^{140}Ba β^- decay 1990Me03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 154, 1 (2018)	20-Nov-2018

Parent: ^{140}Ba: E=0.0; $J^\pi=0^+$; $T_{1/2}$=12.751 d *4*; Q(β^-)=1047 *8*; %β^- decay=100.0

Measured: γ (1991Ch05,1990Me03, 1984Ol08, 1982Ad02,1979Bo26, 1977De34,1977Ge12,1976Li06,1975Ha50,1970Ke09,1969Ka33), ce (1991Ch05,1982Ad02,1966GeZZ,1961Ge01), $\gamma\gamma$ and ceγ (1982Ad02,1965Bu07,1961Ge01,1959Bo61), $\gamma\gamma(\theta)$ (1982Ad02,1965Zu03,1965Bu07,1964Ag01), γ(t) (1982Ad02,1965Bu07), β and $\beta\gamma$ (1965Bu07,1957Pe20,1956Se28), $\beta\gamma(\theta)$ (1964Ag01).

Measured I(Kα x ray)=10.0 *20*, I(Kβ x ray)≤2.0 *3* (1969Ka33); L x ray, K x ray (1991Ch05). Calculated from this decay scheme data (absolute intensity per 100 decays): I(Kα x ray)=1.249 *34*, I(Kβ x ray)=0.301 *10*;

The level scheme is that of 1990Me03.

As there are no levels known in between the highest observed level at 581 keV up to more than 1000 keV allowed by the Q(β^-) value the level scheme can be incomplete.

^{140}La Levels

E(level)	J^π‡	$T_{1/2}$	Comments
0.0	3^-	1.67858 d *21*	%β^-=100 $T_{1/2}$,%β^-: Adopted values.
29.9677 *8*	2^-	0.25 ns *4*	$T_{1/2}$: from 1982Ad02. Other: ≤0.42 ns (1965Bu07).
43.8132 *18*	1^-	0.52† ns *14*	
63.168 *20*	4^-		
162.6585 *8*	2^-	≤10† ps	
467.5350 *17*	1^-	≤7.7† ps	
581.073 *9*	0^-		

† From 1965Bu07 (by delayed coin technique).

‡ Adopted values.

β^- radiations

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(466 *8*)	581.073	24.7 *3*	7.07 *3*	av Eβ=140.7 *28* E(decay): 480 *30* (1965Bu07), 480 (1959Bo61).
(579 *8*)	467.5350	9.6 *2*	7.805 *23*	av Eβ=181.0 *29* E(decay): 590 (1959Bo61), 594 (1965Bu07).
(884 *8*)	162.6585	3.8 *2*	9.30[1u] *3*	av Eβ=310.3 *31* E(decay): 830 (1959Bo61), 870 (1965Bu07).
(1003 *8*)	43.8132	40 *10*	8.03 *11*	av Eβ=344.6 *33* E(decay): 1020 (1965Bu07).
(1017 *8*)	29.9677	20 *11*	8.91[1u] *24*	av Eβ=361.6 *32* Iβ^-: I(1020β)/I(1006β)=0.58 *15* (1965Bu07). E(decay): 1030 *30* (1965Bu07), 1020 (1959Bo61).

† Absolute intensity per 100 decays.

$\gamma(^{140}La)$

Iγ normalization: Absolute I(537γ)=24.39% *22* (1977De34), no β^- to 3^- (g.s.).

E_γ	I_γ[‡][b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[a]	α[&]	Comments
13.846 *15*	5.0 *7*	43.8132	1^-	29.9677	2^-	M1+E2	0.0100 *55*	54.4 *18*	α(L)=43.1 *14*; α(M)=9.0 *3* α(N)=1.97 *7*; α(O)=0.318 *9*; α(P)=0.0239 *4* %Iγ=1.22 *17*. I_γ: Iγ=4.69 *12* (1991Ch05). E_γ: from 1970Ke09. Mult.: L:M:N=212 *40*:46 *9*:12 *2*, L1:L2:L3=1000 *33*:106 *11*:31 *8* (1982Ad02).
29.966 *1*	57.8 *17*	29.9677	2^-	0.0	3^-	M1+(E2)	≤0.009	5.37	α(L)=4.26 *6*; α(M)=0.886 *13* α(N)=0.194 *3*; α(O)=0.0315 *5*; α(P)=0.00242 *4* %Iγ=14.1 *4*. I_γ: 57.8 *17* can not be confirmed neither as from 1977De34 as given by 1994Pe19 nor from other reference. As Iγ=60 *4* from 1990Me03 would produce negative γ feeding to g.s., this presumably determined 1994Pe19 to adjust it to the value adopted here. Mult.: L:M:N=260 *30*:53 *6*:13 *2*; L1/L2=13.8 *34*, L1/L3=55 *9* (1982Ad02); L1:L2:L3:M:N=20:2:1:10:5 (1951Co39); L/M+N=2.4 *3* (1959Bo61).
43.8[c]	<0.008	43.8132	1^-	0.0	3^-	[E2]		44.0	E_γ: from 1970Ke09. α(K)=7.08 *10*; α(L)=28.9 *4*; α(M)=6.46 *9* α(N)=1.360 *19*; α(O)=0.188 *3*; α(P)=0.000465 *7* %Iγ=0.0010 *10*. E_γ: from E(level) difference. I_γ: γ was not observed (1990Me03,1982Ad02). Others: 0.054 *7* (1991Ch05), 0.06 (1969Ka33), ≤0.005 (1970Ke09); ≤0.01 (1966Mo16). Mult.: from Adopted.
63.17 *22*	0.00012 *6*	63.168	4^-	0.0	3^-	M1		4.06 *7*	α(K)=3.47 *6*; α(L)=0.473 *9*; α(M)=0.0983 *17* α(N)=0.0216 *4*; α(O)=0.00351 *6*; α(P)=0.000271 *5* %Iγ=0.00003 *2*. Mult.: from Adopted.
99.49 *2*	0.00008 *5*	162.6585	2^-	63.168	4^-				%Iγ=0.00002 *1*.
113.51 *3*	0.066 *5*	581.073	0^-	467.5350	1^-	M1		0.754	α(K)=0.644 *9*; α(L)=0.0871 *13*; α(M)=0.0181 *3* α(N)=0.00398 *6*; α(O)=0.000647 *9*; α(P)=5.02×10^{-5} *7* %Iγ=0.0161 *12*. Mult.: α(K)exp=0.62 *25*.
118.837 *3*	0.25 *3*	162.6585	2^-	43.8132	1^-	M1		0.662	α(K)=0.566 *8*; α(L)=0.0765 *11*; α(M)=0.01590 *23* α(N)=0.00349 *5*; α(O)=0.000568 *8*; α(P)=4.41×10^{-5} *7* %Iγ=0.061 *7*. Mult.: α(K)exp=0.57 *11*.

^{140}Ba β^- decay 1990Me03 (continued)

$\gamma(^{140}La)$ (continued)

E_γ	I_γ ‡ [b]	E_i(level)	J_i^π	E_f	J_f^π	Mult. †	δ [a]	α &	Comments
132.687 @ *1*	0.83 *2*	162.6585	2−	29.9677	2−	M1		0.486	α(K)=0.415 *6*; α(L)=0.0560 *8*; α(M)=0.01164 *17* α(N)=0.00256 *4*; α(O)=0.000416 *6*; α(P)=3.23×10^{-5} *5* %Iγ=0.202 *5*. Mult.: α(K)exp=0.41 *6* (1982Ad02).
162.660 *1*	25.5 *3*	162.6585	2−	0.0	3−	M1+(E2)	≤0.08	0.276	α(K)=0.236 *4*; α(L)=0.0318 *5*; α(M)=0.00660 *10* α(N)=0.001451 *22*; α(O)=0.000236 *4*; α(P)=1.83×10^{-5} *3* %Iγ=6.21 *9*. E_γ: from 1990Me03. Other: 162.369 *6* (1979Bo26). Mult.: K:L:M=6.7 *3*:1.00 *6*:0.23 *2* (1982Ad02); K:L:M=10:5:2 (1951Co39); K/L+M=3.5 *8* (1959Bo61); L1/L2=13.3 *7*, L1/L3=60 *10* (1966GeZZ). I_γ: absolute Iγ=6.21% *8* (1977De34).
x183.83 # *9*	0.004 # *2*								%Iγ=0.0010 *5*.
x275.18 # *18*	0.0015 # *6*								%Iγ=0.0004 *2*.
304.849 @ *3*	17.6 *2*	467.5350	1−	162.6585	2−	M1+(E2)	≤+0.1	0.0507	α(K)=0.0434 *6*; α(L)=0.00574 *8*; α(M)=0.001191 *17* α(N)=0.000262 *4*; α(O)=4.27×10^{-5} *6*; α(P)=3.35×10^{-6} *5* %Iγ=4.29 *6*. I_γ: absolute Iγ=4.30% *5* (1977De34). Mult.,I_γ: α(K)exp=0.043 *3*; K/L=9.9 *26* (1982Ad02); L1/L2=14.6 *7*, L1/L3≥23 (1966GeZZ); α(K)exp=0.041 *2* (1991Ch05). δ: from $\gamma\gamma(\theta)$ (1982Ad02), see also 1965Bu07.
418.44 *4*	0.015 *1*	581.073	0−	162.6585	2−				%Iγ=0.0037 *3*.
423.722 *1*	12.7 *1*	467.5350	1−	43.8132	1−	M1		0.0217	α(K)=0.0186 *3*; α(L)=0.00243 *4*; α(M)=0.000504 *7* α(N)=0.0001108 *16*; α(O)=1.81×10^{-5} *3*; α(P)=1.430×10^{-6} *20* %Iγ=3.10 *4*. Mult.: α(K)exp=0.018 *2* (1991Ch05); α(K)exp=0.025 *4* (1982Ad02) K:L=0.32 *4*:≈0.044 (1982Ad02). I_γ: absolute Iγ=3.15% *4* (1977De34).
437.575 @ *2*	7.91 *4*	467.5350	1−	29.9677	2−	M1		0.0200	α(K)=0.01717 *24*; α(L)=0.00224 *4*; α(M)=0.000464 *7* α(N)=0.0001020 *15*; α(O)=1.664×10^{-5} *24*; α(P)=1.317×10^{-6} *19* %Iγ=1.93 *2*. Mult.: α(K)exp=0.015 *1* (1991Ch05). I_γ: absolute Iγ=1.93% *4* (1977De34).
467.5 [c]	≤0.002	467.5350	1−	0.0	3−				%Iγ=0.0002 *2*. E_γ: transition is not observed neither in 1982Ad02, nor in 1990Me03; Eγ from E(level) difference.
537.261 *9*	100.0 *3*	581.073	0−	43.8132	1−	M1		0.01196	%Iγ=24.39 *22* α(K)=0.01028 *15*; α(L)=0.001332 *19*; α(M)=0.000276 *4* α(N)=6.06×10^{-5} *9*; α(O)=9.90×10^{-6} *14*; α(P)=7.86×10^{-7} *11* E_γ: from 1982Ad02. Other: 537.261 *33* (1979Bo26). I_γ,Mult.: absolute Iγ=24.39% *22* (1977De34). Others: 23.4% *10* (1982Ad02); 25.7% *6* (1975Ha50); α(K)exp=0.0104 *4*;

$^{140}_{57}La_{83}$-3

^{140}Ba β^- decay 1990Me03 (continued)

$\gamma(^{140}La)$ (continued)

E_γ	I_γ [‡ b]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						K/L/M+N=1.04 *4*/0.13 *1*/0.06 *1* (1991Ch05); α(K)exp=0.0129 *7*; K/L=6.8 *7* (1982Ad02). Others: α(K)exp=0.006 *2*, K/L+=5.2 *5* (1955Ro17); K/L+M=4 (1951Co39).
551.08 *4*	0.0128 *8*	581.073	0^-	29.9677	2^-	%Iγ=0.0031 *2*.
[x]699.89[#] *13*	0.0034[#] *9*					%Iγ=0.0008 *2*.

[†] α(K)exp were normalized to α(K)(M1)=0.24 for 162.672γ.
[‡] From 1990Me03, except where noted otherwise. 1977De34, 1984Ol08, and 1990Me03 all give precise values for Iγ that are in agreement to each other. Only 1990Me03 give values for all Iγ's (while the other two only for the five most intense Iγ's) reason for which they were adopted here.
[#] Assignment to ^{140}Ba decay is uncertain.
[@] Differ by 3σ or more from calculated value.
[&] Additional information 1.
[a] Additional information 2.
[b] For absolute intensity per 100 decays, multiply by 0.2439 *22*.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{140}_{57}La_{83}$-4

^{140}Ba β^- decay 1990Me03

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays