^{167}Tb IT decay (2.1 μs)   **2017Gu08**

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Parent: ^{167}Tb: E=200 6; J$^{\pi}$=(7/2^{-}); T$_{1/2}$=2.1 μs 1; %IT decay=100

^{167}Tb-T$_{1/2}$: From (ion)γ(t) (2017Gu08), authors' weighted average of six values: 2.2 μs 6 for 73γ and 2.3 μs 4 for 147γ for
   fully-stripped ions with setting centered on transmission of ^{170}Dy ions; 2.7 μs 7 for 73γ and 2.2 μs 3 for 147γ for fully-stripped
   ions with setting centered at ^{172}Dy; 2.0 μs 2 for 73γ and 2.1 μs 3 for 147γ for hydrogen-like ions with setting centered at
   ^{172}Dy. In each case, the decay curve was fitted to a single exponential. Other: 2.45 μs 18 (2014YoZZ).

2017Gu08 (also Ph.D. Thesis by L.A. Gurgi, University of Surrey, 2017): fully-stripped and hydrogen-like ions of ^{167}Tb isomer
   produced in ^{9}Be(^{238}U,F) reaction at E(^{238}U)=345 MeV/nucleon, followed by separation in mass and charge using the BigRIPS
   separator and the ZeroDegree Spectrometer at RIBF-RIKEN facility by TOF-Bρ-ΔE method and the ions of interest were
   implanted into the beta-counting system WAS3ABi, surrounded by the EURICA array of 84 HPGe detectors and 18 LaBr$_3$(Ce)
   detectors for fast-timing measurements. Measured Eγ, Iγ, Tb K x-rays, $\gamma\gamma$-coin, (ion)γ(t), half-life of the micro-sec isomer.
   2017Gu08 paper presented at the Zakopane Conference (September 2016).

2014YoZZ: ^{167}Tb isomer produced in ^{9}Be(^{238}U,F) reaction at E(^{238}U)=345 MeV/nucleon, followed by separation in mass and
   charge using the BigRIPS separator at RIBF-RIKEN facility by TOF-Bρ-ΔE method and the ions of interest were implanted into
   the TKE detector consisting of 14 layers of Si detectors, and surrounded by four clover HPGe detectors. Measured Eγ, Iγ,
   $\gamma\gamma$-coin, (ion)γ(t), half-life of the micro-sec isomer. No reply from the first author to an e-mail query sent July 19, 2019, about
   the confirmation of isomer and decay scheme as presented in 2014YoZZ.

Level scheme is tentative according to 2017Gu08. The same level scheme is given in 2014YoZZ.

^{167}Tb Levels

E(level)†	J$^{\pi}$	T$_{1/2}$	Comments
0$^{\#}$	(3/2^{+})‡		
53$^{\#}$ 4	(5/2^{+})‡		
126$^{\#}$ 6	(7/2^{+})‡		
200 6	(7/2^{-})	2.1 μs 1	J$^{\pi}$: possible π7/2[523] orbital (2017Gu08).

† From Eγ data.
‡ Possible member of π3/2[411] band.
$^{\#}$ Band(A): Possible π3/2[411] band. Band assignment by 2017Gu08.

γ(^{167}Tb)

E$_{\gamma}$†	I$_{\gamma}$†	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.	$\alpha^{\ddagger}$	Comments
53 4	0.21 4	53	(5/2^{+})	0	(3/2^{+})	[M1]	14 11	α(K)=12 11; α(L)=1.7 5; α(M)=0.37 10 α(N)=0.087 23; α(O)=0.013 4; α(P)=0.00087 23 E$_{\gamma}$: other: 52 in 2014YoZZ. 2017Gu08 give α(theory)=13.54 19 for mult(53)=M1 from BrIcc, assuming no uncertainty for E$_{\gamma}$. Using ΔE$_{\gamma}$=4 keV, BrIcc gives α=14 11, as the K-shell binding energy is 51.996 keV.
73$^{\#}$ 4	0.13$^{\#}$ 2	126	(7/2^{+})	53	(5/2^{+})	[M1]	5.4 10	α(K)=4.6 9; α(L)=0.67 12; α(M)=0.15 3 α(N)=0.034 6; α(O)=0.0052 10; α(P)=0.00034 7 73γ was observed by 2017Gu08 as self-coincident γ ray, also in coincidence with Tb K x-rays, but not in coincidence with 147γ. 2017Gu08 give α(theory)=5.44 8 for mult(73)=M1 from BrIcc, assuming no uncertainty for E$_{\gamma}$. Using ΔE$_{\gamma}$=4 keV, BrIcc gives α=5.4 10.
73$^{\#}$ 4	0.48$^{\#}$ 6	200	(7/2^{-})	126	(7/2^{+})	[E1]	0.69 12	α(K)=0.58 9; α(L)=0.093 16; α(M)=0.020 4

Continued on next page (footnotes at end of table)

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$\gamma(^{167}$Tb) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[‡]	Comments
								α(N)=0.0046 8; α(O)=0.00065 11; α(P)=3.1×10^{-5} 5
								E_γ: other: 73.6 in 2014YoZZ.
								2017Gu08 give α(theory)=0.694 10 for mult(73)=E1 from BrIcc, assuming no uncertainty for Eγ. Using ΔEγ=4 keV, BrIcc gives α=0.69 12.
147 4	1.2 2	200	(7/2$^-$)	53	(5/2$^+$)	[E1]	0.107 9	α(K)=0.090 7; α(L)=0.0132 11; α(M)=0.00287 23
								α(N)=0.00065 6; α(O)=9.6×10^{-5} 8; α(P)=5.3×10^{-6} 4
								E_γ: other 147.4 in 2014YoZZ.
								2017Gu08 give α(theory)=0.1067 15 for mult(147)=E1 from BrIcc, assuming no uncertainty for Eγ. Using ΔEγ=4 keV, BrIcc gives α=0.107 9.

[†] From 2017Gu08.
[‡] 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.
[#] Multiply placed with intensity suitably divided.

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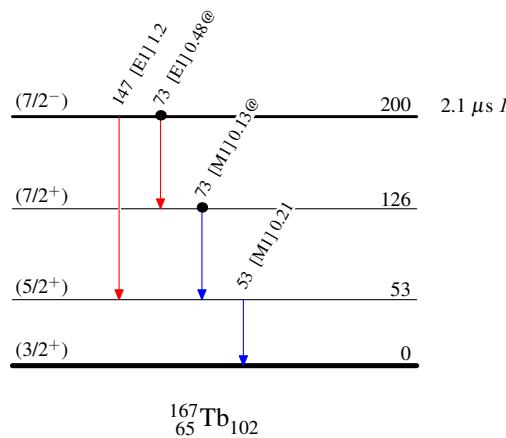
Decay Scheme

Intensities: Relative I$_\gamma$
@ Multiply placed: intensity suitably divided
%IT=100

Legend

I$_\gamma$ < 2%×I$_\gamma^{max}$
I$_\gamma$ < 10%×I$_\gamma^{max}$
I$_\gamma$ > 10%×I$_\gamma^{max}$
● Coincidence

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Band(A): Possible
π3/2[411] band

(7/2$^+$) ———————————— 126

73

(5/2$^+$) ———————————— 53

53

(3/2$^+$) ———————————— 0

$^{167}_{65}$Tb$_{102}$