^{230}Ra β^- decay 1980Gi04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. Morse	NDS 197,259 (2024).	26-Sep-2023

Parent: ^{230}Ra: E=0.0; $J^\pi=0^+$; $T_{1/2}$=93 min *2*; Q(β^-)=678 *19*; %β^- decay=100

^{230}Ra-Q(β^-): From 2021Wa16.

A tentative decay scheme is given as proposed by 1980Gi04. It was constructed from γ-ray energy adjustments to level energies, and from γ-ray intensity considerations. Source strength was insufficient for $\gamma\gamma$ coincidence studies. 1980Gi04 studied the decay of ^{230}Ra without interference from the decay of its daughter ^{230}Ac (122 sec) by a process of continuous chemical separation.

^{230}Ac Levels

E(level)	J^π[†]	$T_{1/2}$	Comments
0.0	(1^+)	122 s *3*	J^π: From Adopted Levels.
8.99 *6*	$(0,1,2)^+$		
72.01 *7*	1^-		
101.07 *6*	1^+		
151.52? *9*	(1^+)		
198.17 *6*	1^-		
211.78 *6*	1^+		
264.69 *9*			
285.19 *7*	1^+		
292.91 *8*			
346.07 *8*	1^+		
375.72 *13*			
395.27 *12*	1^-		
457.92 *7*	1^+		
478.70 *7*	1^+		
536.73 *11*	1^+		
581.16 *10*	1^+		
591.56? *11*	1^+		
635.77? *18*	1^+		

[†] Proposed in 19080Gi04, based on expected quasiparticle states from Nilsson diagrams.

β^- radiations

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(42 *19*)	635.77?	0.22 *6*	4.3 *8*	av Eβ=10.7 *50*
(86 *19*)	591.56?	0.47 *14*	4.9 *4*	av Eβ=22.3 *52*
(97 *19*)	581.16	0.91 *16*	4.8 *3*	av Eβ=25.1 *52*
(141 *19*)	536.73	2.0 *5*	4.94 *23*	av Eβ=37.3 *53*
(199 *19*)	478.70	5.6 *10*	4.96 *16*	av Eβ=53.7 *55*
(220 *19*)	457.92	3.9 *6*	5.25 *14*	av Eβ=59.7 *56*
(283 *19*)	395.27	0.77 *17*	6.30 *14*	av Eβ=78.3 *58*
(302 *19*)	375.72	0.16 *4*	7.08 *15*	av Eβ=84.2 *58*
(332 *19*)	346.07	3.4 *9*	5.88 *15*	av Eβ=93.2 *59*
(385 *19*)	292.91	0.34 *9*	7.09 *14*	av Eβ=109.8 *61*
(393 *19*)	285.19	4.8 *13*	5.97 *14*	av Eβ=112.3 *61*
(413 *19*)	264.69	0.17 *7*	7.49 *19*	av Eβ=118.8 *61*
(466 *19*)	211.78	8.6 *24*	5.95 *14*	av Eβ=135.9 *62*
(480 *19*)	198.17	0.6 *4*	7.2 *3*	av Eβ=140.3 *63*
(527 *19*)	151.52?	0.8 *3*	7.16 *18*	av Eβ=155.7 *64*
(577 *19*)	101.07	11 *4*	6.15 *17*	av Eβ=172.6 *65*
(606 *19*)	72.01	16 *3*	6.06 *10*	av Eβ=182.5 *66*

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^{230}Ra β^- decay 1980Gi04 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†][‡]	Log *ft*	Comments
(678 *19*)	0.0	41 *6*	5.82 *8*	av Eβ=207.3 *67* Iβ(g.s. + 9 keV)=41% *6*.

† Deduced by evaluator from γ-ray transition intensity balance, using Iγ normalization=0.085 *21*.
‡ Absolute intensity per 100 decays.

$\gamma(^{230}Ac)$

Iγ normalization: From Iγ(454.9γ from ^{230}Ac β^- decay)=8.3 % *21* deduced by evaluator, corrected by a factor $F=T^{Ra}_{1/2}/(T^{Ra}_{1/2}-T^{Ac}_{1/2})$, assuming ^{230}Ac (122 sec) was in transient equilibrium with ^{230}Ra (93 min) during the measurement.

E$_\gamma$[†]	I$_\gamma$[‡a]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[#]	α[&]	Comments
(9.0[@])		8.99	(0,1,2)$^+$	0.0	(1$^+$)			
49.2 *1*	2.6 *5*	395.27	1$^-$	346.07	1$^+$	[E1]	0.750 *11*	%Iγ=0.22 *7* α(L)=0.566 *8*; α(M)=0.1391 *21*; α(N)=0.0361 *5*; α(O)=0.00781 *12*; α(P)=0.001221 *18* α(Q)=5.20×10^{-5} *8*
63.0 *1*	40 *2*	72.01	1$^-$	8.99	(0,1,2)$^+$	[E1]	0.388 *6*	%Iγ=3.4 *9* α(L)=0.293 *4*; α(M)=0.0716 *10*; α(N)=0.01863 *27*; α(O)=0.00408 *6*; α(P)=0.000656 *10* α(Q)=3.07×10^{-5} *4*
72.0 *1*	113 *6*	72.01	1$^-$	0.0	(1$^+$)	[E1]	0.272 *4*	%Iγ=9.6 *24* α(L)=0.2057 *30*; α(M)=0.0501 *7*; α(N)=0.01304 *19*; α(O)=0.00287 *4*; α(P)=0.000468 *7* α(Q)=2.298×10^{-5} *33*
92.1 *1*	21 *5*	101.07	1$^+$	8.99	(0,1,2)$^+$	[M1]	4.36 *6*	%Iγ=1.8 *6* α(L)=3.30 *5*; α(M)=0.791 *11*; α(N)=0.2100 *30*; α(O)=0.0488 *7*; α(P)=0.00903 *13* α(Q)=0.000802 *12*
101.0 *1*	16 *3*	101.07	1$^+$	0.0	(1$^+$)	[M1]	3.34 *5*	%Iγ=1.4 *4* α(L)=2.53 *4*; α(M)=0.606 *9*; α(N)=0.1607 *23*; α(O)=0.0374 *5*; α(P)=0.00691 *10* α(Q)=0.000614 *9*
110.7 *1*	3.1 *3*	211.78	1$^+$	101.07	1$^+$			%Iγ=0.26 *7*
[x]117.8 *3*	<0.3							%Iγ=0.026 *6*
[x]125.3 *3*	<0.3							%Iγ=0.026 *6*
132.7 *3*	<0.3	478.70	1$^+$	346.07	1$^+$			%Iγ=0.026 *6*
134.3 *1*	4.5 *5*	346.07	1$^+$	211.78	1$^+$	[M1]	7.36 *10*	%Iγ=0.38 *10* α(K)=5.89 *8*; α(L)=1.112 *16*; α(M)=0.267 *4*; α(N)=0.0707 *10*; α(O)=0.01645 *23* α(P)=0.00304 *4*; α(Q)=0.000270 *4*
[x]138.7 *2*	0.6 *2*							%Iγ=0.051 *21*
141.4 *2*	0.7 *2*	292.91		151.52?	(1$^+$)			%Iγ=0.060 *22*
147.9 *1*	5.6 *3*	346.07	1$^+$	198.17	1$^-$	[E1]	0.1900 *27*	%Iγ=0.48 *12* α(K)=0.1490 *21*; α(L)=0.0310 *4*; α(M)=0.00747 *11*; α(N)=0.001958 *28*; α(O)=0.000440 *6* α(P)=7.57×10^{-5} *11*; α(Q)=4.65×10^{-6} *7*

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^{230}Ra β^- decay 1980Gi04 (continued)

$\gamma(^{230}Ac)$ (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	Comments
151.5 *1*	2.0 *2*	151.52?	(1^+)	0.0	(1^+)	[M1]	5.23 *7*	%Iγ=0.17 *5* α(K)=4.19 *6*; α(L)=0.788 *11*; α(M)=0.1889 *27*; α(N)=0.0501 *7*; α(O)=0.01165 *16* α(P)=0.002155 *30*; α(Q)=0.0001910 *27*
177.5 *3*	0.6 *2*	375.72		198.17	1^-			%Iγ=0.051 *21*
184.1 *1*	11.5 *3*	285.19	1^+	101.07	1^+	[M1]	3.01 *4*	%Iγ=0.98 *24* α(K)=2.416 *34*; α(L)=0.453 *6*; α(M)=0.1085 *15*; α(N)=0.0288 *4*; α(O)=0.00669 *9* α(P)=0.001238 *17*; α(Q)=0.0001097 *15*
189.2 *1*	16.7 *5*	198.17	1^-	8.99	$(0,1,2)^+$	[E1]	0.1053 *15*	%Iγ=1.42 *35* α(K)=0.0834 *12*; α(L)=0.01655 *23*; α(M)=0.00398 *6*; α(N)=0.001044 *15* α(O)=0.0002362 *33*; α(P)=4.11×10^{-5} *6*; α(Q)=2.69×10^{-6} *4*
192.6 *1*	1.4 *3*	264.69		72.01	1^-			%Iγ=0.12 *4*
197.1 *2*	1.3 *2*	395.27	1^-	198.17	1^-	[M1]	2.49 *4*	%Iγ=0.111 *32* α(K)=1.994 *28*; α(L)=0.373 *5*; α(M)=0.0895 *13*; α(N)=0.02373 *34*; α(O)=0.00552 *8* α(P)=0.001021 *15*; α(Q)=9.04×10^{-5} *13*
198.2 *1*	3.4 *4*	198.17	1^-	0.0	(1^+)	[E1]	0.0943 *13*	%Iγ=0.29 *8* α(K)=0.0748 *11*; α(L)=0.01473 *21*; α(M)=0.00354 *5*; α(N)=0.000929 *13* α(O)=0.0002103 *30*; α(P)=3.67×10^{-5} *5*; α(Q)=2.429×10^{-6} *34*
202.8 *1*	30.8 *10*	211.78	1^+	8.99	$(0,1,2)^+$	[M1]	2.296 *32*	%Iγ=2.6 *7* α(K)=1.841 *26*; α(L)=0.344 *5*; α(M)=0.0825 *12*; α(N)=0.02190 *31*; α(O)=0.00509 *7* α(P)=0.000942 *13*; α(Q)=8.34×10^{-5} *12*
211.8 *1*	11.3 *3*	211.78	1^+	0.0	(1^+)	[M1]	2.033 *29*	%Iγ=0.96 *24* α(K)=1.630 *23*; α(L)=0.305 *4*; α(M)=0.0730 *10*; α(N)=0.01937 *27*; α(O)=0.00450 *6* α(P)=0.000833 *12*; α(Q)=7.38×10^{-5} *10*
[x]236.3 *3*	<0.3							%Iγ=0.026 *6*
[x]247.4 *3*	<0.3							%Iγ=0.026 *6*
251.5 *1*	9.9 *5*	536.73	1^+	285.19	1^+	[M1]	1.259 *18*	%Iγ=0.84 *21* α(K)=1.010 *14*; α(L)=0.1883 *26*; α(M)=0.0451 *6*; α(N)=0.01196 *17*; α(O)=0.00278 *4* α(P)=0.000515 *7*; α(Q)=4.56×10^{-5} *6*
255.7 *2*	1.6 *4*	264.69		8.99	$(0,1,2)^+$			%Iγ=0.14 *5*
259.9 *2*	3.4 *5*	457.92	1^+	198.17	1^-	[E1]	0.0501 *7*	%Iγ=0.29 *8* α(K)=0.0401 *6*; α(L)=0.00757 *11*; α(M)=0.001812 *26*; α(N)=0.000477 *7* α(O)=0.0001084 *15*; α(P)=1.915×10^{-5} *27*; α(Q)=1.346×10^{-6} *19*
274.6 *2*	1.0 *3*	375.72		101.07	1^+			%Iγ=0.085 *33*
285.2 *1*	18.2 *7*	285.19	1^+	0.0	(1^+)	[M1]	0.889 *12*	%Iγ=1.5 *4* α(K)=0.714 *10*; α(L)=0.1327 *19*; α(M)=0.0318 *4*; α(N)=0.00843 *12*; α(O)=0.001960 *28* α(P)=0.000363 *5*; α(Q)=3.21×10^{-5} *5*
288.2 *2*	1.0 *3*	581.16	1^+	292.91				%Iγ=0.085 *33*
292.9 *1*	4.3 *6*	292.91		0.0	(1^+)			%Iγ=0.37 *10*
296.1 *2*	1.2 *2*	581.16	1^+	285.19	1^+	[M1]	0.801 *11*	%Iγ=0.102 *30* α(K)=0.644 *9*; α(L)=0.1196 *17*;

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^{230}Ra β^- decay 1980Gi04 (continued)

$\gamma(^{230}Ac)$ (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	Comments
								α(M)=0.0286 *4*; α(N)=0.00759 *11*; α(O)=0.001766 *25*
								α(P)=0.000327 *5*; α(Q)=2.89×10^{-5} *4*
[x]297.6 *2*	0.5 *2*							%Iγ=0.043 *20*
316.4 *1*	1.0 *2*	581.16	1$^+$	264.69				%Iγ=0.085 *27*
[x]363.9 *3*	0.6 *2*							%Iγ=0.051 *21*
375.8 *2*	0.3 *1*	375.72		0.0	(1$^+$)			%Iγ=0.026 *11*
[x]412.9 *1*	0.9 *2*							%Iγ=0.076 *25*
437.7 *3*	0.3 *1*	635.77?	1$^+$	198.17	1$^-$	[E1]	0.01601 *23*	%Iγ=0.026 *11*
								α(K)=0.01299 *18*; α(L)=0.002294 *32*; α(M)=0.000546 *8*; α(N)=0.0001437 *20*
								α(O)=3.30×10^{-5} *5*; α(P)=5.93×10^{-6} *8*; α(Q)=4.60×10^{-7} *6*
440.0 *3*	0.3 *1*	591.56?	1$^+$	151.52?	(1$^+$)	[M1]	0.272 *4*	%Iγ=0.026 *11*
								α(K)=0.2190 *31*; α(L)=0.0404 *6*; α(M)=0.00965 *14*; α(N)=0.00256 *4*; α(O)=0.000595 *8*
								α(P)=0.0001101 *16*; α(Q)=9.76×10^{-6} *14*
448.9 *1*	15.0 *5*	457.92	1$^+$	8.99	(0,1,2)$^+$	[M1]	0.258 *4*	%Iγ=1.27 *32*
								α(K)=0.2075 *29*; α(L)=0.0382 *5*; α(M)=0.00914 *13*; α(N)=0.002423 *34*; α(O)=0.000563 *8*
								α(P)=0.0001042 *15*; α(Q)=9.24×10^{-6} *13*
457.9 *1*	18.5 *6*	457.92	1$^+$	0.0	(1$^+$)	[M1]	0.2445 *34*	%Iγ=1.6 *4*
								α(K)=0.1967 *28*; α(L)=0.0362 *5*; α(M)=0.00866 *12*; α(N)=0.002296 *32*; α(O)=0.000534 *7*
								α(P)=9.88×10^{-5} *14*; α(Q)=8.76×10^{-6} *12*
469.7 *1*	29.3 *10*	478.70	1$^+$	8.99	(0,1,2)$^+$	[M1]	0.2283 *32*	%Iγ=2.5 *6*
								α(K)=0.1837 *26*; α(L)=0.0338 *5*; α(M)=0.00808 *11*; α(N)=0.002143 *30*; α(O)=0.000498 *7*
								α(P)=9.22×10^{-5} *13*; α(Q)=8.18×10^{-6} *11*
[x]473.5 *3*	<0.3							%Iγ=0.026 *6*
478.7 *1*	24.2 *10*	478.70	1$^+$	0.0	(1$^+$)	[M1]	0.2170 *30*	%Iγ=2.1 *5*
								α(K)=0.1746 *24*; α(L)=0.0321 *4*; α(M)=0.00768 *11*; α(N)=0.002035 *29*; α(O)=0.000473 *7*
								α(P)=8.76×10^{-5} *12*; α(Q)=7.77×10^{-6} *11*
484.2 *2*	1.9 *4*	635.77?	1$^+$	151.52?	(1$^+$)	[M1]	0.2104 *30*	%Iγ=0.16 *5*
								α(K)=0.1693 *24*; α(L)=0.0311 *4*; α(M)=0.00744 *10*; α(N)=0.001973 *28*; α(O)=0.000459 *6*
								α(P)=8.49×10^{-5} *12*; α(Q)=7.53×10^{-6} *11*
490.5 *1*	4.3 *8*	591.56?	1$^+$	101.07	1$^+$	[M1]	0.2032 *28*	%Iγ=0.37 *11*
								α(K)=0.1636 *23*; α(L)=0.0301 *4*; α(M)=0.00719 *10*; α(N)=0.001905 *27*; α(O)=0.000443 *6*
								α(P)=8.20×10^{-5} *11*; α(Q)=7.27×10^{-6} *10*
509.4 *2*	6.5 *6*	581.16	1$^+$	72.01	1$^-$	[E1]	0.01175 *16*	%Iγ=0.55 *15*
								α(K)=0.00957 *13*; α(L)=0.001661 *23*; α(M)=0.000394 *6*; α(N)=0.0001039 *15*
								α(O)=2.388×10^{-5} *33*; α(P)=4.31×10^{-6} *6*; α(Q)=3.42×10^{-7} *5*
536.9 *2*	1.2 *2*	536.73	1$^+$	0.0	(1$^+$)	[M1]	0.1596 *22*	%Iγ=0.102 *30*

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^{230}Ra β^- decay 1980Gi04 (continued)

$\gamma(^{230}Ac)$ (continued)

E_γ [†]	E_i(level)	Comments
		α(K)=0.1285 *18*; α(L)=0.02356 *33*; α(M)=0.00563 *8*; α(N)=0.001492 *21*; α(O)=0.000347 *5* α(P)=6.42×10^{-5} *9*; α(Q)=5.70×10^{-6} *8*

† From 1980Gi04.
‡ Photon intensity relative to Iγ(454.9γ from ^{230}Ac decay)=100.
# Based on theoretical spin/parity assignments to levels.
@ Transition was not observed. Eγ from level energy.
& Additional information 1.
a For absolute intensity per 100 decays, multiply by 0.085 *21*.
x γ ray not placed in level scheme.

^{230}Ra β^- decay 1980Gi04

Decay Scheme

Intensities: I_γ per 100 parent decays