Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 108, 681 (2007)	1-Jun-2006

Q(β^-)=2194 *5*; S(n)=5221 *5*; S(p)=5682 *5*; Q(α)=4077 *17* 2012Wa38
Note: Current evaluation has used the following Q record.
Q(β^-)=2195 *4*; S(n)=5220 *5*; S(p)=5681 *5*; Q(α)=4110 *SY* 2003Au03
Additional information 1.

^{234}Pa Levels

Cross Reference (XREF) Flags

A ^{234}Th β^- decay
B ^{234}Pa IT decay (1.159 min)

E(level)‡	J^π	$T_{1/2}$	XREF	Comments
0.0	4^+	6.70 h *5*	AB	%β^-=100 J^π: log *ft* values for the β^- decays to the 5^+, 5^-, 3^+, 3^-, 6^- levels are consistent only with $J^\pi=4^+$. Analogy with ^{231}Pa, ^{233}Pa, ^{235}U suggests $J^\pi=4^+$ with π 1/2[530], ν 7/2[743] configuration as the main component for the g.s. of ^{234}Pa. β^- decay to 5^+, π 5/2[622], ν 5/2[633] state in ^{234}U suggests that there might be some admixture of π 3/2[651], ν 5/2[622] state in ^{234}Pa g.s.. $T_{1/2}$: the measured half-lives are 6.7 h (1931Cu01), 6.658 h *12* (1954Zi02), 6.75 h *3* (1962Bj01). The unweighted average of 6.70 h *5* has been adopted (the weighted average is 6.67 h *3*).
73.92 *2*	(3^+)		AB	J^π: 73.92γ is (M1+E2). π 1/2[530], ν 7/2[743] configuration proposed by 1973Go40.
73.92+x	(0^-)	1.159 min *11*	AB	%β^-=99.84 *4*; %IT=0.16 *4* See 1.159-min ^{234}Pa IT decay for references and methods of obtaining the branching ratios. $T_{1/2}$: Value recommended in 2004WoZZ: weighted average (Limitation of Relative Statistical Weight procedure) of $T_{1/2}$=1.175 min *3* (1951Ba83), 1.25 min *10* (1956On07), 1.14 min *1* (1963Bj02), 1.183 min *37* (1969SaZR). Other value: 1.175 min (1969DeZX). J^π: β feeding from ^{234}Th to J=0 and J=1 levels in ^{234}U suggest J<2. $J^\pi=0^-$, π 1/2[530], ν 1/2[631] configuration proposed in 1963Bj02.
103.42+x	(2^-)	<0.5 ns	A	J^π: 29.49γ to (0^-) is E2. This level is possibly the $J^\pi=2^-$ member of a rotational band built on the $J^\pi=0^-$ state at 73.92+x. $T_{1/2}$: by $\gamma\gamma$(t) in ^{234}Th β^- decay.
166.30+x	(1^-)	≤0.1 ns	A	J^π: 92.38γ to (0^-) is M1. K=1, π 1/2[530], ν 1/2[631] configuration proposed in 1965De10 from γ-ray-transition rates to the K=0, π 1/2[530], ν 1/2[631] band. $T_{1/2}$: $\beta\gamma$(t) in ^{234}Th β^- decay.
166.72+x	(1^+)†	0.55 ns *10*	A	J^π: 92.80γ to (0^-) is E1. $T_{1/2}$: $\beta\gamma$(t) in ^{234}Th β^- decay.
177.27+x?			A	
186.73+x	(1^+)†		A	J^π: 20.02γ to (1^+) is M1+E2; strong γ-ray transition to (0^-) level.

† π 3/2[651], ν 1/2[631] and π 1/2[660], ν 1/2[631] are possible configurations for the 166.72+x and 186.73+x levels.
‡ All levels are from ^{234}Th β^- decay. x<10 keV.

Adopted Levels, Gammas (continued)

$\gamma(^{234}Pa)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	δ	α[‡]	Comments
73.92	(3$^+$)	73.92[#] *2*		0.0	4$^+$	(M1+E2)	0.11 *3*	10.6 *4*	α(L)=7.96 *25*; α(M)=1.94 *7*; α(N+..)=0.669 *23* α(N)=0.520 *18*; α(O)=0.124 *4*; α(P)=0.0235 *7*; α(Q)=0.00185 *3*
73.92+x	(0$^-$)	(<10)		73.92	(3$^+$)				Transition was not observed. Its energy was deduced from a limit on experimental detection (1973Go40). See ^{234}Th β^- decay.
103.42+x	(2$^-$)	29.49 *2*		73.92+x	(0$^-$)	E2		4.40×10^3	B(E2)(W.u.)>130. α(L)=3.22×10^3 *5*; α(M)=882 *13*; α(N+..)=299 *5* α(N)=237 *4*; α(O)=53.4 *8*; α(P)=8.54 *13*; α(Q)=0.01691 *25*
166.30+x	(1$^-$)	62.86 *2*	0.75 *12*	103.42+x	(2$^-$)	M1+E2	0.33 *8*	25 *5*	α(L)=19 *4*; α(M)=4.8 *9*; α(N+..)=1.7 *3* α(N)=1.30 *24*; α(O)=0.30 *6*; α(P)=0.054 *9*; α(Q)=0.00277 *12* B(M1)(W.u.)>0.00071; B(E2)(W.u.)>3.5
		92.38 *1*	100 *6*	73.92+x	(0$^-$)	M1		5.27	α(L)=3.98 *6*; α(M)=0.960 *14*; α(N+..)=0.332 *5* α(N)=0.257 *4*; α(O)=0.0618 *9*; α(P)=0.01180 *17*; α(Q)=0.000977 *14* B(M1)(W.u.)>0.042
166.72+x	(1$^+$)	63.29 *2*	100 *10*	103.42+x	(2$^-$)	E1		0.405	B(E1)(W.u.)=6.2×10^{-4} *14* α(L)=0.305 *5*; α(M)=0.0750 *11*; α(N+..)=0.0250 *4* α(N)=0.0197 *3*; α(O)=0.00447 *7*; α(P)=0.000737 *11*; α(Q)=3.14×10^{-5} *5*
		92.80 *2*	57 *4*	73.92+x	(0$^-$)	E1		0.1472	B(E1)(W.u.)=1.12×10^{-4} *24* α(L)=0.1110 *16*; α(M)=0.0271 *4*; α(N+..)=0.00910 *13* α(N)=0.00716 *10*; α(O)=0.001643 *23*; α(P)=0.000281 *4*; α(Q)=1.370×10^{-5} *20*
177.27+x?		73.92[#@]		103.42+x	(2$^-$)				
		103.35 *10*		73.92+x	(0$^-$)				
186.73+x	(1$^+$)	20.02 *2*	3.6 *10*	166.72+x	(1$^+$)	M1+E2	0.08 *2*	246 *70*	
		83.30 *5*	28.6 *15*	103.42+x	(2$^-$)				
		112.81 *5*	100 *8*	73.92+x	(0$^-$)				

[†] From ^{234}Th β^- decay.

[‡] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{234}Pa)$ (continued)

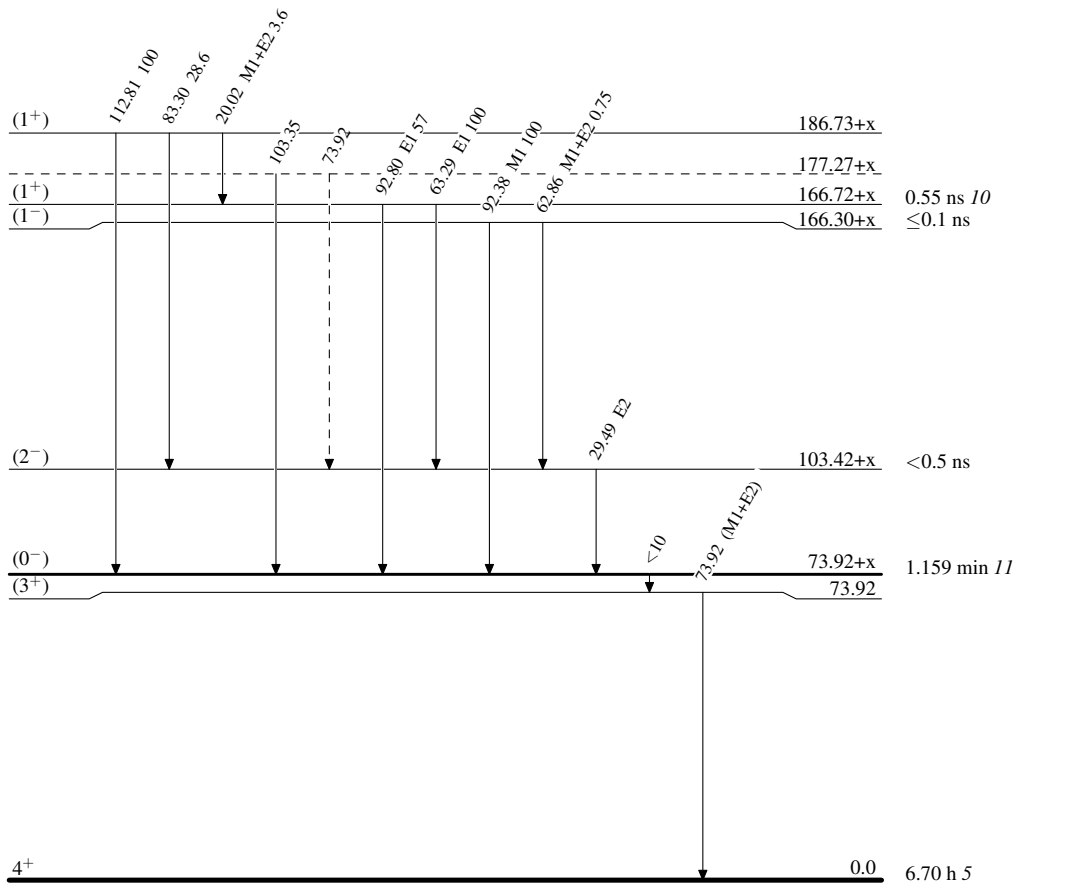
based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[#] Multiply placed.
[@] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level



$^{234}_{91}Pa_{143}$