^{204}Po ε decay 1979Va21

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. J. Chiara and F. G. Kondev	NDS 111,141 (2010)	1-Oct-2009

Parent: ^{204}Po: E=0.0; $J^\pi=0^+$; $T_{1/2}$=3.519 h *12*; Q(ε)=2330 *30*; %ε+%β^+ decay=99.33 *3*

1979Va21: Mass separated ^{204}Po from chemically separated Po fraction following spallation of Th target; measured γ′s and γγ coin withGe(Li); ce with magnetic spectrometer and Si(Li).

Others: 1971DaZM, 1971Ku16, 1978VaZD, 1990Br19.

^{204}Bi Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0	6^+		J^π: From Adopted Levels.
5.55 *5*	5^+		
15.07 *7*	4^+		
78.26 *7*	3^+		
200.84 *8*	$(4)^+$		
215.28 *8*	2^+		
332.08 *8*	3^+		
895.70 *8*	1^+		
983.21 *8*	$(2^-,3^-)$		
1018.45 *8*	$(3)^+$		
1094.57 *8*	2^-	3.96 ns *8*	$T_{1/2}$: 270γ-1016γ(t) in 1970BrZP. The assignment to this level is tentative. It is possible that the lifetime is associated with the 1099-keV level.
1099.27 *8*	$1^-,2^-$		
1255.30 *9*	1^+		
1369.34 *8*	1^-		
1404.23 *8*	1^-		
1478.37 *9*	$(1,2)^+$		
1526.11 *8*	2^-		
1546.42? *8*	$(1)^-$		
1634.17 *8*	1^-		

† From a least-squares fit to Eγ.
‡ From deduced transition multipolarities, unless otherwise specified.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I(ε+β^+)†‡	Comments
(7.0×10^2 *3*)	1634.17		24.0 *9*	5.90 *5*	24.0 *9*	εK=0.7713 *21*; εL=0.1709 *15*; εM+=0.0579 *6*
(7.8×10^2 *3*)	1546.42?		2.53 *10*	6.99 *5*	2.53 *10*	εK=0.7763 *16*; εL=0.1673 *12*; εM+=0.0564 *5*
(8.5×10^2# *3*)	1478.37		2.06 *8*	7.16 *4*	2.06 *8*	εK=0.7795 *13*; εL=0.1650 *10*; εM+=0.0555 *4*
(9.3×10^2 *3*)	1404.23		4.5 *3*	6.90 *5*	4.5 *3*	εK=0.7823 *11*; εL=0.1630 *8*; εM+=0.0547 *3*
(9.6×10^2 *3*)	1369.34		51.6 *18*	5.87 *4*	51.6 *18*	εK=0.7834 *10*; εL=0.1622 *7*; εM+=0.0544 *3*
(1.07×10^3 *3*)	1255.30		11.3 *5*	6.64 *4*	11.3 *5*	εK=0.7866 *8*; εL=0.1599 *6*; εM+=0.05346 *22*
(1.43×10^3 *3*)	895.70	0.0013 *5*	4.9 *3*	7.27 *4*	4.9 *3*	av Eβ=208 *14*; εK=0.7929 *4*; εL=0.1552 *3*; εM+=0.05159 *12*

† I(ε+β^+) were calculated from γ+ce intensity balances. The quoted uncertainties do not include≈12% unplaced Iγ.
‡ For absolute intensity per 100 decays, multiply by 0.9933 *3*.
# Existence of this branch is questionable.

$\gamma(^{204}$Bi)

Iγ normalization: Using Ti(γ's above the 332-keV level) and by assuming that there is no direct $\varepsilon+\beta^+$ feeding to levels located at abd below the 332-keV one. The decay scheme is complete, since there is a good agreement between ^{204}Po ε decay Q value of 2312 keV *29*, calculated using the decay scheme and RADLST, and that of 2318 keV *28*, as deduced from Q in 2003Au03.

E_γ[‡]	I_γ[‡@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[†]	$I_{(\gamma+ce)}$[@]	Comments
(4.7)		1099.27	$1^-,2^-$	1094.57	2^-	[M1]		104 *4*	E_γ: Not observed directly. The value is from level energy differences. $I_{(\gamma+ce)}$: From intensity balance.
5.55 *5*		5.55	5^+	0	6^+	M1	2.33×10^3 *8*	320 *15*	ce(M)/(γ+ce)=0.759 *17*; ce(N+)/(γ+ce)=0.240 *9* ce(N)/(γ+ce)=0.196 *8*; ce(O)/(γ+ce)=0.0400 *17*; ce(P)/(γ+ce)=0.00476 *21* $I_{(\gamma+ce)}$: From intensity balance, the γ was not seen. E_γ,Mult.: From 1990Br19. N2/N1=0.13 *3*; N3/N1=0.006 *5*; N1/M1=0.21 *7*.
9.52 *5*		15.07	4^+	5.55	5^+	M1	468 *10*	320 *15*	ce(M)/(γ+ce)=0.759 *11*; ce(N+)/(γ+ce)=0.239 *7* ce(N)/(γ+ce)=0.195 *6*; ce(O)/(γ+ce)=0.0397 *12*; ce(P)/(γ+ce)=0.00472 *14* $I_{(\gamma+ce)}$: From intensity balance, the γ was not seen. E_γ,Mult.: From 1990Br19. M2/M1=1.7; M3/M1=0.03 *2*; N1/M1=0.23 *3*. Note, that no evidence was found in 1990Br19 for the expected 15.1 keV crossover transition.
63.185 *7*	36.0 *11*	78.26	3^+	15.07	4^+	M1	7.28		α(L)=5.56 *8*; α(M)=1.309 *19*; α(N+..)=0.411 *6* α(N)=0.335 *5*; α(O)=0.0684 *10*; α(P)=0.00814 *12* Mult.: α(M)exp=1.55 *34*, α(N)exp=0.31 *7*.
108.055 *8*	1.18 *4*	1634.17	1^-	1526.11	2^-	M1	8.17		α(K)=6.64 *10*; α(L)=1.169 *17*; α(M)=0.275 *4*; α(N+..)=0.0865 *13* α(N)=0.0704 *10*; α(O)=0.01438 *21*; α(P)=0.001711 *24* Mult.: α(L12)exp=0.98 *23*, α(L3)exp<0.08.
116.057 *10*	2.36 *7*	1099.27	$1^-,2^-$	983.21	$(2^-,3^-)$	(M1+E2)	5.1 *16*		α(K)=2.9 *25*; α(L)=1.6 *7*; α(M)=0.42 *20*; α(N+..)=0.13 *6* α(N)=0.11 *5*; α(O)=0.020 *9*; α(P)=0.0018 *5* Mult.: α(K)exp=1.20 *26*; α(L)exp=1.5 *5*.
122.582 *8*	3.80 *10*	200.84	$(4)^+$	78.26	3^+	M1	5.70		α(K)=4.63 *7*; α(L)=0.813 *12*; α(M)=0.191 *3*; α(N+..)=0.0601 *9* α(N)=0.0489 *7*; α(O)=0.01000 *14*; α(P)=0.001190 *17* Mult.: α(K)exp=4.1 *6*, α(L12)exp=0.76 *8*, α(L3)exp<6.
131.224 *14*	3.00 *7*	332.08	3^+	200.84	$(4)^+$	M1	4.69		α(K)=3.82 *6*; α(L)=0.669 *10*; α(M)=0.1573 *22*; α(N+..)=0.0495 *7* α(N)=0.0402 *6*; α(O)=0.00822 *12*; α(P)=0.000979 *14* Mult.: α(K)exp=4.1 *4*, α(L12)exp=0.66 *10*.
137.023 *3*	32.5 *7*	215.28	2^+	78.26	3^+	M1	4.15		α(K)=3.37 *5*; α(L)=0.591 *9*; α(M)=0.1390 *20*; α(N+..)=0.0437 *7* α(N)=0.0356 *5*; α(O)=0.00727 *11*; α(P)=0.000865 *13* Mult.: α(L12)exp=0.59 *6*, α(M)exp=0.150 *16*.

γ(^{204}Bi) (continued)

E_γ‡	I_γ‡@	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	α†	Comments
^{x}152.321 *19*	0.89 *7*							
203.561 *10*	9.4 *3*	1099.27	$1^-,2^-$	895.70	1^+	E1	0.0766	α(K)=0.0621 *9*; α(L)=0.01112 *16*; α(M)=0.00262 *4*; α(N+..)=0.000807 *12* α(N)=0.000662 *10*; α(O)=0.0001307 *19*; α(P)=1.403×10^{-5} *20* Mult.: α(K)exp≈0.15, α(L12)exp=0.013 *4*, α(L3)exp=0.032 *10*. Note that an M2 admixture is possible.
^{x}209.841 *20*	2.10 *25*					E2	0.380	α(K)=0.1504 *21*; α(L)=0.1709 *24*; α(M)=0.0448 *7*; α(N+..)=0.01372 *20* α(N)=0.01141 *16*; α(O)=0.00213 *3*; α(P)=0.0001761 *25* Mult.: α(L12)exp=0.13 *4*.
229.94 *3*	2.67 *19*	1634.17	1^-	1404.23	1^-	M1	0.966	α(K)=0.787 *11*; α(L)=0.1367 *20*; α(M)=0.0321 *5*; α(N+..)=0.01010 *15* α(N)=0.00822 *12*; α(O)=0.001679 *24*; α(P)=0.000200 *3* Mult.: α(K)exp=0.79 *9*.
^{x}244.724 *14*	6.07 *24*					E1	0.0491	α(K)=0.0400 *6*; α(L)=0.00700 *10*; α(M)=0.001643 *23*; α(N+..)=0.000508 *8* α(N)=0.000416 *6*; α(O)=8.26×10^{-5} *12*; α(P)=9.00×10^{-6} *13* Mult.: α(L12)exp<0.01.
253.836 *22*	1.98 *11*	332.08	3^+	78.26	3^+	(M1)	0.735	α(K)=0.599 *9*; α(L)=0.1038 *15*; α(M)=0.0244 *4*; α(N+..)=0.00766 *11* α(N)=0.00624 *9*; α(O)=0.001275 *18*; α(P)=0.0001518 *22* Mult.: α(K)exp≈0.5, α(L12)exp≈0.1.
270.068 *11*	93 *3*	1369.34	1^-	1099.27	$1^-,2^-$	M1	0.619	α(K)=0.505 *7*; α(L)=0.0874 *13*; α(M)=0.0205 *3*; α(N+..)=0.00645 *9* α(N)=0.00525 *8*; α(O)=0.001073 *15*; α(P)=0.0001278 *18* Mult.: α(K)exp=0.52, α(L)exp=0.092 *7*, α(M)exp=0.0239 *26*.
304.964 *12*	10.9 *4*	1404.23	1^-	1099.27	$1^-,2^-$	M1	0.444	α(K)=0.362 *5*; α(L)=0.0625 *9*; α(M)=0.01468 *21*; α(N+..)=0.00461 *7* α(N)=0.00375 *6*; α(O)=0.000767 *11*; α(P)=9.14×10^{-5} *13* Mult.: α(K)exp=0.38 *5*, α(L)exp=0.066 *10*.
309.80 *14*	1.84 *16*	1404.23	1^-	1094.57	2^-	M1	0.425	α(K)=0.347 *5*; α(L)=0.0598 *9*; α(M)=0.01406 *20*; α(N+..)=0.00442 *7* α(N)=0.00360 *5*; α(O)=0.000735 *11*; α(P)=8.75×10^{-5} *13* Mult.: α(K)exp=0.39 *7*.
317.016 *9*	14.3 *13*	332.08	3^+	15.07	4^+	M1	0.399	α(K)=0.326 *5*; α(L)=0.0562 *8*; α(M)=0.01319 *19*; α(N+..)=0.00415 *6* α(N)=0.00337 *5*; α(O)=0.000690 *10*; α(P)=8.21×10^{-5} *12* Mult.: α(K)exp=0.355 *5*, α(L)exp=0.065 *8*, α(M)exp=0.0155 *28*.
^{x}362.14 *4*	4.24 *17*					(M1)	0.278	α(K)=0.227 *4*; α(L)=0.0390 *6*; α(M)=0.00917 *13*; α(N+..)=0.00288 *4* α(N)=0.00234 *4*; α(O)=0.000479 *7*; α(P)=5.71×10^{-5} *8* Mult.: α(K)exp≈0.26.
^{x}419.13 *11*	1.74 *17*							
426.82 *3*	6.3 *4*	1526.11	2^-	1099.27	$1^-,2^-$	M1	0.179	α(K)=0.1460 *21*; α(L)=0.0250 *4*; α(M)=0.00587 *9*; α(N+..)=0.00184 *3* α(N)=0.001500 *21*; α(O)=0.000307 *5*; α(P)=3.66×10^{-5} *6* Mult.: α(K)exp=0.167 *20*, α(L)exp=0.030 *5*.
451.846 *22*	6.40 *24*	1546.42?	$(1)^-$	1094.57	2^-	M1	0.1535	α(K)=0.1254 *18*; α(L)=0.0214 *3*; α(M)=0.00503 *7*; α(N+..)=0.001581 *23* α(N)=0.001287 *18*; α(O)=0.000263 *4*; α(P)=3.14×10^{-5} *5* Mult.: α(K)exp=0.15 *3*.
459.90 *5*	3.22 *15*	1478.37	$(1,2)^+$	1018.45	$(3)^+$	(M1)	0.1464	α(K)=0.1197 *17*; α(L)=0.0204 *3*; α(M)=0.00480 *7*; α(N+..)=0.001507 *22* α(N)=0.001227 *18*; α(O)=0.000251 *4*; α(P)=2.99×10^{-5} *5* Mult.: α(K)exp≈0.15.
534.92 *6*	44.3 *22*	1634.17	1^-	1099.27	$1^-,2^-$	M1	0.0980	α(K)=0.0802 *12*; α(L)=0.01364 *20*; α(M)=0.00320 *5*; α(N+..)=0.001005 *14*

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γ(^{204}Bi) (continued)

E_γ ‡	I_γ ‡@	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	α †	Comments
								α(N)=0.000818 *12*; α(O)=0.0001673 *24*; α(P)=1.99×10^{-5} *3* Mult.: α(M)exp=0.0033 *5*.
539.5 *4*	4.5 *3*	1634.17	1$^-$	1094.57	2$^-$	M1	0.0959	α(K)=0.0784 *11*; α(L)=0.01334 *19*; α(M)=0.00313 *5*; α(N+..)=0.000983 *14* α(N)=0.000800 *12*; α(O)=0.0001635 *24*; α(P)=1.95×10^{-5} *3* Mult.: α(K)exp=0.098 *20*, α(L)exp=0.019 *5*.
582.70 *6*	2.16 *11*	1478.37	(1,2)$^+$	895.70	1$^+$	M1	0.0782	α(K)=0.0640 *9*; α(L)=0.01087 *16*; α(M)=0.00255 *4*; α(N+..)=0.000800 *12* α(N)=0.000651 *10*; α(O)=0.0001332 *19*; α(P)=1.589×10^{-5} *23* Mult.: α(K)exp=0.067 *11*, α(L)exp=0.0089 *23*.
680.39 *4*	25.5 *7*	895.70	1$^+$	215.28	2$^+$	M1	0.0521	α(K)=0.0427 *6*; α(L)=0.00721 *10*; α(M)=0.001689 *24*; α(N+..)=0.000531 *8* α(N)=0.000432 *6*; α(O)=8.83×10^{-5} *13*; α(P)=1.055×10^{-5} *15* Mult.: α(K)exp=0.049 *6*, α(L)exp=0.0079 *12*.
^{x}751.59 *6*	3.54 *23*					M1	0.0402	α(K)=0.0330 *5*; α(L)=0.00555 *8*; α(M)=0.001300 *19*; α(N+..)=0.000408 *6* α(N)=0.000332 *5*; α(O)=6.80×10^{-5} *10*; α(P)=8.12×10^{-6} *12* Mult.: α(K)exp=0.048 *12*.
762.52 *3*	38.5 *11*	1094.57	2$^-$	332.08	3$^+$	E1	0.00430 *6*	α=0.00430 *6*; α(K)=0.00357 *5*; α(L)=0.000559 *8*; α(M)=0.0001297 *19*; α(N+..)=4.05×10^{-5} *6* α(N)=3.30×10^{-5} *5*; α(O)=6.69×10^{-6} *10*; α(P)=7.78×10^{-7} *11* Mult.: α(K)exp=0.0041 *7*, α(L)exp=0.0014 *3*.
768.1 *3*	1.23 *26*	983.21	(2$^-$,3$^-$)	215.28	2$^+$	[E1]	0.00424 *6*	α=0.00424 *6*; α(K)=0.00352 *5*; α(L)=0.000551 *8*; α(M)=0.0001279 *18*; α(N+..)=3.99×10^{-5} *6* α(N)=3.25×10^{-5} *5*; α(O)=6.59×10^{-6} *10*; α(P)=7.67×10^{-7} *11*
817.6&		895.70	1$^+$	78.26	3$^+$	[E2]	0.01044	α(K)=0.00809 *12*; α(L)=0.001780 *25*; α(M)=0.000430 *6*; α(N+..)=0.0001340 *19* α(N)=0.0001098 *16*; α(O)=2.19×10^{-5} *3*; α(P)=2.37×10^{-6} *4*
817.61 *5*	2.36 *10*	1018.45	(3)$^+$	200.84	(4)$^+$	(E2+M1)	0.021 *11*	α(K)=0.017 *10*; α(L)=0.0031 *14*; α(M)=0.0007 *3*; α(N+..)=0.00023 *10* α(N)=0.00019 *8*; α(O)=3.8×10^{-5} *17*; α(P)=4.4×10^{-6} *21* Mult.: α(K)exp=0.0123 *22*.
883.960 *25*	100.0 *21*	1099.27	1$^-$,2$^-$	215.28	2$^+$	E1	0.00326 *5*	α=0.00326 *5*; α(K)=0.00271 *4*; α(L)=0.000421 *6*; α(M)=9.75×10^{-5} *14*; α(N+..)=3.04×10^{-5} *5* α(N)=2.48×10^{-5} *4*; α(O)=5.04×10^{-6} *7*; α(P)=5.89×10^{-7} *9* Mult.: α(K)exp=0.0031 *4*, α(L)exp=0.0048 *10*.
905.15 *7*	4.14 *25*	983.21	(2$^-$,3$^-$)	78.26	3$^+$	(E1+M2)	0.03 *3*	α(K)=0.026 *24*; α(L)=0.005 *5*; α(M)=0.0012 *11*; α(N+..)=0.0004 *4* α(N)=0.0003 *3*; α(O)=6.E−5 *6*; α(P)=7.E−6 *7* Mult.: α(K)exp=0.0322 *5*, α(L)exp=0.0070 *18*. The K/L ratio favors E1+M2 assignment, but α(K)exp and α(L)exp values are also consistent with M1+E2 mult.
1003.31 *8*	1.71 *12*	1018.45	(3)$^+$	15.07	4$^+$	M1	0.0191	α(K)=0.01564 *22*; α(L)=0.00261 *4*; α(M)=0.000611 *9*; α(N+..)=0.000192 *3* α(N)=0.0001562 *22*; α(O)=3.20×10^{-5} *5*; α(P)=3.82×10^{-6} *6* Mult.: α(K)exp=0.020 *7*.

From ENSDF

γ(^{204}Bi) (continued)

E_γ‡	I_γ‡@	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	α†	Comments
1016.29 *3*	80.5 *18*	1094.57	2^-	78.26	3^+	E1	0.00253 *4*	α=0.00253 *4*; α(K)=0.00211 *3*; α(L)=0.000324 *5*; α(M)=7.50×10^{-5} *11*; α(N+..)=2.34×10^{-5} *4* α(N)=1.91×10^{-5} *3*; α(O)=3.88×10^{-6} *6*; α(P)=4.57×10^{-7} *7* Mult.: α(K)exp=0.0023 *4*, α(L)exp=0.00043 *9*.
1040.01 *4*	32.1 *11*	1255.30	1^+	215.28	2^+	M1	0.01738	α(K)=0.01427 *20*; α(L)=0.00238 *4*; α(M)=0.000556 *8*; α(N+..)=0.0001748 *25* α(N)=0.0001423 *20*; α(O)=2.91×10^{-5} *4*; α(P)=3.48×10^{-6} *5* Mult.: α(K)exp=0.0161 *26*, α(L)exp=0.0031 *7*, α(M)exp=0.00078 *15*.
^{x}1046.45 *22*	1.05 *13*							
1177.7 *5*	0.39 *19*	1255.30	1^+	78.26	3^+	(E2)	0.00512 *8*	α=0.00512 *8*; α(K)=0.00411 *6*; α(L)=0.000765 *11*; α(M)=0.000182 *3*; α(N+..)=5.90×10^{-5} *9* α(N)=4.63×10^{-5} *7*; α(O)=9.34×10^{-6} *14*; α(P)=1.060×10^{-6} *15*; α(IPF)=2.21×10^{-6} *5* Mult.: α(K)exp≈0.008.
1194.35 *14*	0.44 *6*	1526.11	2^-	332.08	3^+	[E1]	0.00192 *3*	α=0.00192 *3*; α(K)=0.001588 *23*; α(L)=0.000242 *4*; α(M)=5.59×10^{-5} *8*; α(N+..)=3.09×10^{-5} *5* α(N)=1.423×10^{-5} *20*; α(O)=2.90×10^{-6} *4*; α(P)=3.42×10^{-7} *5*; α(IPF)=1.342×10^{-5} *20*
1419.0 *4*	≈0.3	1634.17	1^-	215.28	2^+			
^{x}1461.13 *20*	≈0.2							

† Additional information 1.
‡ From 1979Va21, unless otherwise specified.
# From measured conversion coefficients and sub-shell ratios in 1979Va21 and 1990Br19, unless otherwise specified.
@ For absolute intensity per 100 decays, multiply by 0.343 *4*.
& Placement of transition in the level scheme is uncertain.
^{x} γ ray not placed in level scheme.

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^{204}Po ε decay 1979Va21

Decay Scheme

Intensities: I_γ per 100 parent decays