^{240}Np β^- decay (61.9 min) 1982Pa23

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, E. Browne	NDS 109, 2439 (2008)	31-Jul-2008

Parent: ^{240}Np: E=0.0; $J^\pi=(5^+)$; $T_{1/2}$=61.9 min *2*; Q(β^-)=2188 *15*; %β^- decay=100.0
^{240}Np-Configuration=ν5/2[622]⊗π5/2[642], $K^\pi=5^+$.
1982Pa23: measured Eγ, Iγ, $\gamma\gamma$.
Other: 1967Wa27.

^{240}Pu Levels

E(level)	J^π[†]	$T_{1/2}$	Comments
0[‡]	0^+		
42.8[‡] *1*	2^+		
141.7[‡] *1*	4^+		
294.34[‡] *13*	6^+		
648.86[#] *13*	3^-		
742.35[#] *13*	5^-	<2 ns	$T_{1/2}$: from delayed coincidence (1967Wa27).
958.80[@] *15*	(2^-)		
1001.94[@] *13*	(3^-)		
1030.51[&] *13*	$(3)^+$		
1037.51[@] *13*	(4^-)		
1076.23[&] *15*	(4^+)		
1115.54[@] *13*	(5^-)		
1161.54[@] *14*	(6^-)		
1177.38[a] *14*	(3^+)		
1232.48[a] *15*	(4^+)		
1308.75 *12*	(5^-)	165 ns *10*	$T_{1/2}$: from $\beta\gamma$(t) (1967Wa27). Configuration=π5/2[523]⊗π5/2[642], $K^\pi=5^-$.

[†] From 'Adopted Levels'.
[‡] Band(A): $K^\pi=0^+$, g.s. band.
[#] Band(B): $K^\pi=0^-$ band.
[@] Band(C): $K^\pi=1^-$ band.
[&] Band(D): $K^\pi=3^+$ band. Configuration=ν5/2[622]⊗ν1/2[631].
[a] Band(E): $K^\pi=2^+$ band.

β^- radiations

The log *ft* values for 1076, (4^+) and 1308, (5^-) levels are discussed by 2006Sa35 In terms of intrinsic states and K-forbidden transitions.

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(879 *15*)	1308.75	79 *12*	5.9 *1*	av Eβ=276.2 *54* E(decay): 890 20 (1951Or08).
(956[#] *15*)	1232.48	0.3	8.4	av Eβ=303.7 *55*
(1011[#] *15*)	1177.38	9 *4*	7.0	av Eβ=323.9 *56* Iβ^-: feeding is unrealistic in view of ΔJ=2, $\Delta\pi$=no; and also ΔK=3.

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^{240}Np β^- decay (61.9 min) 1982Pa23 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(1026[#] *15*)	1161.54	<5	>7.3	av Eβ=329.7 *56* Iβ^-: 1 *4* from intensity balance.
(1072[#] *15*)	1115.54	<17	>6.8	av Eβ=346.6 *56* Iβ^-: 7 *10* from intensity balance.
(1112[#] *15*)	1076.23	0.5	8.4	av Eβ=361.2 *56*
(1150[#] *15*)	1037.51	<10	>7.2	av Eβ=375.7 *57* Iβ^-: 5 *5* from intensity balance.
(1157[#] *15*)	1030.51	<5	>7.5	av Eβ=378.3 *57* Iβ^-: 1 *4* from intensity balance.
(1186[#] *15*)	1001.94	1.3	8.7[1u]	av Eβ=373.0 *52*
(1229[#] *15*)	958.80	1.3	8.2	av Eβ=405.3 *57*
(1446[#] *15*)	742.35	<5	>7.8	av Eβ=488.0 *58* Iβ^-: 1 *4* from intensity balance.
(1539[#] *15*)	648.86	1.0	9.4[1u]	av Eβ=498.5 *55*
(1894[#] *15*)	294.34	<3	>8.5	av Eβ=664.1 *60* Iβ^-: from intensity balance but none expected from ΔK=5 involved.

[†] The β feedings are poorly known for most levels since the multipolarities and mixing ratios of γ-ray transitions are not well established, thus all feedings, except that for 1309 keV level are treated as uncertain and given mostly without uncertainties. From K^π assignments, only the strong feeding to the topmost level at 1309 keV is definite with ΔK=0. All other feedings are less likely since these involve a high degree of K-forbiddenness with ΔK=2 to 5. Apparent large intensity imbalances for some of the levels suggests that the decay scheme is incomplete.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

$\gamma(^{240}Pu)$

Iγ normalization: 1982Pa23 measure absolute γ-ray intensity of 27.6 *14* for 566γ. If the g-ray intensities are treated as relative then normalization factor=0.935 *18*, assuming, as expected, no β feeding to the 4^+ and 6^+ members of the g.s. band due to large ΔK=5 involved. This normalization factor gives absolute intensity of 25.8 *14* for the 566γ, in reasonable agreement with 27.6 *14* from 1982Pa23.

E$_\gamma$	I$_\gamma$[a]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.	α[b]	Comments
(42.8)	0.12[@] *4*	42.8	2^+	0	0^+	E2[‡]	908 *17*	α(L)=660 *12*; α(M)=184 *4*; α(N+..)=64.2 *12* α(N)=50.5 *10*; α(O)=11.87 *22*; α(P)=1.86 *4*; α(Q)=0.00391 *7*
(98.9)	5.24[@] *22*	141.7	4^+	42.8	2^+	E2[‡]	16.62	α(L)=12.06 *18*; α(M)=3.38 *5*; α(N+..)=1.182 *18* α(N)=0.929 *14*; α(O)=0.219 *4*; α(P)=0.0348 *6*; α(Q)=0.0001221 *18*
139.9 *1*	0.26 *5*	1177.38	(3^+)	1037.51	(4^-)	[E1][#]	0.235	α(K)=0.180 *3*; α(L)=0.0418 *6*; α(M)=0.01024 *15*; α(N+..)=0.00354 *5* α(N)=0.00276 *4*; α(O)=0.000664 *10*; α(P)=0.0001142 *17*; α(Q)=4.92×10^{-6} *7*
147.2[c&] *1*	1.28[c] *14*	1177.38	(3^+)	1030.51	(3)$^+$	[M1,E2][†]	6 *3*	α(K)=4 *4*; α(L)=1.7 *3*; α(M)=0.44 *11*; α(N+..)=0.16 *4*

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^{240}Np β^- decay (61.9 min) 1982Pa23 (continued)

$\gamma(^{240}Pu)$ (continued)

E_γ	I_γ[a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[b]	Comments
								α(N)=0.12 *3*; α(O)=0.029 *7*; α(P)=0.0051 *7*; α(Q)=0.00016 *13*
147.2[c&] *1*	1.28[c] *14*	1308.75	(5$^-$)	1161.54	(6$^-$)	[M1,E2]†	6 *3*	α(K)=4 *4*; α(L)=1.7 *3*; α(M)=0.44 *11*; α(N+..)=0.16 *4* α(N)=0.12 *3*; α(O)=0.029 *7*; α(P)=0.0051 *7*; α(Q)=0.00016 *13*
152.7 *1*	7.3 *4*	294.34	6$^+$	141.7	4$^+$	E2‡	2.48	α(K)=0.196 *3*; α(L)=1.661 *24*; α(M)=0.464 *7*; α(N+..)=0.1626 *24* α(N)=0.1276 *19*; α(O)=0.0301 *5*; α(P)=0.00487 *7*; α(Q)=2.76×10^{-5} *4*
175.4[d] *1*	5.1 *3*	1177.38	(3$^+$)	1001.94	(3$^-$)	[E1]#	0.1391	α(K)=0.1076 *16*; α(L)=0.0236 *4*; α(M)=0.00577 *9*; α(N+..)=0.00200 *3* α(N)=0.001556 *22*; α(O)=0.000376 *6*; α(P)=6.59×10^{-5} *10*; α(Q)=3.02×10^{-6} *5*
193.3 *1*	6.1 *3*	1308.75	(5$^-$)	1115.54	(5$^-$)	[M1,E2]†	2.5 *16*	α(K)=1.7 *16*; α(L)=0.62 *3*; α(M)=0.161 *5*; α(N+..)=0.0566 *15* α(N)=0.0440 *15*; α(O)=0.01067 *16*; α(P)=0.00188 *14*; α(Q)=7.E−5 *6*
x222.5 *3*	0.40 *5*							
x239.3 *1*	0.45 *6*							
271.3 *1*	6.2 *3*	1308.75	(5$^-$)	1037.51	(4$^-$)	[M1,E2]†	0.9 *7*	α(K)=0.7 *6*; α(L)=0.20 *6*; α(M)=0.050 *11*; α(N+..)=0.018 *4* α(N)=0.014 *3*; α(O)=0.0033 *8*; α(P)=0.00061 *18*; α(Q)=2.8×10^{-5} *23*
295.2 *1*	0.48 *6*	1037.51	(4$^-$)	742.35	5$^-$	[M1,E2]†	0.7 *6*	α(K)=0.5 *5*; α(L)=0.15 *5*; α(M)=0.038 *10*; α(N+..)=0.013 *4* α(N)=0.010 *3*; α(O)=0.0025 *7*; α(P)=0.00046 *15*; α(Q)=2.2×10^{-5} *18*
306.8 *1*	0.43 *5*	1308.75	(5$^-$)	1001.94	(3$^-$)	[E2]†	0.197	α(K)=0.0742 *11*; α(L)=0.0899 *13*; α(M)=0.0246 *4*; α(N+..)=0.00863 *13* α(N)=0.00675 *10*; α(O)=0.001608 *23*; α(P)=0.000270 *4*; α(Q)=4.20×10^{-6} *6*
388.7 *1*	0.97 *7*	1037.51	(4$^-$)	648.86	3$^-$	[M1,E2]†	0.34 *25*	α(K)=0.26 *21*; α(L)=0.06 *3*; α(M)=0.016 *6*; α(N+..)=0.0057 *22* α(N)=0.0044 *17*; α(O)=0.0011 *5*; α(P)=0.00020 *9*; α(Q)=1.1×10^{-5} *9*
419.2 *1*	0.86 *7*	1161.54	(6$^-$)	742.35	5$^-$	[M1,E2]†	0.28 *20*	α(K)=0.21 *17*; α(L)=0.052 *23*; α(M)=0.013 *6*; α(N+..)=0.0046 *19* α(N)=0.0035 *14*; α(O)=0.0009 *4*; α(P)=0.00016 *8*; α(Q)=9.E−6 *7*
448.01 *6*	13.4 *6*	742.35	5$^-$	294.34	6$^+$	[E1]#	0.0179	α(K)=0.01433 *20*; α(L)=0.00269 *4*; α(M)=0.000648 *9*; α(N+..)=0.000227 *4* α(N)=0.0001753 *25*; α(O)=4.31×10^{-5} *6*; α(P)=7.90×10^{-6} *11*; α(Q)=4.45×10^{-7} *7*
466.7 *1*	1.17 *6*	1115.54	(5$^-$)	648.86	3$^-$	[E2]†	0.0622	α(K)=0.0349 *5*; α(L)=0.0200 *3*; α(M)=0.00533 *8*; α(N+..)=0.00187 *3* α(N)=0.001460 *21*; α(O)=0.000351 *5*; α(P)=6.09×10^{-5} *9*; α(Q)=1.633×10^{-6} *23*
507.3 *2*	1.82 *9*	648.86	3$^-$	141.7	4$^+$			
566.34 *6*	27.6 *14*	1308.75	(5$^-$)	742.35	5$^-$	[M1,E2]†	0.13 *9*	α(K)=0.10 *8*; α(L)=0.022 *11*; α(M)=0.005 *3*; α(N+..)=0.0019 *9* α(N)=0.0015 *7*; α(O)=0.00036 *18*; α(P)=7.E−5 *4*; α(Q)=4.E−6 *3*

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^{240}Np β^- decay (61.9 min) 1982Pa23 (continued)

$\gamma(^{240}Pu)$ (continued)

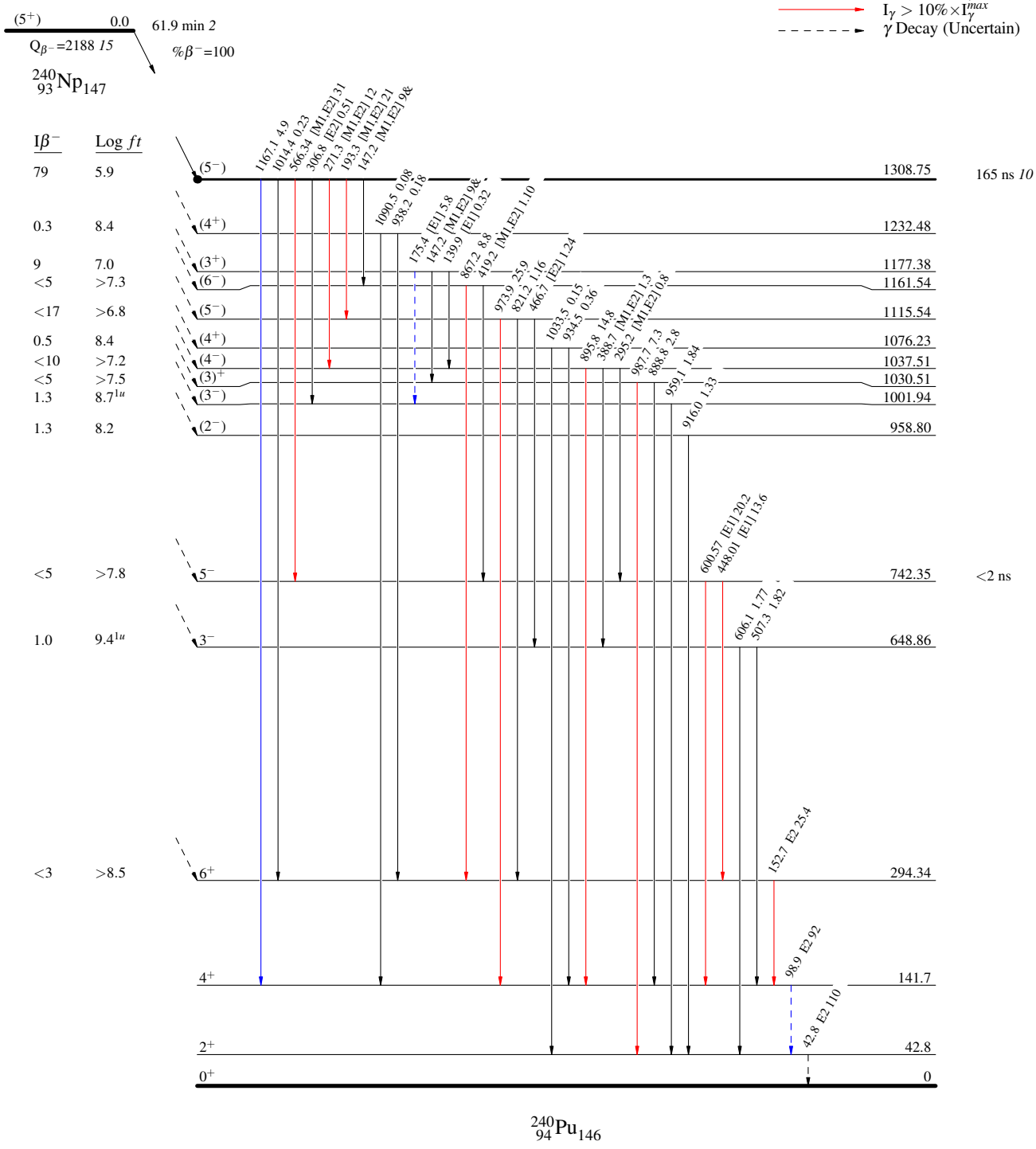
E_γ	I_γ[a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[b]	Comments
[x]583.9 *1*	0.40 *8*							
600.57 *6*	20.0 *10*	742.35	5^-	141.7	4^+	[E1][#]	0.01013	α(K)=0.00818 *12*; α(L)=0.001480 *21*; α(M)=0.000355 *5*; α(N+..)=0.0001243 *18* α(N)=9.60×10^{-5} *14*; α(O)=2.37×10^{-5} *4*; α(P)=4.38×10^{-6} *7*; α(Q)=2.59×10^{-7} *4*
606.1 *1*	1.77 *9*	648.86	3^-	42.8	2^+			
[x]633.5 *2*	0.22 *4*							
821.2 *1*	1.16 *9*	1115.54	(5^-)	294.34	6^+			
867.2 *1*	8.8 *5*	1161.54	(6^-)	294.34	6^+			
888.8 *1*	2.5 *1*	1030.51	$(3)^+$	141.7	4^+			
895.8 *1*	14.8 *7*	1037.51	(4^-)	141.7	4^+			
916.0 *1*	1.33 *11*	958.80	(2^-)	42.8	2^+			
934.5 *1*	0.36 *4*	1076.23	(4^+)	141.7	4^+			
938.2 *1*	0.18 *3*	1232.48	(4^+)	294.34	6^+			
959.1 *1*	1.84 *13*	1001.94	(3^-)	42.8	2^+			
973.9 *1*	25.9 *13*	1115.54	(5^-)	141.7	4^+			
987.7 *1*	7.3 *4*	1030.51	$(3)^+$	42.8	2^+			
1014.4 *1*	0.23 *6*	1308.75	(5^-)	294.34	6^+			
1033.5 *2*	0.15 *4*	1076.23	(4^+)	42.8	2^+			
1090.5 *2*	0.08 *3*	1232.48	(4^+)	141.7	4^+			
1167.1 *1*	4.9 *3*	1308.75	(5^-)	141.7	4^+			

† Intensity balance is consistent with mult=E1,E2 or M1. Adopted J^π values rule out mult=E1.
‡ From adopted γ's.
# Intensity balance is consistent with mult=E1,E2 or M1. Adopted J^π values rule out mult=M1,E2.
@ Deduced from I(γ+ce) intensity balance.
& Placement from 1177 level proposed by the evaluators to seek some intensity balance at 1030 keV. 1982Pa23 proposed placement from only the 1309 keV level. The ΔK=4 involved for a transition from 1309-keV level to 1161-keV level suggests placement by 1982Pa23 is less likely.
[a] Absolute intensity per 100 decays.
[b] 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.
[c] Multiply placed with undivided intensity.
[d] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{240}Np β^- decay (61.9 min) 1982Pa23

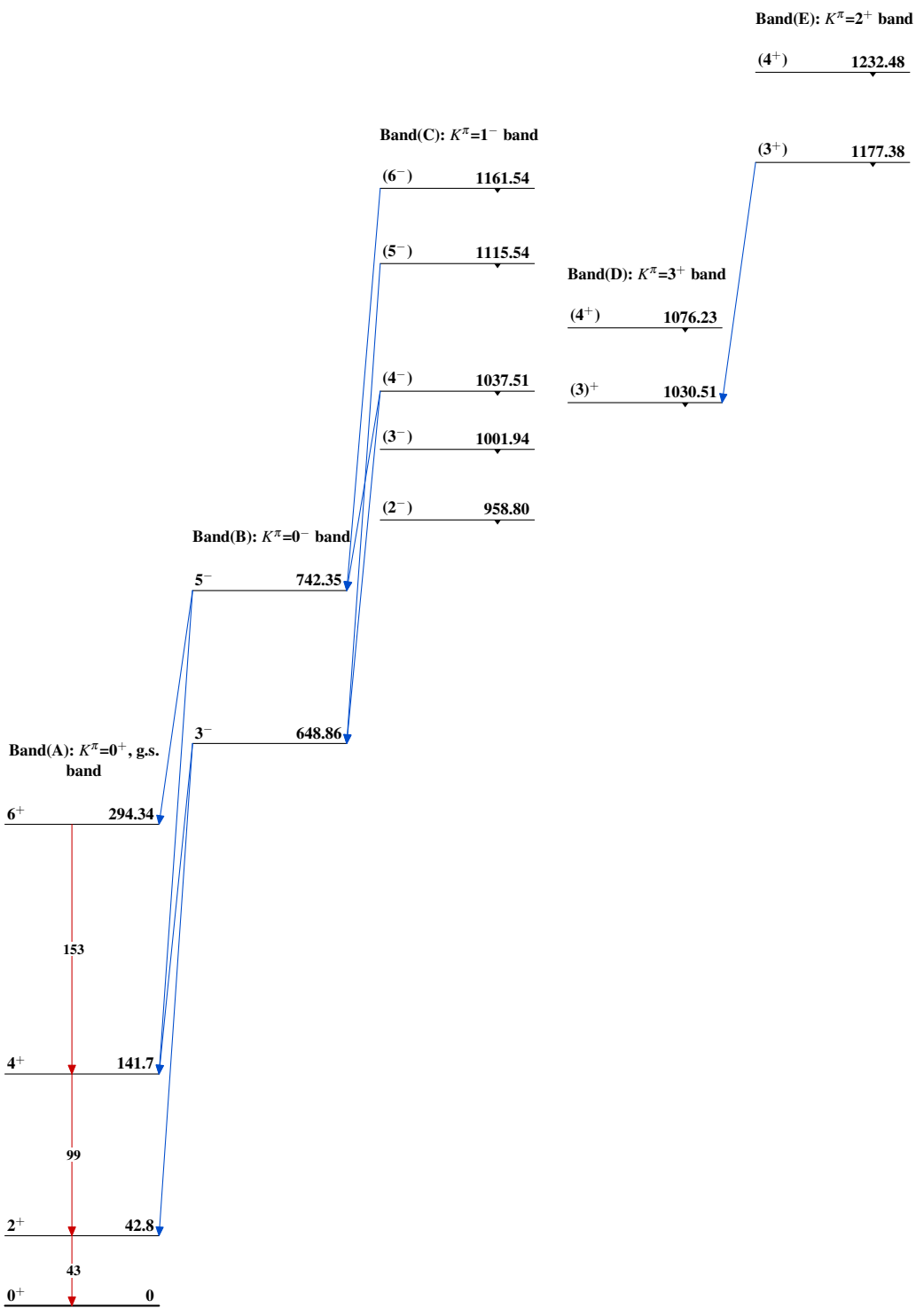
Decay Scheme

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



$^{240}_{94}Pu_{146}$

^{240}Np β^- decay (61.9 min) 1982Pa23



$^{240}_{94}Pu_{146}$