^{100}Y β^- decay (0.94 s) 2002Lh01

History

Type	Author	Citation	Literature Cutoff Date
Update	Balraj Singh and Jun Chen	ENSDF	12-Dec-2022

Parent: ^{100}Y: E=145 *15*; $J^\pi=4^+$; $T_{1/2}$=0.94 s *3*; Q(β^-)=9051 *14*; %β^- decay=100

^{100}Y-E,J^π,$T_{1/2}$: From ^{100}Y Adopted Levels. Note that isomer energy is listed as 144 keV *16* in 2021Ko07.

^{100}Y-Q(β^-): From 2021Wa16.

2002Lh01: ^{100}Y source was produced by 25-MeV p-induced fission of ^{238}U. Fission products were separated by the IGISOL separator. γ rays were detected with four Ge detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels, J, π, β-decay branching ratios, log *ft*. Comparisons with theoretical calculations.

Others:

1977Kh03: ^{100}Y source was produced from ^{235}(U,F) with the JOSEF gas-filled separator. γ rays were detected with Ge(Li) detector, x rays were detected with a Ge detector and conversion electrons were detected with a Si(Li) detector. Measured Eγ, Iγ, $\gamma\gamma$-coin, γ(t),ce(t). Deduced levels, J, π, β-decay branching ratios, log *ft*, parent $T_{1/2}$.

1977Pf01: measured Eγ, Iγ, $T_{1/2}$(^{100}Y isotope) with the isotope separator Lohengrin.

1979Bo26: measured selected Eγ using curved-crystal measurement.

The identification of this isomer is based on the observation of an intense 352γ, decaying with $T_{1/2}$=0.96 s and in coincidence with the 212γ to the g.s. The 352γ is most likely the same as the (4^+) to 2^+ transition observed in ^{252}Cf SF decay. 1977Kh03 assigned five γ rays to this isomer only, on the basis of $T_{1/2}$ data, but the later work of 1986Wo01 showed that all these γ rays were also present in the decay of the 735-ms isomer, with the difference that the 352γ was much more intense in the spectrum obtained by 1977Kh03 and a weak 1097γ was not reported by 1986Wo01. The source collection procedures were different in 1977Kh03 and 1986Wo01, although both used mass separation of fragments from neutron fission of ^{235}U. The recoil-separator method used by 1977Kh03 collected all the activities of A=100 whereas only the ^{100}Rb and ^{100}Sr isotopes were collected in the method used by 1986Wo01. In the former, all isomers of ^{100}Y (high and low spin) would be observed whereas in the latter mainly the low spin isomer would be detected since the formation of ^{100}Y was entirely due to ^{100}Sr β^- decay (g.s. $J^\pi=0^+$). It may also be pointed out that the γ-ray spectra shown by 1977Kh03 contain a much larger number of contaminants than those in the spectra shown by 1986Wo01.

Existence of isomerism in ^{100}Y is confirmed in precision mass measurements of 2007Ha32.

Q(β^-)=9310 *70* (1988GrZX,1984Pa19). Other: 7920 *100* (1985IaZZ).

Total decay energy deposit of 9041 keV *1093* calculated by RADLIST code is in agreement with expected value of 9195 keV *20*. However the decay scheme is considered as incomplete in view of unrealistic large β feeding (thus low log *ft* values) to several $\Delta J=2$, $\Delta\pi$=no levels in ^{100}Zr probably due to unobserved transitions from higher-energy levels. There is a large gap of about 7 MeV between Q(β^-) value and the highest known populated level at 2349.

^{100}Zr Levels

1408 and 1428 levels proposed by 1977Kh03 have been discarded, 1196γ from 1408 level has now been placed from 1196 level and 1096.7γ (Iγ=4 *2*) from 1428 level has not been reported by 2002Lh01.

E(level)[†]	J^π[#]
0.0	0^+
212.532 *9*	2^+
331.12 *11*	0^+
564.492 *15*	4^+
878.48 *11*	2^+
1061.59 *20*	6^+
1196.10 *11*	(2^+)
1397.92 *17*	(3^+)
1414.6 *3*	4^+
1441.41[‡] *14*	$(1,2^+)$
1856.0 *3*	$4^{(+)}$
1961.7 *4*	(6^+)

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^{100}Y β^- decay (0.94 s) 2002Lh01 (continued)

^{100}Zr Levels (continued)

E(level)[†]	Jπ[#]	Comments
2003.1? *4*		
2070.27 *16*	(3,4$^+$)	
2220.3 *3*	(2$^+$,3,4$^+$)	
2349.29 *19*	(3,4$^+$)	
6827+x		E(level): x<2369 *24* from Q(β^-) (for ^{100}Y decay) + Energy of the isomer − S(n)(^{100}Zr), where Q(β^-)=9051 *14*, energy of the isomer=145 *15* and S(n)=6827 *13* from 2021Wa16.

[†] From a least-squares fit to γ-ray energies.
[‡] The branching ratios of γ rays are in disagreement with those from 1986Wo01 in the decay of ^{100}Y β^- decay (735 ms).
[#] From the Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ$^-$[†‡]	Log *ft*[†]	Comments
(1.2×10^3[@] *12*)	6827+x	1.02 *6*		Iβ$^-$: %β$^-$n=1.02 *6* for the decay of the ^{100}Y g.s. and the isomer.
(6847 *21*)	2349.29	≈13.5	≈5.6	av Eβ=3108.7 *99* Iβ=14.8 *25*, log *ft*=5.7 (2002Lh01). Apparent Iβ=13.5 *25* (evaluators).
(6976 *21*)	2220.3	<1.7	>6.6	av Eβ=3170.8 *99* Iβ=1.9 *5*, log *ft*=6.6 (2002Lh01). Apparent Iβ=1.7 *5* (evaluators).
(7126 *21*)	2070.27	≈11.6	≈5.8	av Eβ=3242.9 *99* Iβ=12.7 *22*, log *ft*=5.8 (2002Lh01). Apparent Iβ=11.6 *22* (evaluators).
(7193[#] *21*)	2003.1?	<0.8	>6.9	av Eβ=3275.3 *99* Apparent Iβ=0.8 *3* (evaluators).
(7234[#] *21*)	1961.7			av Eβ=3295.2 *99* Iβ=0.2 *2*, log *ft*=7.3 (2002Lh01). Apparent Iβ=0.26 *11* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=2 β transition.
(7340 *21*)	1856.0	<1.0	>6.9	av Eβ=3346.0 *99* Iβ=1.9 *4*, log *ft*=6.7 (2002Lh01). Apparent Iβ=1.0 *2* (evaluators).
(7781 *21*)	1414.6	<2.4	>6.6	av Eβ=3558.3 *99* Iβ=2.4 *5*, log *ft*=6.7 (2002Lh01). Apparent Iβ=2.4 *5* (evaluators).
(7798 *21*)	1397.92	<3.2	>6.5	av Eβ=3566.3 *99* Iβ=3.6 *8*, log *ft*=6.5 (2002Lh01). Apparent Iβ=3.2 *8* (evaluators).
(8000[#] *21*)	1196.10			av Eβ=3663.3 *99* Iβ=6.9 *15*, log *ft*=6.3 (2002Lh01). Apparent Iβ=6.2 *16* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=2 β transition.
(8134[#] *21*)	1061.59			av Eβ=3727.9 *99* Iβ=1.6 *3*, log *ft*=6.9 (2002Lh01). Apparent Iβ=1.1 *3* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=2 β transition.
(8318[#] *21*)	878.48			Iβ=7.2 *22*, log *ft*=6.3 (2002Lh01). Apparent Iβ=6.8 *22* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=2 β transition.
(8632 *21*)	564.492	≈15	≈6.0	Iβ=16.9 *32*, log *ft*=6.0 (2002Lh01). Apparent Iβ=15 *4* (evaluators).
(8865[#] *21*)	331.12			Iβ=2.3 *23*, log *ft*=6.9 (2002Lh01). Apparent Iβ=7 *3* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=4 β transition.
(8984[#] *21*)	212.532			av Eβ=4135.6 *99* Iβ=28 *11*, log *ft*=5.9 (2002Lh01). Apparent Iβ=28 *16* (evaluators) is probably due to missing γ intensity from higher levels, as no β feeding is expected for a ΔJ=2, Δπ=yes β transition.

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^{100}Y β^- decay (0.94 s) 2002Lh01 (continued)

β^- radiations (continued)

† All the values are considered as approximate since a large gap of about 7 MeV between Q(β^-) value and the highest known populated level at 2349 allows the possibility of additional levels and undetected gamma rays. Quoted values of Iβ^- are from I(γ+ce) intensity balance at each level. All the Iβ and log *ft* are listed as limits, with only three cases with I$\beta\geq$10% listed as approximate. Values of Iβ and log ft as given in Table V of 2002Lh01 are listed under comments, as are apparent Iβ feedings deduced by the evaluators from γ-intensity intensity balances.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

@ Estimated for a range of levels.

$\gamma(^{100}Zr)$

Iγ normalization: From ΣI(γ+ce to g.s.)=99 to g.s., allowing for %β^-n=1.02 *6* for ^{100}Y and/or ^{100m}Y decay from the Adopted Levels of ^{100}Y. The γ normalization factor is treated as approximate by the evaluators as the decay scheme is not known well, in particular, apparent 28% β feeding to the first 2^+ state, and the source may have mixed activity from the decay of the g.s. and the isomer.

The following γ rays with Eγ (Iγ) assigned to ^{100}Y decay by 1977Pf01 have been discarded: 455.6(8), 555.6 (26), 583.0 (12), 724.6 (13), 809.4 (12), 826.7 (21), 831.5 (21), 911.1 (15). None of these γ rays was assigned to ^{100}Y by 2002Lh01, 1986Wo01 or 1977Kh03. A 1096.7γ, Iγ=4 *2* reported only by 1977Kh03 has also been discarded.

E$_\gamma$[†]	I$_\gamma$[†&]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[‡]	δ[‡]	α[a]	I$_{(\gamma+ce)}$[&]	Comments
118.6 *2*	29 *6*	331.12	0^+	212.532	2^+	E2		0.597		E$_\gamma$: other: 118.5 *3* (1977Pf01). I$_\gamma$: 5 *2* (1977Kh03), 11 (1977Pf01).
212.531[#] *9*	322 *58*	212.532	2^+	0.0	0^+	E2		0.0723		E$_\gamma$: other: 212.5 *1* (2002Lh01), 212.5 *3* (1977Pf01). I$_\gamma$: 100 (1977Kh03).
(314.0)	0.4[@] *2*	878.48	2^+	564.492	4^+					
(318.0)	0.8[@] *4*	1196.10	(2^+)	878.48	2^+					
331.1 *2*		331.12	0^+	0.0	0^+	E0			14 *5*	I$_{(\gamma+ce)}$: 7.4 *15* (1977Kh03). I$_{(\gamma+ce)}$: deduced by 2002Lh01.
351.960[#] *12*	100 *8*	564.492	4^+	212.532	2^+	E2				E$_\gamma$: other: 351.8 *2* (2002Lh01), 351.9 *3* (1977Pf01). I$_\gamma$: 33 *4* (1977Kh03), 48 (1977Pf01).
353.0	0.6 *2*	1414.6	4^+	1061.59	6^+					E$_\gamma$,I$_\gamma$: from $\gamma\gamma$-coin (2002Lh01).
497.1 *2*	6.2 *6*	1061.59	6^+	564.492	4^+	E2				
547.4 *2*	14.7 *23*	878.48	2^+	331.12	0^+					
631.6 *2*	3.8 *8*	1196.10	(2^+)	564.492	4^+					
665.8 *2*	40 *6*	878.48	2^+	212.532	2^+	(M1+E2)	+1.0 *3*			E$_\gamma$: other: 666.8 *3* (1977Pf01). I$_\gamma$: 13 *3* (1977Kh03), 24 (1977Pf01).
672.4 *2*	7.0 *12*	2070.27	$(3,4^+)$	1397.92	(3^+)					
833.5 *3*	2.8 *10*	1397.92	(3^+)	564.492	4^+					
850.1 *3*	9.3 *8*	1414.6	4^+	564.492	4^+	(M1+E2)	+0.99 *6*			
865.0 *2*	14.2 *23*	1196.10	(2^+)	331.12	0^+					
874.3 *3*	8.7 *17*	2070.27	$(3,4^+)$	1196.10	(2^+)					
878.6 *2*	23 *3*	878.48	2^+	0.0	0^+					I$_\gamma$: 18 *3* (1977Kh03).
900.1 *3*	1.1 *4*	1961.7	(6^+)	1061.59	6^+	(M1+E2)	+0.74 *7*			
907.8 *3*	13.8 *16*	2349.29	$(3,4^+)$	1441.41	$(1,2^+)$					
983.2 *3*	7.0 *12*	1196.10	(2^+)	212.532	2^+					
1110.1 *3*	4.3 *8*	1441.41	$(1,2^+)$	331.12	0^+					
1153.0 *3*	11.1 *15*	2349.29	$(3,4^+)$	1196.10	(2^+)					
1185.4 *3*	17.7 *15*	1397.92	(3^+)	212.532	2^+					
1191.6 *3*	22.1 *17*	2070.27	$(3,4^+)$	878.48	2^+					
1196.2 *2*	20 *3*	1196.10	(2^+)	0.0	0^+					E$_\gamma$,I$_\gamma$: in 1977Kh03, 1195.5γ, Iγ=5 *2* was tentatively assigned from 1408 to 213 level.

$\gamma(^{100}Zr)$ (continued)

E_γ [†]	I_γ [†&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
1229.0 *3*	4.9 *10*	1441.41	(1,2$^+$)	212.532	2$^+$			
1291.5 *3*	4.2 *6*	1856.0	4$^{(+)}$	564.492	4$^+$	(M1+E2)	−2.8 *7*	
1438.6[b] *4*	3.4 *8*	2003.1?		564.492	4$^+$			
1441.4 *2*	3.6 *6*	1441.41	(1,2$^+$)	0.0	0$^+$			
1471.0 *3*	27 *3*	2349.29	(3,4$^+$)	878.48	2$^+$			
1505.5 *5*	3.0 *8*	2070.27	(3,4$^+$)	564.492	4$^+$			
[x]1644.2 *3*	3.2 *8*							E_γ: γ in coin with 213γ, but possibly not from 1856 level (2002Lh01).
1655.8 *3*	5.9 *10*	2220.3	(2$^+$,3,4$^+$)	564.492	4$^+$			
1857.8 *4*	7.7 *21*	2070.27	(3,4$^+$)	212.532	2$^+$			
2008.0[b] *8*	1.3 *8*	2220.3	(2$^+$,3,4$^+$)	212.532	2$^+$			
2137.0 *8*	4.3 *17*	2349.29	(3,4$^+$)	212.532	2$^+$			

† From 2002Lh01, unless otherwise stated.
‡ From the Adopted Gammas.
# From curved-crystal measurement (1979Bo26).
@ Intensity deduced from the Adopted Gammas.
& For absolute intensity per 100 decays, multiply by ≈0.24.
[a] 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.
[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{100}_{40}Zr_{60}$-5

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Decay Scheme

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