19*	0.7 *3*	av Eβ=1135 *14*; εK=0.612 *6*; εL=0.1004 *10*; εM+=0.0310 *3*
(3.64×10^3 *3*)	1120.54	1.3 *1*	3.4 *4*	6.77 *5*	4.7 *5*	av Eβ=1182 *14*; εK=0.592 *6*; εL=0.0970 *10*; εM+=0.0300 *3*
(3.65×10^3 *3*)	1110.65	0.45 *6*	1.15 *14*	7.24 *6*	1.60 *20*	av Eβ=1187 *14*; εK=0.590 *6*; εL=0.0967 *10*; εM+=0.0299 *3*
(3.68×10^3 *3*)	1082.62	0.38 *3*	0.92 *7*	7.34 *4*	1.3 *1*	av Eβ=1199 *14*; εK=0.585 *6*; εL=0.0958 *10*; εM+=0.0296 *3*
(3.72×10^3 *3*)	1044.82	1.7 *2*	4.1 *6*	6.70 *7*	5.8 *8*	av Eβ=1216 *14*; εK=0.578 *6*; εL=0.0946 *10*; εM+=0.0292 *3*
(4.07×10^3 *3*)	694.58	0.9 *9*	1.6 *16*	7.2 *5*	2.5 *25*	av Eβ=1375 *14*; εK=0.511 *6*; εL=0.0835 *10*; εM+=0.0258 *3*
(4.42×10^3 *3*)	343.01	10 *2*	12 *2*	6.39 *8*	22 *4*	av Eβ=1535 *14*; εK=0.447 *6*; εL=0.0728 *9*; εM+=0.0225 *3* Eβ=3.30 *18* (measured in coin with 237.3γ) (1970Go20). Other: 3.1 (1957Ha04).
(4.65×10^3 *3*)	106.03	10 *5*	9 *4*	6.54 *21*	19 *9*	av Eβ=1644 *14*; εK=0.407 *5*; εL=0.0661 *9*; εM+=0.0204 *3*

† Values obtained using theoretical ε/β+ ratios.
‡ Absolute intensity per 100 decays.

$\gamma(^{178}W)$

Iγ normalization: From decay scheme assuming ΣI(γ+ce)(g.s.)=100%.

Experimental restrictions in 2001Ki10 did not allow detecting transitions higher than Eγ≈1.9 MeV. Some observed, but unplaced, transitions of 1970Go20 have been placed by 2001Ki10 in the level scheme. All experimental conversion and γ-γ directional correlation coefficients are from 2001Ki10, except when otherwise noted. Quoted relative γ-ray intensities from 2001Ki10 have been normalized to the Iγ(237) value from 1970Go20.

E_γ[†]	I_γ[@ c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[#]	α[d]	Comments
75.7[&] 2	0.11[&] 6	1120.54	3−	1044.82	2−	M1(+E2)		11.4 10	
106.0 2	24.5 13	106.03	2+	0.0	0+	E2		3.10	Mult.: α(L)exp=2.1 4, α(M)exp+α(N)exp=0.54 11 (1970Go20).
180.9 2	0.59 7	1225.70	4−	1044.82	2−	(E2)		0.434	
192.5[&] 2	0.13[&] 3	1275.39	4+	1082.62	2+	E2		0.351	
224.5[&] 2	0.71[&] 13	1345.01	5−	1120.54	3−	(E2)		0.210	
237.0 2	46.5 13	343.01	4+	106.03	2+	E2		0.176	The intensity of this transition has been used by the evaluators for normalization of the 2001Ki10 Iγ values to those of 1970Go20. Mult.: A_2=+0.08 2, A_4=+0.02 2 (2001Ki10). α(K)exp=0.12 (1968Be53); α(K)theo=0.1064. Additional information 1.
280.7[&] 2	0.36[&] 6	1556.28	6+	1275.39	4+	E2		0.1039	
335.3[&] 2	0.12[&] 3	1417.79	2+	1082.62	2+	(M1,E2)		0.11 5	
351.7 2	5.8 3	694.58	6+	343.01	4+	E2		0.0535	Mult.: from adopted gammas; GS rotational band member.
481.5[&] 2	0.93[&] 14	1718.27	4+	1236.70	3+	(M1,E2)		0.043 20	
501.0[b] 2	1.62 9	1545.8		1044.82	2−				
521.2[b] 2	0.88 19	1641.68		1120.54	3−				
538.7[b] 2	0.61 7	1764.4		1225.70	4−				
580.8[&] 2	0.56[&] 10	1275.39	4+	694.58	6+	E2		0.01460	
607.7 2	0.44 9	1718.27	4+	1110.65	2+	(E2)		0.01314	
635.7 2	0.60 13	1718.27	4+	1082.62	2+	(E2)		0.01184	
650.4[b] 2	0.70 4	1345.01	5−	694.58	6+	(E1)		0.00409	
683.8 2	0.59 7	1728.6		1044.82	2−				Seen, together with the 685.8 keV γ ray, as a single peak at 684.1 keV in 1970Go20.
685.8 2	0.35 9	1380.41	4+	694.58	6+	(E2)		0.00998	See comment for the 683.8 keV γ ray.
739.7 2	0.24 6	1082.62	2+	343.01	4+	E2		0.00845	Mult.: Transition to J^π=4+ 343-keV level.
767.8 2	0.40 9	1110.65	2+	343.01	4+	E2		0.00780	Mult.: Transition to J^π=4+ 343-keV level.
777.6 2	6.0 3	1120.54	3−	343.01	4+	E1(+M2)	+0.02 2	0.00289 7	Mult.: α(K)exp<0.0055 (1970Go20); a(K)exp=0.0068 15, A_2=−0.15 6, A_4=−0.3 6. Additional information 2.
842.4[&] 2	0.51[&] 14	1962.9		1120.54	3−				
861.9[&] 2	0.12[&] 3	1556.28	6+	694.58	6+	(M1,E2)		0.010 4	
878.2[&] 2	0.22[&] 4	1572.75	5+	694.58	6+	(M1,E2)		0.010 4	

^{178}Re ε decay 2001Ki10,1970Go20 (continued)

γ(^{178}W) (continued)

E_γ [†]	I_γ [@ c]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	δ [#]	α [d]	Comments
882.7 *2*	0.78 *7*	1225.70	4^-	343.01	4^+	E1		0.00225	Mult.: α(K)exp < 0.002.
893.6 [&] *2*	0.88 [&] *9*	1236.70	3^+	343.01	4^+	E2		0.00566	Mult.: α(K)exp=0.0048 *6*.
932.4 *2*	2.52 *14*	1275.39	4^+	343.01	4^+	E0+M1+E2	−6.6 *+15−30*	0.00533 *12*	Mult.: α(K)exp=0.061 *10* (1970Go20). α(K)exp=0.0176 *11*, α(L)exp=0.0027 *2*, α(M)exp=0.0014 *2*, A_2=−0.07 *5*, A_4=+0.14 *6*. q^2(E0/E2)=3.2 *3*; X(E0/E2)=0.140 *13* (2001Ki10).
938.8 *2*	10.4 *3*	1044.82	2^-	106.03	2^+	E1(+M2)		0.015 *14*	Mult.: α(K)exp=0.0056 *19* (1970Go20). α(K)exp=0.00152 *11*, α(L)exp=0.00016 *4*, A_2=+0.17 *3* (2001Ki10).
[x]962.8 [a] *5*	0.40 [a] *15*								
976.5 *2*	2.32 *13*	1082.62	2^+	106.03	2^+	E0+M1+E2	−12.3 *+28−64*	0.00476 *8*	Mult.: α(K)exp=0.024 *6* (1970Go20). A_2=0.00 *6*, A_4=+0.22 *7*. α(K)exp=0.0076 *5*, α(L)exp=0.00110 *14*, α(M)exp=0.00035 *5*; q^2(E0/E2)=0.94 *13*; X(E0/E2)=0.045 *6* (2001Ki10).
1002.0 [&] *2*	0.39 [&] *7*	1345.01	5^-	343.01	4^+	E1		1.78×10^{-3}	Mult.: α(K)exp=0.0025 *5*.
1004.6 *2*	0.41 *9*	1110.65	2^+	106.03	2^+	E0+M1+E2	>+2	0.0050 *6*	Mult.: α(K)exp=0.0090 *8*, α(L)exp=0.0010 *2*. q^2(E0/E2)=1.5 *3*; X(E0/E2)=0.076 *+14−13* (2001Ki10).
1009.4 [&] *2*	0.34 [&] *4*	1703.94	4^+	694.58	6^+	(E2)		0.00442	Mult.: α(K)exp=0.0042 *9*.
1037.4 *2*	1.63 *11*	1380.41	4^+	343.01	4^+	E0+M1+E2	−1.9 *+7−12*	0.0052 *9*	Mult.: α(K)exp=0.0051 *5*, α(L)exp=0.00063 *12*; A_2=+0.14 *10*, A_4=+0.35 *11*. q^2(E0/E2)=0.7 *5*; X(E0/E2)=0.014 *18* (2001Ki10). Additional information 4.
1106.6 *2*	0.88 *12*	1449.48	2^+	343.01	4^+	E2		0.00369	Mult.: α(K)exp=0.0030 *4*.
1110.6 *2*	1.29 *7*	1110.65	2^+	0.0	0^+	E2		0.00366	Mult.: α(K)exp=0.00276 *17*.
1130.7 [b] *2*	1.81 *13*	1236.70	3^+	106.03	2^+	E2+M1	+6.9 *+77−24*	0.00361 *11*	Mult.: α(K)exp=0.00282 *18*; A_2=−0.07 *6*, A_4=−0.21 *8*.
1169.4 *2*	0.107 *23*	1275.39	4^+	106.03	2^+	E2		0.00331	Additional information 3.
1169.5 [ea] *5*	0.8 [ea] *4*	1864.2	(4^+)	694.58	6^+	(E2)		0.00331	Transition doubly placed in 1970Go20, not placed here by 2001Ki10.
1188.7 [&] *2*	0.29 [&] *9*	1294.57	0^+	106.03	2^+	(E2)		0.00321	
1229.7 *2*	0.63 *7*	1572.75	5^+	343.01	4^+	(M1,E2)		0.0044 *14*	
1255.1 *2*	2.19 *19*	1598.02	4^+	343.01	4^+	E0+M1+E2		0.0042 *14*	Mult.: α(K)exp=0.0101 *8*, α(M)exp=0.00059 *7*. q^2(E0/E2)=3.7 *+4−9*; X(E0/E2)=0.30 *+3−7* (2001Ki10).
1274.4 *2*	0.75 *10*	1380.41	4^+	106.03	2^+	E2		0.00282	Mult.: α(K)exp=0.0019 *2*.
[x]1289.0 [a] *10*	0.5 [a] *3*								
1294.4 [&] *2*	[&]	1294.57	0^+	0.0	0^+	E0			$I_{(\gamma+ce)}$: TI=0.024 *2*, deduced by evaluators from experimental values α_K/α_L=5.6 *8* and Ice(K)=0.044 *3* (2001Ki10).

$^{178}_{74}W_{104}$-5

^{178}Re ε decay 2001Ki10,1970Go20 (continued)

γ(^{178}W) (continued)

E_γ †	I_γ @ c	E_i(level)	J_i^π	E_f	J_f^π	Mult. ‡	α d	Comments
								q^2(E0/E2)=26 *2* and X(E0/E2)=1.73 *12* (2001Ki10).
1298.6 & *2*	0.25 & *7*	1641.68		343.01	4+			
1311.5 b *2*	1.40 *19*	1417.79	2+	106.03	2+	E0+M1+E2	0.0038 *12*	Mult.: α(K)exp=0.0149 *13*, α(L)exp=0.00255 *28*, α(M)exp=0.00092 *12*. q^2(E0/E2)=6.9 *+7−17*; X(E0/E2)=0.61 *+7−15*.
1343.3 *2*	0.83 *16*	1449.48	2+	106.03	2+	E2	0.00256	Mult.: α(K)exp=0.0018 *3*.
1361.0 *2*	0.75 *10*	1703.94	4+	343.01	4+	(M1)	0.00455	Mult.: α(K)exp=0.0041 *4*.
1375.2 & *2*	0.39 & *7*	1718.27	4+	343.01	4+	(M1,E2)	0.0035 *10*	
x1377.2 a *10*	0.4 a *2*							
1417.9 b *2*	0.59 *10*	1417.79	2+	0.0	0+	E2	0.00233	Mult.: α(K)exp=0.0016 *3*.
1449.5 *2*	1.68 *10*	1449.48	2+	0.0	0+	E2	0.00225	Mult.: α(K)exp=0.00172 *16*.
1491.9 *2*	1.40 *23*	1598.02	4+	106.03	2+	E2	0.00214	Mult.: α(K)exp=0.00166 *16*.
x1499.4 a *5*	0.6 a *2*							
1521.4 a *10*	0.4 a *2*	1864.2	(4+)	343.01	4+	(M1,E2)	0.0028 *8*	
x1580.0 a *10*	0.5 a *2*							
1596.4 & *2*	0.23 & *7*	1939.41		343.01	4+			
1597.8 *2*	1.03 *9*	1703.94	4+	106.03	2+	(E2)	0.00193	
x1608.5 a *4*	0.7 a *2*							
1654.1 & *2*	0.65 & *9*	1997.43		343.01	4+			
x1708.2 a *4*	0.3 a *1*							
x1744.6 a *5*	0.5 a *2*							
1758.2 a *6*	0.7 a *2*	1864.2	(4+)	106.03	2+	(E2)	1.70×10^{-3}	
1778.3 & *2*	0.66 & *13*	2121.32		343.01	4+			
x1795.6 a *7*	0.2 a *1*							
x1833.9 a *8*	0.7 a *2*							
x1836.0 a *15*	0.2 a *1*							
1891.7 & *2*	0.20 & *6*	1997.43		106.03	2+			
x1893.3 a *8*	0.5 a *2*							
x1924.7 a *8*	0.4 a *2*							
x2016.3 a *8*	0.3 a *1*							
2036.5 a *8*	0.65 a *21*	3634.6		1598.02	4+			
x2053.0 a *8*	0.4 a *1*							
x2133.1 a *8*	0.6 a *1*							
2247.8 a *8*	0.43 a *15*	3369.1	(2+)	1120.54	3−	(E1)	1.17×10^{-3}	
x2263.7 a *8*	0.20 a *7*							
2287.0 ea *6*	0.65 ea *21*	3369.1	(2+)	1082.62	2+	(M1,E2)	0.00160 *25*	
2287.0 ea *6*	0.65 ea *21*	3512.1		1225.70	4−			
x2306.6 a *8*	0.20 a *7*							
x2312.1 a *8*	0.4 a *1*							

$^{178}_{74}W_{104}$-6

^{178}Re ε decay 2001Ki10,1970Go20 (continued)

γ(^{178}W) (continued)

E_γ [†]	I_γ [@c]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [d]
2324.6 [ea] 8	0.43 [ea] 21	3369.1	(2+)	1044.82	2−	(E1)	1.20×10−3
2324.6 [ea] 8	0.43 [ea] 21	3551.2		1225.70	4−		
x2455.9 [a] 7	0.21 [a] 7						
2468.0 [a] 20	0.43 [a] 21	3551.2		1082.62	2+		
2957.6 [a] 5	1.9 [a] 4	3301.3		343.01	4+		
x2997.6 [a] 6	0.7 [a] 2						
3011.8 [a] 6	0.32 [a] 11	3706.5		694.58	6+		
3025.0 [a] 5	1.0 [a] 3	3369.1	(2+)	343.01	4+		
3112.3 [a] 5	0.65 [a] 21	3807.3		694.58	6+		
3116.3 [a] 5	0.65 [a] 21	3810.9		694.58	6+		
x3133.6 [a] 5	0.3 [a] 1						
3156.8 [a] 5	1.3 [a] 4	3499.5		343.01	4+		
x3164.0 [a] 6	0.5 [a] 2						
3168.6 [a] 5	1.9 [a] 4	3512.1		343.01	4+		
3172.2 [a] 6	0.7 [a] 3	3515.2	(2+)	343.01	4+	(E2)	1.33×10−3
x3182.0 [a] 6	0.27 [a] 8						
x3188.1 [a] 6	0.54 [a] 15						
3196.0 [a] 5	0.58 [a] 17	3301.3		106.03	2+		
3208.5 [a] 5	1.6 [a] 4	3551.2		343.01	4+		
x3217.2 [a] 6	0.27 [a] 8						
x3232.5 [a] 6	0.21 [a] 7						
3237.6 [a] 6	0.67 [a] 21	3580.4		343.01	4+		
3242.9 [a] 6	0.60 [a] 21	3585.7		343.01	4+		
x3247.5 [a] 6	0.18 [a] 7						
3251.6 [a] 5	0.9 [a] 3	3595.0		343.01	4+		
x3254.2 [a] 6	0.36 [a] 12						
x3257.5 [a] 6	0.36 [a] 12						
3263.6 [a] 6	0.9 [a] 3	3369.1	(2+)	106.03	2+		
3277.4 [a] 6	0.8 [a] 3	3383.4		106.03	2+		
3291.6 [a] 6	0.49 [a] 17	3634.6		343.01	4+		
3363.6 [a] 6	0.43 [a] 13	3706.5		343.01	4+		
3369.5 [a] 6	0.34 [a] 11	3369.1	(2+)	0.0	0+		
x3376.0 [a] 6	0.10 [a] 3						
3383.3 [a] 6	0.28 [a] 9	3383.4		0.0	0+		
3392.9 [a] 6	0.39 [a] 13	3499.5		106.03	2+		
3399.4 [a] 6	0.73 [a] 19	3505.9		106.03	2+		
3406.1 [a] 6	1.0 [a] 3	3512.1		106.03	2+		
3409.0 [a] 8	0.39 [a] 13	3515.2	(2+)	106.03	2+	(M1,E2)	0.00153 17
x3417.2 [a] 6	0.59 [a] 7						

$^{178}_{74}W_{104}$-7

^{178}Re ε decay 2001Ki10,1970Go20 (continued)

γ(^{178}W) (continued)

E_γ †	I_γ @ c	E_i(level)	E_f	J^π_f	E_γ †	I_γ @ c	E_i(level)	J^π_i	E_f	J^π_f
x3428.1 a 8	0.28 a 9				3489.9 a 8	0.17 a 4	3595.0		106.03	2+
x3431.4 a 6	0.62 a 9				3506.7 a 8	0.09 a 4	3505.9		0.0	0+
x3441.2 a 6	0.31 a 10				3512.0 a 8	0.21 a 6	3512.1		0.0	0+
3445.2 a 6	2.02 a 21	3551.2	106.03	2+	x3525.7 a 8	0.10 a 3				
3464.9 a 6	0.19 a 4	3807.3	343.01	4+	3528.7 a 8	0.45 a 15	3634.6		106.03	2+
3467.7 a 8	0.19 a 4	3810.9	343.01	4+	x3544.2 a 8	0.05 a 2				
3474.0 a 8	0.21 a 6	3580.4	106.03	2+	x3559.0 a 8	0.06 a 2				
3479.3 a 8	0.21 a 6	3585.7	106.03	2+						

† Energy values from 2001Ki10 unless noted otherwise. An uncertainty of 0.2 keV has been assigned to the γ-ray energies from 2001Ki10.

‡ Multipolarities on the basis of conversion coefficients from 2001Ki10 and 1970Go20, and from γ-γ directional correlation coefficient measurements from 2001Ki10. Conversion coefficients quoted from 1970Go20 have been normalized to α(K,237keV,E2,theo)=0.1064 by the evaluators. Some multipolarities have been tentatively assigned by the evaluators, based mainly on the J^π values of the connected levels.

Mixing ratios from 2001Ki10.

@ γ-ray intensities from 2001Ki10, unless otherwise noted.

& Not seen by 1970Go20.

a From 1970Go20, γ ray not seen by 2001Ki10.

b γ ray seen by 1970Go20 but not placed in their level scheme; placed by 2001Ki10.

c For absolute intensity per 100 decays, multiply by 0.9565.

d 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.

e Multiply placed with undivided intensity.

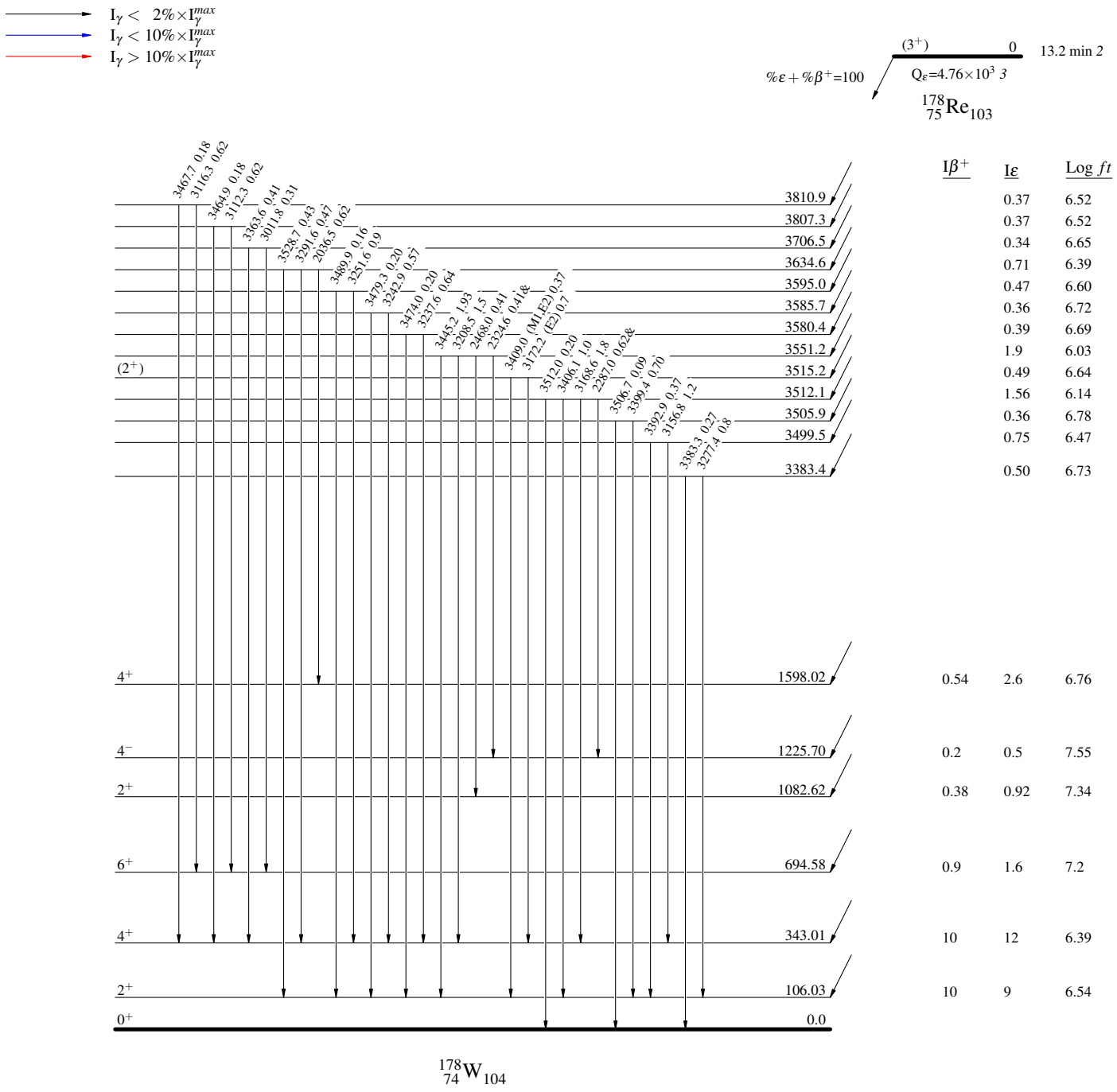
x γ ray not placed in level scheme.

$^{178}_{74}W_{104}$-8

^{178}Re ε decay 2001Ki10,1970Go20

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given

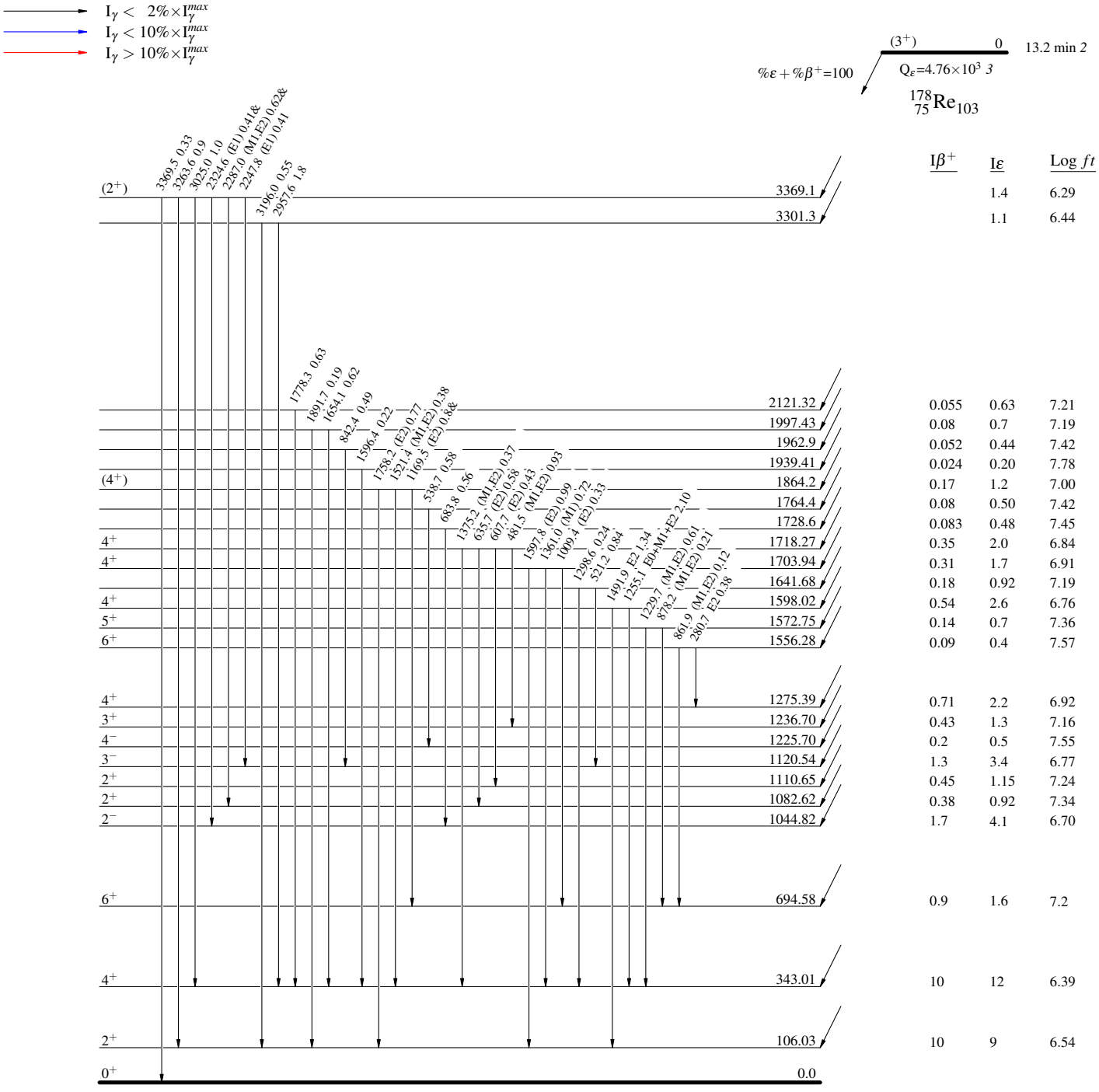


	Iβ+	Iε	Log *ft*
3810.9		0.37	6.52
3807.3		0.37	6.52
3706.5		0.34	6.65
3634.6		0.71	6.39
3595.0		0.47	6.60
3585.7		0.36	6.72
3580.4		0.39	6.69
3551.2		1.9	6.03
3515.2		0.49	6.64
3512.1		1.56	6.14
3505.9		0.36	6.78
3499.5		0.75	6.47
3383.4		0.50	6.73
1598.02	0.54	2.6	6.76
1225.70	0.2	0.5	7.55
1082.62	0.38	0.92	7.34
694.58	0.9	1.6	7.2
343.01	10	12	6.39
106.03	10	9	6.54

^{178}Re ε decay 2001Ki10,1970Go20

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given

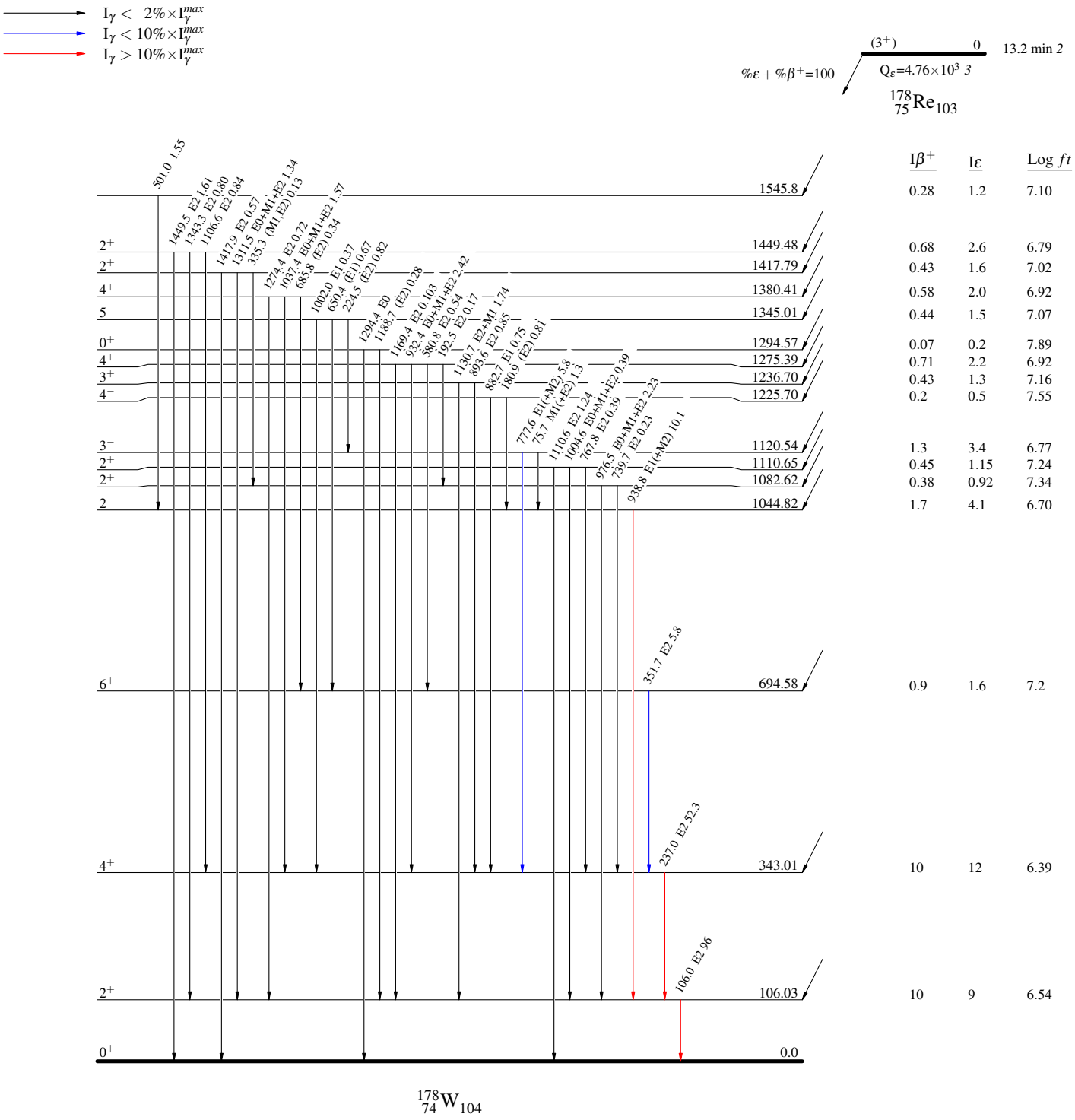


$^{178}_{74}W_{104}$

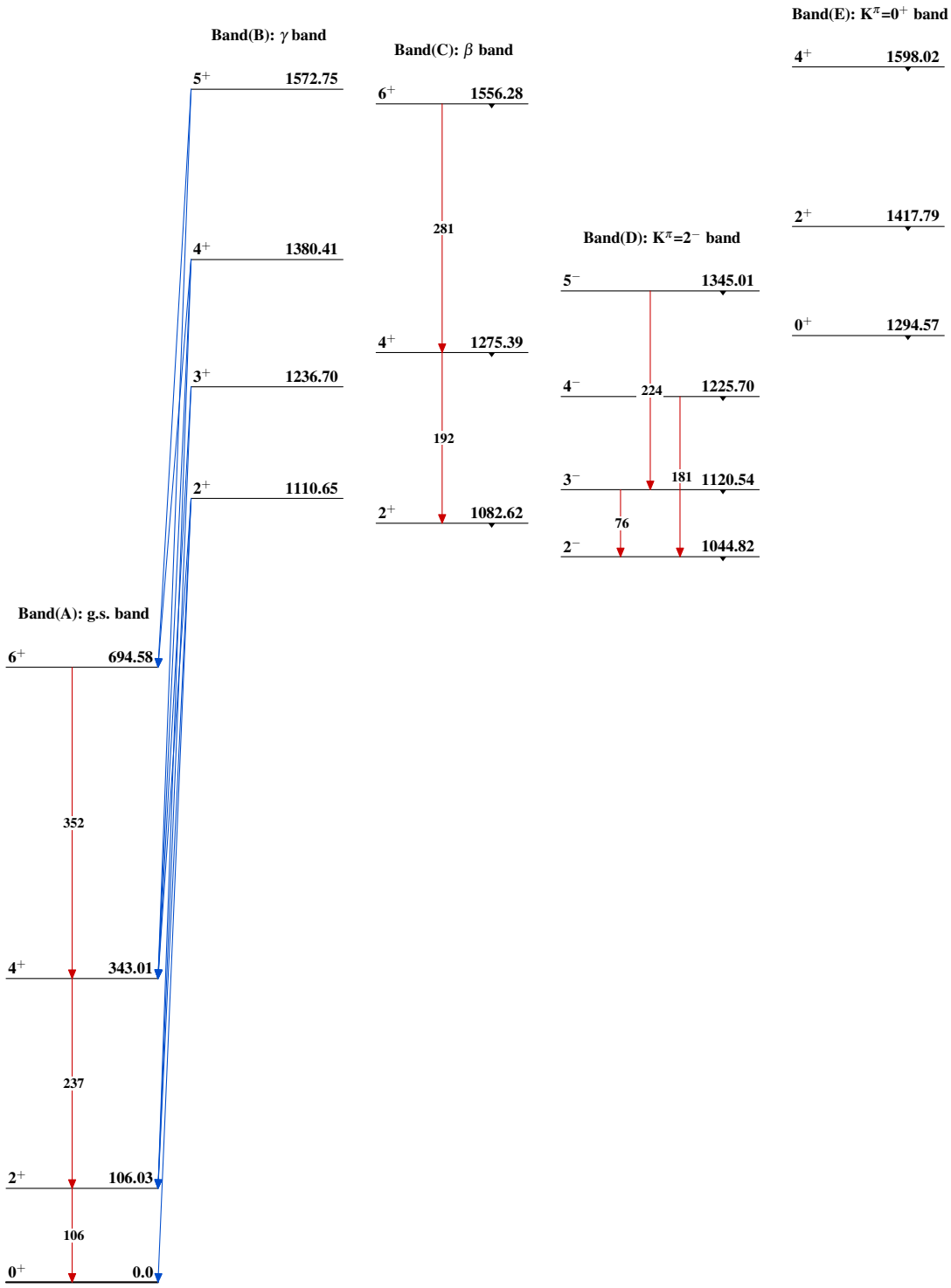
^{178}Re ε decay 2001Ki10,1970Go20

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given



^{178}Re ε decay 2001Ki10,1970Go20



$^{178}_{74}W_{104}$