^{196}Bi ε decay (240 s) 1987Va09,1984Va11,1976Ch30

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Huang Xiaolong	NDS 108, 1093 (2007)	1-Jan-2006

Parent: ^{196}Bi: E=271 *5*; J^π=(10$^-$); $T_{1/2}$=240 s *3*; Q(ε)=7352 *28*; %ε+%$β^+$ decay=74.2 *25*

^{196}Bi-$T_{1/2}$: From mean half-life of 372γ, 338γ and 138γ (1987Va09).

^{196}Bi-E: ^{196}Bi Adopted Levels.

Additional information 1.

1987Va09 present a composite decay scheme for the 308-s and 240-s isomers. The evaluators have attempted to separate the decay schemes on the basis of intensity balance and assuming that the two isomers populate levels with different range of spins. The 308-s isomer populating the low spin levels (J≤4), and 240-s isomer populating the high-spin levels (J≥7). The low-lying levels, however, will be seen in the decay of all activities.

Because of some unplaced γ rays the decay scheme is incomplete.

1987Va09: sources produced in reaction ^{16}O on nat Re, E(^{16}O)<210 MeV. Mass separation. Measured Eγ, Iγ, x-rays (Ge detectors, FWHM=2.0 keV at 1332 keV, FWHM=580 eV at 122 keV), E(ce), Ice (Si(Li), FWHM=2.5 keV at 624 keV), γγ coin, ceγ coin, triparameter coin.

1976Ch30: prepared by ^{185}Re(^{16}O,5n) and ^{187}Re(^{16}O,7n), E(^{16}O)<210 MeV; and ^{181}Ta(^{22}Ne,7n), E(^{22}Ne)=150 MeV.

Others: 1971ChYB, 1971BrZC, 1973KhZY.

^{196}Pb Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0.0	0$^+$	37 min *3*	
1049.23 *17*	2$^+$		
1142.87 *23*	0$^+$		J^π: 1143γ is E0; T, coincidence with Pb K x ray and absence of coincidence with 1049γ.
1449.93 *18*	2$^+$		J^π: 1450γ to g.s. is E2.
1738.62 *21*	4$^+$		placed In ^{196}Bi low spin ε decay also. Iγ deduced from intensity balance and branching ratios At 1739-keV level.
1797.96 *24*	5$^-$		
2170.2 *3*	7$^-$		
2308.6 *4*	9$^-$		
2334.7 *4*	8$^-$		J^π: from systematics of the 8$^-$ state In ^{192}Pb, ^{194}Pb and 165γ to 7$^-$ (1987Va09). from high spin ε-decay, γ to high spin.
2591.8 *4*	8$^-$		J^π: 422γ to 7$^-$ is E1, 283γ to 9$^-$.
2646.1 *4*	10$^+$		
3088.1 *4*	9$^-$,(10$^-$)		J^π: (9,10)$^-$ from 496γ M1+(E2) to 8$^-$.
3395.1 *4*	10$^-$		

[†] From a least-squares fit to γ-ray energies of 1987Va09.
[‡] From ^{196}Pb Adopted Levels, except as noted.
[#] From 1961Sv01, 1957An53.

ε,$β^+$ radiations

E(decay)	E(level)	I$β^+$ [†]	Iε[†]	Log *ft*	I(ε+$β^+$)[†]	Comments
(4.23×10^3 *3*)	3395.1	0.36 *11*	0.9 *3*	7.20 *14*	1.3 *4*	av Eβ=1444 *13*; εK=0.582 *5*; εL=0.1046 *8*; εM+=0.0341 *3*
(4.53×10^3 *3*)	3088.1	1.4 *3*	2.8 *5*	6.79 *9*	4.2 *8*	av Eβ=1582 *13*; εK=0.537 *5*; εL=0.0963 *8*; εM+=0.0313 *3*
(4.98×10^3 *3*)	2646.1	10.2 *6*	14.4 *9*	6.16 *3*	24.6 *15*	av Eβ=1783 *13*; εK=0.473 *4*; εL=0.0845 *8*; εM+=0.02749 *24*
(5.03×10^3 *3*)	2591.8	4.8 *6*	6.6 *8*	6.51 *5*	11.4 *13*	av Eβ=1807 *13*; εK=0.465 *4*; εL=0.0832 *8*; εM+=0.02703 *24* Log *ft*: log $f^{1u}t$=7.6 *4*.
(5.29×10^3 *3*)	2334.7	3.2 *6*	3.7 *6*	6.80 *8*	6.9 *12*	av Eβ=1925 *13*; εK=0.430 *4*; εL=0.0767 *7*; εM+=0.02495

Continued on next page (footnotes at end of table)

^{196}Bi ε decay (240 s) 1987Va09,1984Va11,1976Ch30 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ †	Iε†	Log *ft*	I(ε+β+)†	Comments
					23	
(5.31×10^3 *3*)	2308.6	6.9 *10*	7.8 *12*	6.48 *7*	14.7 *22*	av Eβ=1937 *13*; εK=0.426 *4*; εL=0.0761 *7*; εM+=0.02474 *23*
(5.45×10^3 *3*)	2170.2	5.4 *15*	5.6 *15*	6.65 *12*	11 *3*	av Eβ=2000 *13*; εK=0.408 *4*; εL=0.0728 *7*; εM+=0.02367 *22*

† Absolute intensity per 100 decays.

γ(^{196}Pb)

Iγ normalization: calculated from ΣI(γ+ce)=100% to g.s., assuming no (ε+β$^+$)-feeding to the ^{196}PB g.s.

E_γ[‡]	I_γ[#@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ	α[&]	Comments
59.2 *3*	31 *3*	1797.96	5$^-$	1738.62	4$^+$	E1		0.376 *8*	α(L)=0.287 *6*; α(M)=0.0683 *14*; α(N+..)=0.0202 *4*
138.4 *2*	10.1 *4*	2308.6	9$^-$	2170.2	7$^-$	E2		1.67	α(K)=0.366 *6*; α(L)=0.971 *15*; α(M)=0.256 *4*; α(N+..)=0.0766 *12* α(L)exp=1.2 *1*; α(M)exp=0.28 *3* I_γ: imbalance with 337.5γ 15.2 and 283.2γ 1.5.
164.5 *2*	1.3 *2*	2334.7	8$^-$	2170.2	7$^-$	M1		2.29	α(K)=1.87 *3*; α(L)=0.322 *5*; α(M)=0.0754 *11*; α(N+..)=0.0234 *4*
283.2 *2*	1.5 *2*	2591.8	8$^-$	2308.6	9$^-$	M1		0.503	α(K)=0.412 *6*; α(L)=0.0703 *10*; α(M)=0.01647 *24*; α(N+..)=0.00511 *8*
288.7 *2*	0.6 *2*	1738.62	4$^+$	1449.93	2$^+$	E2		0.1298	α(K)=0.0712 *10*; α(L)=0.0439 *7*; α(M)=0.01130 *17*; α(N+..)=0.00341 *5*
306.9[a] *3*	0.04[a] *1*	1449.93	2$^+$	1142.87	0$^+$	E2		0.1081	α(K)=0.0617 *9*; α(L)=0.0348 *5*; α(M)=0.00892 *13*; α(N+..)=0.00270 *4* α(K)exp=0.18 *3*; α(L)exp=0.020 *3* B(E2;307γ)/B(E2;1450γ)=377 (1984Va11). Mult.: this transition has a doublet structure.
306.9[a] *3*	0.3[a] *1*	3395.1	10$^-$	3088.1	9$^-$,(10$^-$)	M1		0.404	α(K)exp=0.18 *3*; α(L)exp=0.020 *3* α(K)=0.330 *5*; α(L)=0.0564 *8*; α(M)=0.01320 *19*; α(N+..)=0.00410 *6* α: α=0.4176 for M1, α=0.1093 for E2.
337.5 *2*	15.2 *4*	2646.1	10$^+$	2308.6	9$^-$	E1		0.0225	α(K)=0.0185 *3*; α(L)=0.00309 *5*; α(M)=0.000721 *11*; α(N+..)=0.000220 *4* α(L)exp=0.004 *1*
372.2 *2*	43.3 *10*	2170.2	7$^-$	1797.96	5$^-$	E2		0.0626	α(K)=0.0396 *6*; α(L)=0.01724 *25*; α(M)=0.00437 *7*; α(N+..)=0.001325 *19* α(L)exp=0.017 *2*; α(M)exp=0.0058 *9* I_γ: From intensity balance at 1797.9 level.
400.9 *2*	0.3 *1*	1449.93	2$^+$	1049.23	2$^+$	E0+M1+E2		0.12 *8*	α(K)exp=0.29 *2*; α(L)exp=0.068 *9*; α(M)exp=0.012 *3* α(K)=0.10 *7*; α(L)=0.020 *7*; α(M)=0.0049 *15*; α(N+..)=0.0015 *5* the conversion coefficient of the 401γ shows the presence of a strong E0 component.
421.7 *2*	7.7 *4*	2591.8	8$^-$	2170.2	7$^-$	E2		0.0449	α(K)=0.0300 *5*; α(L)=0.01124 *16*; α(M)=0.00283 *4*; α(N+..)=0.000859 *13* α(K)exp=0.019 *9*
496.3 *2*	2.8 *4*	3088.1	9$^-$,(10$^-$)	2591.8	8$^-$	M1+(E2)	0.89	0.0752	α(K)=0.0601 *9*; α(L)=0.01150 *17*; α(M)=0.00273 *4*; α(N+..)=0.000844 *12* α(K)exp=0.062 *9*; α(L)exp=0.018 *4* α(K)exp=0.062 *9*,α(L)exp=0.018 *4*. Mult.: From α(K)exp. δ: from α(K)exp and α(L)exp. α: α(K)exp+α(L)exp=0.080 *10*.
689.3 *2*	41.5 *13*	1738.62	4$^+$	1049.23	2$^+$	E2		0.01422	α(K)=0.01081 *16*; α(L)=0.00259 *4*; α(M)=0.000629 *9*;

$^{196}_{82}Pb_{114}$-3

^{196}Bi ε decay (240 s) 1987Va09,1984Va11,1976Ch30 (continued)

γ(^{196}Pb) (continued)

E_γ[‡]	I_γ[#@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[&]	$I_{(\gamma+ce)}$[@]	Comments
									α(N+..)=0.000193 *3* α(L)exp=0.0026 *4*; α(M)exp=0.0009 *2*
748.8 *2*	3.3 *4*	1797.96	5^-	1049.23	2^+	E3	0.0312		α(K)exp=0.024 *3* α(K)=0.0211 *3*; α(L)=0.00762 *11*; α(M)=0.00192 *3*; α(N+..)=0.000589 *9* α(K)=0.0208, α(L)=0.00754. α: E3 α(theory)′s mult. By 0.975 *10* (Cf. 1990Ne01).
749.0 *2*	<0.4	3395.1	10^-	2646.1	10^+				
803.1 *5*	0.2 *1*	3395.1	10^-	2591.8	8^-	E2	0.01033		α(K)=0.00804 *12*; α(L)=0.001745 *25*; α(M)=0.000420 *6*; α(N+..)=0.0001290 *19*
1049.4 *2*	45.7 *18*	1049.23	2^+	0.0	0^+	E2	0.00608		α(K)=0.00486 *7*; α(L)=0.000927 *13*; α(M)=0.000220 *3*; α(N+..)=6.78×10^{-5} *10* α(L)exp=0.00093 *9*; α(M)exp=0.0004 *1* ΔIγ: From 665.4γ of 3042 level (evaluators).
1142.7 *3*		1142.87	0^+	0.0	0^+	E0		0.044 *11*	Mult.: from comparison of γ and ce- spectrum. E_γ: 1143.4 *2* keV from 1984Va11.
1449.7 *3*	0.3 *1*	1449.93	2^+	0.0	0^+	E2	0.00335		α(K)=0.00269 *4*; α(L)=0.000464 *7*; α(M)=0.0001089 *16*; α(N+..)=8.26×10^{-5} *12* α(K)exp=0.0026 *4*

[†] From ^{196}Pb adopted gammas,except as noted.
[‡] From 1987Va09. See ^{196}Bi ε decay (308 s) for unplaced γ′s.
[#] Intensities are relative to 100 for 1049.4γ with ^{196}Bi ε decay (high-spin + low-spin).
[@] For absolute intensity per 100 decays, multiply by 1.60 *9*.
[&] 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.
[a] Multiply placed with intensity suitably divided.

$^{196}_{82}Pb_{114}$-4

^{196}Bi ε decay (240 s) 1987Va09,1984Va11,1976Ch30

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided