^{149}Ce β^- decay (5.12 s) 1996YaZV,1977Pf01,2014Ko27

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 185, 2 (2022)	23-Aug-2022

Parent: ^{149}Ce: E=0.0; J^π=(3/2$^-$); $T_{1/2}$=5.12 s *25*; Q(β^-)=4369 *14*; %β^- decay=100.0

^{149}Ce-J^π,$T_{1/2}$: From ^{149}Ce Adopted Levels.

^{149}Ce-Q(β^-): From 2021Wa16.

1996YaZV: ^{149}Ce was produced at KUR-ISOL (Kyoto University Reactor, Isotope Separator On-Line) in the thermal-neutron induced fission of ^{235}U, followed by mass-separation using KUR-ISOL. Measured Eγ, Iγ, $\gamma\gamma$-coin, half-life of decay of ^{149}Ce by decay curve for 58-keV γ, and level half-lives by $\beta\gamma$(t). Deduced levels, and decay scheme.

1977Pf01: measured Eγ, Iγ, $T_{1/2}$. ^{149}Ce obtained as recoil fragments from fission and analyzed according to mass and ionic charge at Lohengrin.

The decay scheme is considered incomplete due to a large Q(β^-) value of 4369 *14* and the highest populated level at 951 keV.

2014Ko27: measured level half-lives by $\gamma\gamma$(t) using $LaBr_3$ and HPGe detectors at KUR-ISOL, and decay curves analyzed by slope method.

1980KeZQ (also 1986Gr11): $\beta\gamma$-coin and Q(β^-) value. Q(β^-)=4190 *75* (1986Gr11 reanalyzed their earlier (1980KeZQ) data).

Others:

1995Ik03: measured Q(β^-) from $\beta\gamma$.

1993RuZW: $T_{1/2}$.

1987Ka20: yield in ^{235}U(n,F).

1979En02: $T_{1/2}$ and yield in ^{235}U(n,F).

1977ArZS: γ, $T_{1/2}$.

1974Ar17: $T_{1/2}$.

1973SeYX: γ, $T_{1/2}$.

The decay scheme is from 1996YaZV. It is considered by the evaluators as incomplete.

^{149}Pr Levels

E(level)†	J^π‡	$T_{1/2}$‡#	Comments
0.0	(5/2$^+$)	2.26 min *8*	
58.11 *6*	(7/2$^-$)	7.4 ns *7*	$T_{1/2}$: from weighted average of 7.2 ns *6* (2014Ko27, average of 7.2 ns *8* from (105γ)(58γ)(t) and 7.2 ns *10* from (173γ)(58γ)(t)); and 9.7 ns *21* (1996YaZV, $\beta\gamma$(t)). Note that the value in the Adopted Levels is 23.4 ns *18* from SF decays (2010Rz02, 1974ClZX). Reason for the discrepancy is not clear, if the same 58.2-keV transition is involved in SF decays and β^- decay.
86.40 *6*	(7/2$^+$)	4.2 ns *5*	$T_{1/2}$: from 2014Ko27; average of 4.0 ns *8* from (76γ)(86γ)(t) and 4.3 ns *7* from (129γ)(86γ)(t).
106.86 *7*			
125.55 *7*		1.0 ns *2*	$T_{1/2}$: from (323γ)(67γ)(t) (2014Ko27).
162.97 *7*			
215.46 *8*			
230.98 *8*			
311.90 *12*			
380.27 *7*			
397.70 *12*			
448.33 *7*			
546.16 *13*			
575.28 *13*			
951.11 *9*			

† From a least-squares fit to γ-ray energies.

‡ From the Adopted Levels.

From $\gamma\gamma$(t) and slope method (2014Ko27), unless otherwise noted. The same values are recommended in the Adopted Levels.

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β^- radiations

E(decay)†	E(level)	Comments
(3418 *14*)	951.11	E(decay): 3530 *250*, 3400 *180* (1980KeZQ).
(3989 *14*)	380.27	E(decay): 3770 *150* (1980KeZQ), 4040 *230* ($\beta\gamma$,1995Ik03).
(4283 *14*)	86.40	E(decay): 3990 *150* (1980KeZQ), 4210 *300* ($\beta\gamma$,1995Ik03).
(4311 *14*)	58.11	E(decay): 4120 *180* (1980KeZQ), 4370 *230* ($\beta\gamma$,1995Ik03).
(4369 *14*)	0.0	E(decay): 4330 *24* (1995Ik03).

† Measured values from $\beta\gamma$ (1980KeZQ) are given under comments. 1980KeZQ analyzed their $\beta\gamma$ data using level energies from a preliminary report (priv. comm. to 1980KeZQ).

$\gamma(^{149}Pr)$

Iγ normalization: The γ-normalization factor (Iγ/100 decays of the parent) cannot be determined, since the decay scheme of ^{149}Pr is considered incomplete, and multipolarities of low-energy transitions are unknown.

E_γ†	I_γ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α@	Comments
28.4 *1*	>4.2	86.40	(7/2$^+$)	58.11	(7/2$^-$)	[E1]	1.347 *23*	α(L)=1.066 *18*; α(M)=0.225 *4* α(N)=0.0483 *8*; α(O)=0.00685 *12*; α(P)=0.000281 *5*
48.8 *1*	7.2 *4*	106.86		58.11	(7/2$^-$)			
52.6 *1*	0.27 *2*	215.46		162.97				
56.2 *1*	0.39 *3*	162.97		106.86				
58.2 *1*	100 *5*	58.11	(7/2$^-$)	0.0	(5/2$^+$)	E1	1.089 *16*	α(K)=0.912 *13*; α(L)=0.1401 *21*; α(M)=0.0294 *4* α(N)=0.00642 *10*; α(O)=0.000964 *14*; α(P)=5.02×10^{-5} *7* Eγ=57.7 *3*, Iγ=100 (1977Pf01).
67.4 *1*	3.7 *2*	125.55		58.11	(7/2$^-$)			
x72.4 *1*	0.12 *2*							
76.5 *1*	1.43 *7*	162.97		86.40	(7/2$^+$)			
86.5 *1*	15.3 *8*	86.40	(7/2$^+$)	0.0	(5/2$^+$)	M1	1.963 *28*	α(K)=1.671 *24*; α(L)=0.2310 *33*; α(M)=0.0487 *7* α(N)=0.01089 *16*; α(O)=0.001751 *25*; α(P)=0.0001284 *18* Eγ=86.4 *3*, Iγ=20.2 (1977Pf01).
104.9 *1*	1.25 *6*	162.97		58.11	(7/2$^-$)			Eγ=104.5 *3*, Iγ=2.2 (1977Pf01).
106.9 *1*	0.52 *3*	106.86		0.0	(5/2$^+$)			
125.6 *1*	0.03 *1*	125.55		0.0	(5/2$^+$)			
128.9 *1*	2.1 *1*	215.46		86.40	(7/2$^+$)			Eγ=129.2 *3*, Iγ=1.8 (1977Pf01).
144.9 *1*	2.6 *1*	230.98		86.40	(7/2$^+$)			Eγ: level-energy difference=144.6. Eγ=144.7 *3*, Iγ=2.7 (1977Pf01).
157.5 *1*	0.13 *2*	215.46		58.11	(7/2$^-$)			
172.6 *1*	1.72 *9*	230.98		58.11	(7/2$^-$)			Eγ=172.5 *3*, Iγ=2.8 (1977Pf01).
x211.4# *3*	2.0							
217.4 *1*	0.21 *2*	448.33		230.98				
225.5 *1*	0.43 *3*	311.90		86.40	(7/2$^+$)			Eγ=225.7 *3*, Iγ=1.3 (1977Pf01).
233.0 *1*	1.31 *7*	448.33		215.46				Eγ=232.8 *3*, Iγ=1.8 (1977Pf01).
x258.5# *3*	1.5							
285.3 *1*	1.53 *8*	448.33		162.97				Eγ=284.9 *3*, Iγ=1.5 (1977Pf01).
294.1 *1*	5.8 *3*	380.27		86.40	(7/2$^+$)			Eγ=294.0 *3*, Iγ=6.3 (1977Pf01).
311.3 *1*	0.89 *5*	397.70		86.40	(7/2$^+$)			Eγ=311.0 *3*, Iγ=1.3 (1977Pf01).
322.2 *1*	4.6 *2*	380.27		58.11	(7/2$^-$)			Eγ=322.4 *3*, Iγ=7.2 (1977Pf01).

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$\gamma(^{149}Pr)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	E_f	J^π_f	Comments
322.8 *1*	3.1 *2*	448.33	125.55		
330.7 *1*	0.58 *4*	546.16	215.46		
344.3 *1*	0.32 *4*	575.28	230.98		
361.8 *1*	1.40 *8*	448.33	86.40	$(7/2^+)$	
380.0 *1*	27 *1*	380.27	0.0	$(5/2^+)$	Eγ=380.0 *3*, Iγ=33.7 (1977Pf01).
390.2 *1*	1.9 *1*	448.33	58.11	$(7/2^-)$	Eγ=390.0 *3*, Iγ=2.3 (1977Pf01).
[x]417.3[#] *3*	1.8				
[x]438.5 *1*	0.53 *4*				
[x]460.0[#] *3*	2.0				
[x]702.5 *1*	0.55 *6*				Eγ=702.8 *3*, Iγ=2.5 (1977Pf01).
[x]831.2 *1*	0.33 *6*				
864.7 *1*	6.5 *3*	951.11	86.40	$(7/2^+)$	Eγ=864.5 *3*, Iγ=7.8 (1977Pf01).
893.0 *1*	7.3 *4*	951.11	58.11	$(7/2^-)$	Eγ=892.7 *3*, Iγ=8.0 (1977Pf01).

[†] From 1996YaZV, unless otherwise stated.
[‡] From the Adopted Gammas.
[#] From 1977Pf01. This γ is not reported by 1996YaZV. Evaluators consider this γ uncertain, as with the intensity reported by 1977Pf01, this γ should have been detected by 1996YaZV.
[@] 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.
[x] γ ray not placed in level scheme.

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Decay Scheme

Intensities: Relative I_γ

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- Coincidence