^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

Parent: ^{76}Cu: E=0; J$^\pi$=3$^{(-)}$; T$_{1/2}$=637 ms *7*; Q(β^-)=11321.4 *17*; %β^- decay=100

^{76}Cu-J$^\pi$,T$_{1/2}$: From Adopted Levels of ^{76}Cu.

^{76}Cu-Q(β^-): From 2021Wa16.

2022Si25: ^{76}Cu activity from 54-MeV proton beam on a UC$_x$ target at HRIBF at ORNL. Fragments passed through a low-resolution mass separator to select A=76 nuclei and then a high-resolution mass separator. ^{76}Zn passed into LeRIBSS and implanted into a moving tape. Measured Eγ, Iγ, $\gamma\gamma$, $\beta\gamma$ using four HPGe detectors and two plastic scintillators.

2005Va19 (also 2002VaZX thesis): ^{76}Cu produced by ^{238}U(n,F) and ^{238}U(p,F) at ISOLDE facility, measured Eγ, Iγ, $\gamma\gamma$, $\beta\gamma$, timing of $\beta\gamma$ and $\gamma\gamma$ coin spectra.

1990Wi12: measured γ, $\gamma\gamma$, (integral β)(γ) coin for T$_{1/2}$ of ^{76}Cu decay.

2021Ch56: ^{76}Cu ion beam was produced in ^{9}Be(^{86}Kr,X) at E(^{86}Kr)=140 MeV/nucleon incident energy, followed by separation of fragments of interest using A1900 fragment separator at NSCL-MSU facility. Ions were implanted into a CeBr$_3$ scintillator, coupled to a position-sensitive photomultiplier tube (PSPMT) consisting of a single dynode and 256 anodes arranged, and identified event-by-event using the ΔE-TOF method. Measured (ions)β-correlations, Eγ, Iγ, $\beta\gamma$- and $\gamma\gamma$-coin, level half-life by $\gamma\gamma$(t) using and array of 15 LaBr$_3$ detectors and array of 16 HPGe clover detectors. Main experimental finding of this work is in the identification of a 25-ns isomer in ^{76}Zn at 2634 keV. Detailed comparison with shell-model calculations using jj44b, jj44c and JUN45 interactions.

Others (mainly T$_{1/2}$ and production of ^{76}Cu):

1991Kr15: T$_{1/2}$.

1987LuZX: T$_{1/2}$, γ (598,697,947 γ rays reported).

1987Ar21: production of ^{76}Cu.

1993Ru01: quote T$_{1/2}$ and %β^-n measurement by Reeder et al. in Proceedings of the Specialists Meeting on Delayed Neutron Properties, p37 (1986).

^{76}Cu production in 1991Kr15, 1987Ar21 and 1987LuZX: mass separation of fission products from ^{235}U(n,F).

In accordance with conclusions of study by 2005Va19, a 1.27-s isomer proposed in 1990Wi12 has not been included here; no evidence was found for an isomer in ^{76}Cu in 2022Si25.

The decay scheme given here is from 2022Si25, significantly extended from that in 2005Va19. It should considered incomplete due to a large gap of about 5 MeV between the highest observed level at E=5973 keV and Q-value=11321.4 keV *17* (2021Wa16).

Additional information 1.

^{76}Zn Levels

Based on reassignment of some of the γ rays by 2005Va19, the 1031, (0$^+$) and 1716 levels in 1990Wi12 are omitted, and 1761 level is interchanged by 2350 level.

E(level)†	J$^\pi$‡	T$_{1/2}$‡	Comments
0.00	0$^+$		
598.695 *13*	2$^+$		
1296.498 *19*	(4$^+$)		
2266.484 *23*	(2$^+$)		
2349.663 *28*	(6$^+$)		J$^\pi$: 2022Si25 propose this level as possibly the 6$^+$ yrast state seen in a high-spin experiment (Ref[38] in 2022Si25).
2633.635 *23*	(4$^-$)	25.4 ns *4*	J$^\pi$: 2021Ch56 state that this state may be high-spin negative-parity state formed by the occupation of the $\nu 0g_{9/2}$ orbital; 2022Si25 proposed (4$^-$) based on comparion of calculated β feeding with their observed β feeding. T$_{1/2}$: from distribution of time difference between the first and the second γ ray ($\gamma\gamma$(t)) fitted with an exponential decay plus a constant background (2021Ch56).
2739.23 *6*	(3$^+$)		J$^\pi$: (3$^+$) proposed in 2022Si25 based on measured γ intensity splitting with theoretical predictions.
2813.790 *26*	(4$^+$,5)		

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

^{76}Zn Levels (continued)

E(level)†	J$^\pi$‡	Comments
2949.80 *11*		
2974.563 *26*	(3$^-$)	J$^\pi$: 2022Si25 proposed (3$^-$) based on comparion of calculated β feeding with their observed β feeding.
3017.08 *5*	(1)	J$^\pi$: 2$^+$ is disfavored by a predicted weak transition to g.s. relative to that of 2418γ if 2$^+$, as compared to the observed relatively strong transition to g.s. (2022Si25).
3033.77 *8*		
3079.65 *14*		
3154.64 *6*	(2$^+$,3)	
3212.13 *17*		
3233.259 *29*	(3$^-$,4$^-$)	
3272.718 *34*	(3,4$^+$)	
3512.2 *5*		
3514.38 *9*		
3572.7 *5*		
3604.97 *18*		
3638.11 *17*		
3710.57 *9*		
3756.25 *13*		
3760.30 *13*		
3914.65 *9*		
3967.15 *30*		
3980.39 *15*		
4013.26 *30*		
4102.55 *30*		
4123.84 *7*		
4231.62 *14*		
4317.38 *15*		
4368.80 *30*		
4423.09 *19*		
4539.87 *17*		
4668.32 *7*		
4715.70 *11*		
4858.67 *8*		
4866.2 *4*		
4959.35 *7*		
5002.59 *21*		
5106.88 *14*		
5128.4 *4*		
5146.07 *13*		
5184.5 *4*		
5238.2 *4*		
5317.43 *27*		
5345.66 *19*		
5351.05 *19*		
5373.25 *17*		
5460.0 *4*		
5494.50 *16*		
5523.6 *5*		
5560.55 *14*		
5717.31 *15*		
5725.0 *6*		
5886.70 *17*		
5921.5 *5*		
5973.1 *4*		
S(n)+x		E(level): S(n)(^{76}Zn)=7815.4 *24* (2021Wa16), x<3512 keV from Q(β^-)(^{76}Cu)-S(n)(^{76}Zn).

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

^{76}Zn Levels (continued)

† From a least-squares fit to Eγ data.
‡ From Adopted Levels. As indicated in comments, some Adopted J^π assignments are taken from this dataset which are based on shell-model preditions, systematics of neighboring even-even Zn isotopes as given under comments.

β^- radiations

E(decay)	E(level)	$I\beta^-$ ‡#@	Log *ft* †#	Comments
(1.8×10^3 & *18*)	S(n)+x	7.2 *5*		$I\beta^-$: from %β^-n=7.2 *5* for ^{76}Cu decay (2009Wi03).
(5348.3 *20*)	5973.1	≈0.92	≈6.0	av Eβ=2409.9 *8*
(5399.9 *21*)	5921.5	≈0.28	≈6.5	av Eβ=2434.9 *9*
(5434.7 *20*)	5886.70	≈1.24	≈5.9	av Eβ=2451.8 *8*
(5596.4 *21*)	5725.0	≈0.20	≈6.8	av Eβ=2530.1 *9*
(5604.1 *20*)	5717.31	≈0.69	≈6.2	av Eβ=2533.9 *8*
(5760.9 *20*)	5560.55	≈2.28	≈5.8	av Eβ=2609.8 *8*
(5797.8 *21*)	5523.6	≈0.41	≈6.5	av Eβ=2627.8 *9*
(5826.9 *20*)	5494.50	≈0.65	≈6.3	av Eβ=2641.9 *8*
(5861.4 *20*)	5460.0	≈0.21	≈6.8	av Eβ=2658.6 *8*
(5948.2 *20*)	5373.25	≈1.21	≈6.1	av Eβ=2700.7 *8*
(5970.4 *20*)	5351.05	≈1.15	≈6.1	av Eβ=2711.5 *8*
(5975.7 *20*)	5345.66	≈0.61	≈6.4	av Eβ=2714.1 *8*
(6004.0 *20*)	5317.43	≈0.38	≈6.6	av Eβ=2727.8 *8*
(6083.2 *20*)	5238.2	≈0.28	≈6.8	av Eβ=2766.2 *8*
(6136.9 *20*)	5184.5	≈0.61	≈6.5	av Eβ=2792.3 *8*
(6175.3 *20*)	5146.07	≈1.04	≈6.2	av Eβ=2810.9 *8*
(6193.0 *20*)	5128.4	≈0.21	≈6.9	av Eβ=2819.5 *8*
(6214.5 *20*)	5106.88	≈0.94	≈6.3	av Eβ=2829.9 *8*
(6318.8 *20*)	5002.59	≈1.13	≈6.2	av Eβ=2880.6 *8*
(6362.1 *20*)	4959.35	≈2.15	≈6.0	av Eβ=2901.5 *8*
(6455.2 *20*)	4866.2	≈0.24	≈7.0	av Eβ=2946.8 *8*
(6462.7 *20*)	4858.67	≈3.65	≈5.8	av Eβ=2950.4 *8*
(6605.7 *20*)	4715.70	≈1.56	≈6.2	av Eβ=3019.8 *8*
(6653.1 *20*)	4668.32	≈0.85	≈6.5	av Eβ=3042.9 *8*
(6781.5 *20*)	4539.87	≈0.89	≈6.5	av Eβ=3105.2 *8*
(6898.3 *20*)	4423.09	≈0.77	≈6.6	av Eβ=3161.9 *8*
(6952.6 *20*)	4368.80	≈0.28	≈7.0	av Eβ=3188.3 *8*
(7004.0 *20*)	4317.38	≈1.10	≈6.5	av Eβ=3213.2 *8*
(7089.8 *20*)	4231.62	≈0.87	≈6.6	av Eβ=3254.9 *8*
(7197.6 *20*)	4123.84	≈2.19	≈6.2	av Eβ=3307.3 *8*
(7218.9 *20*)	4102.55	≈0.60	≈6.8	av Eβ=3317.6 *8*
(7308.1 *20*)	4013.26	≈0.24	≈7.2	av Eβ=3360.9 *8*
(7341.0 *20*)	3980.39	≈0.56	≈6.9	av Eβ=3376.9 *8*
(7354.3 *20*)	3967.15	≈0.21	≈7.3	av Eβ=3383.4 *8*
(7406.8 *20*)	3914.65	≈0.94	≈6.6	av Eβ=3408.9 *8*
(7561.1 *20*)	3760.30	≈0.51	≈7.0	av Eβ=3483.8 *8*
(7565.2 *20*)	3756.25	≈0.63	≈6.9	av Eβ=3485.8 *8*
(7610.8 *20*)	3710.57	≈1.18	≈6.6	av Eβ=3508.0 *8*
(7683.3 *20*)	3638.11	≈0.84	≈6.8	av Eβ=3543.2 *8*
(7716.4 *20*)	3604.97	≈0.29	≈7.2	av Eβ=3559.3 *8*
(7748.7 *21*)	3572.7	≈0.13	≈7.6	av Eβ=3575.0 *9*
(7807.0 *20*)	3514.38	≈1.21	≈6.6	av Eβ=3603.3 *8*
(7809.2 *21*)	3512.2	≈0.62	≈6.9	av Eβ=3604.4 *9*
(8048.7 *20*)	3272.718	≈2.31	≈6.4	av Eβ=3720.7 *8*
(8088.1 *20*)	3233.259	≈6.9	≈6.0	av Eβ=3739.9 *8*
(8109.3 *20*)	3212.13	≈0.81	≈6.9	av Eβ=3750.2 *8*
(8166.8 *20*)	3154.64	≈1.13	≈6.8	av Eβ=3778.1 *8*
(8241.8 *20*)	3079.65	≈0.44	≈7.2	av Eβ=3814.5 *8*
(8287.6 *20*)	3033.77	≈0.92	≈6.9	av Eβ=3836.8 *8*

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^- ‡#@	Log *ft* †#	Comments
(8304.3 *20*)	3017.08	≈0.59	≈9.3[1u]	av Eβ=3840.6 *8*
(8346.8 *20*)	2974.563	≈10.4	≈5.8	av Eβ=3865.5 *8*
(8371.6 *20*)	2949.80	≈0.90	≈6.9	av Eβ=3877.6 *8*
(8507.6 *20*)	2813.790	≈1.5	≈6.7	av Eβ=3943.6 *8*
(8582.2 *20*)	2739.23	≈1.58	≈6.7	av Eβ=3979.9 *8*
(8687.8 *20*)	2633.635	≈5.2	≈6.2	av Eβ=4031.2 *8*
(8971.7 *20*)	2349.663	≈0.4	≈12.1	av Eβ=4166.8 *8*
(9054.9 *20*)	2266.484	≈1.47	≈6.9	av Eβ=4209.5 *8*
(10024.9 *20*)	1296.498	≈7.7	≈6.3	av Eβ=4680.5 *8*
(10722.7 *20*)	598.695	≈13.4	≈6.2	av Eβ=5019.2 *8*

† Additional information 2.
‡ From γ+ce intensity balance at each level.
# The β feedings and associated log *ft* values should be treated as approximate due to seemingly incomplete decay scheme.
@ Absolute intensity per 100 decays.
& Estimated for a range of levels.

γ(^{76}Zn)

Iγ normalization: 0.893 *20* deduced from Σ(Iγ of gammas to g.s.)=100−%β^-n, with %β^-n=7.2 *5* (2009Wi03) and assuming no β feeding to g.s. Since the level scheme may be missing high-energy levels, the normalization factor is treated as approximate. 2022Si25 deduce a normalization factor of 0.893 *19* taking sum of all transitions to the ground state assuming no direct g.s. beta feeding; if all unplaced transitions directly feed the ground the normalization becomes 0.774 *15*.

A 947γ reported by 1987LuZX is assigned as a sum line (199+748) (γ rays from ^{76}Zn β^-) by 1990Wi12.

Following γ rays with Eγ(Iγ) in Table I of 1990Wi12 are omitted here based on results in 2005Va19 and 2022Si25: 431.83 *8* (9.5 *9*), 1097.6 *5* (3.0 *13*), 1783.46 *21* (7.0 *11*).

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π	Comments
117.88 *13*	0.30 *4*	3272.718	(3,4$^+$)	3154.64	(2$^+$,3)	%Iγ≈0.27
137.47 *5*	1.12 *5*	3154.64	(2$^+$,3)	3017.08	(1)	%Iγ≈1.0
180.12 *3*	3.21 *11*	2813.790	(4$^+$,5)	2633.635	(4$^-$)	%Iγ≈2.9 E_γ: others: 179.6 *3* (2005Va19, 179.8 in Fig. 5 of 2005Va19), 180 (2021Ch56), 180.2 *3* (1990Wi12). I_γ: others: 3.8 *4* (2005Va19), 3.2 *11* (1990Wi12), 12 *2* (2021Ch56).
[x]235.81 *11*	0.48 *4*					%Iγ≈0.43
258.63 *3*	3.4 *3*	3233.259	(3$^-$,4$^-$)	2974.563	(3$^-$)	%Iγ≈3.0 E_γ: others: 258.5 *1* (2005Va19), 258 (2021Ch56). I_γ: others: 2.0 *4* (2005Va19); 10 *3* (2021Ch56) is largely discrepant.
298.10 *10*	0.81 *11*	3272.718	(3,4$^+$)	2974.563	(3$^-$)	%Iγ≈0.72
340.921 *20*	19.5 *4*	2974.563	(3$^-$)	2633.635	(4$^-$)	%Iγ≈17 E_γ: others: 340.87 *9* (2005Va19), 340.89 *7* (1990Wi12), 341 (2021Ch56). I_γ: others: 16 *1* (2005Va19), 16.4 *12* (1990Wi12); 68 *5* (2021Ch56) is largely discrepant.
365.47 *24*	1.39 *18*	3638.11		3272.718	(3,4$^+$)	%Iγ≈1.2 E_γ: unresolved doublet with ^{76}Zn γ ray.
419.50 *2*	6.2 *3*	3233.259	(3$^-$,4$^-$)	2813.790	(4$^+$,5)	%Iγ≈5.5 E_γ: others: 419.3 *4* (2005Va19), 419.50 *7* (1990Wi12), 419 (2021Ch56); γ placed from a 1715 level in 1990Wi12.

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

$\gamma(^{76}Zn)$ (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	α [&]	Comments
								I_γ: others: 3.4 *4* (2005Va19), 9.7 *7* (1990Wi12), 8.8 *19* (2021Ch56); note a large difference between value from 2005Va19 and others.
464.160[#] *22*	4.3 *4*	2813.790	(4^+,5)	2349.663	(6^+)			%Iγ≈3.8 E_γ: others: 464.3 *3* (2005Va19), 464.42 *21* (1990Wi12). I_γ: others: 3.0 *4* (2005Va19), 2.9 *7* (1990Wi12).
527.04 *13*	0.57 *15*	3760.30		3233.259	(3^-,4^-)			%Iγ≈0.51 E_γ: unresolved doublet with background γ ray.
598.706 *14*	100.0 *22*	598.695	2^+	0.00	0^+	[E2]	1.15×10^{-3}	%Iγ≈89 E_γ: others: 598.70 *6* (2005Va19), 598.68 *5* (1990Wi12), 599 (2021Ch56). I_γ: others: 100 *5* (2005Va19), 100 *3* (1990Wi12), 103 *6* (2021Ch56).
639.08 *14*	0.36 *5*	3272.718	(3,4^+)	2633.635	(4^-)			%Iγ≈0.32
697.815 *14*	66.6 *11*	1296.498	(4^+)	598.695	2^+	[E2]	7.42×10^{-4}	%Iγ≈59 E_γ: others: 697.69 *7* (2005Va19), 697.78 *5* (1990Wi12), 698 (2021Ch56). I_γ: others: 59 *3* (2005Va19), 52.9 *20* (1990Wi12), 99 *6* (2021Ch56).
707.92 *6*	0.95 *5*	2974.563	(3^-)	2266.484	(2^+)			%Iγ≈0.85
781.71 *13*	0.50 *7*	3756.25		2974.563	(3^-)			%Iγ≈0.45
888.59 *11*	0.57 *5*	3154.64	(2^+,3)	2266.484	(2^+)			%Iγ≈0.51
939.1 *5*	0.14 *6*	3572.7		2633.635	(4^-)			%Iγ≈0.13
1006.23 *3*	2.95 *7*	3272.718	(3,4^+)	2266.484	(2^+)			%Iγ≈2.6 E_γ,I_γ: other: 1006.5 *2* with Iγ=1.7 *10* (2005Va19).
1053.22[#] *3*	5.06 *17*	2349.663	(6^+)	1296.498	(4^+)			%Iγ≈4.5 E_γ: others: 1053 *1* (2005Va19), 1053.4 *5* (1990Wi12). I_γ: others: 3.1 *9* (2005Va19), 2.4 *10* (1990Wi12).
1077.63 *19*	0.45 *9*	4715.70		3638.11				%Iγ≈0.4
1149.43 *8*	1.50 *16*	4123.84		2974.563	(3^-)			%Iγ≈1.3
1218.47 *22*	0.50 *22*	5886.70		4668.32				%Iγ≈0.45
[x]1258.0 *3*	0.24 *5*							%Iγ≈0.21
1280.98 *9*	1.44 *9*	3914.65		2633.635	(4^-)			%Iγ≈1.3
1337.109 *16*	38.3 *7*	2633.635	(4^-)	1296.498	(4^+)	[E1]		%Iγ≈34 E_γ: others 1337 *1* (2005Va19), 1337.08 *8* (1990Wi12), 1337 (2021Ch56). I_γ: others: 30 *2* (2005Va19), 30.2 *20* (1990Wi12), 100 *7* (2021Ch56). Mult.: possible E1 (2021Ch56) from analysis of expected transition probabilities for E1, M1, E2 and M2 transitions.
1442.76 *8*	0.77 *5*	2739.23	(3^+)	1296.498	(4^+)			%Iγ≈0.69
1468.9 *3*	0.67 *14*	4102.55		2633.635	(4^-)			%Iγ≈0.6

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

γ(^{76}Zn) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J^π_i	E_f	J^π_f	Comments
						E_γ: unresolved doublet with ^{76}Zn γ ray.
1489.85 *18*	0.33 *5*	4123.84		2633.635	(4⁻)	%Iγ≈0.29
1517.38 *4*	1.75 *7*	2813.790	(4⁺,5)	1296.498	(4⁺)	%Iγ≈1.6 E_γ,I_γ: other: 1517 *2* with Iγ=0.6 *2* (2005Va19).
1561.2 *5*	0.39 *5*	4715.70		3154.64	(2⁺,3)	%Iγ≈0.35
[x]1568.3 *3*	0.22 *5*					%Iγ≈0.2
1598.15 *19*	0.66 *8*	4231.62		2633.635	(4⁻)	%Iγ≈0.59
[x]1608.14 *18*	0.49 *6*					%Iγ≈0.44
1667.80 *3*	4.65 *9*	2266.484	(2⁺)	598.695	2⁺	%Iγ≈4.1 E_γ,I_γ: other: 1668 *2* with Iγ=3.4 *6* (2005Va19).
1678.3[a] *4*		2974.563	(3⁻)	1296.498	(4⁺)	E_γ: likely a sum peak.
1682.9 *5*	0.32 *12*	4317.38		2633.635	(4⁻)	%Iγ≈0.29
1693.75 *7*	1.45 *15*	4668.32		2974.563	(3⁻)	%Iγ≈1.3
1698.35 *15*	0.41 *5*	4715.70		3017.08	(1)	%Iγ≈0.37
1704.03 *23*	0.30 *6*	4858.67		3154.64	(2⁺,3)	%Iγ≈0.27
1737.25 *8*	1.03 *6*	3033.77		1296.498	(4⁺)	%Iγ≈0.92
1857.8 *4*	0.20 *6*	3154.64	(2⁺,3)	1296.498	(4⁺)	%Iγ≈0.18
1873.60 *14*	1.06 *17*	5106.88		3233.259	(3⁻,4⁻)	%Iγ≈0.94
[x]1907.0 *3*	0.33 *6*					%Iγ≈0.29
[x]1928.1 *4*	0.16 *5*					%Iγ≈0.14
1933.5 *6*	0.15 *5*	5146.07		3212.13		%Iγ≈0.13
1936.49 *18*	0.46 *6*	3233.259	(3⁻,4⁻)	1296.498	(4⁺)	%Iγ≈0.41 E_γ,I_γ: other: 1937 *3* with Iγ=1.0 *11* (2005Va19).
1964.89 *21*	0.32 *5*	4231.62		2266.484	(2⁺)	%Iγ≈0.29
1971.8 *3*	0.38 *9*	5886.70		3914.65		%Iγ≈0.34
1976.35 *16*	0.50 *6*	3272.718	(3,4⁺)	1296.498	(4⁺)	%Iγ≈0.45
[x]1984.2 *6*	0.12 *6*					%Iγ≈0.11
[x]1998.4 *3*	0.27 *6*					%Iγ≈0.24
[x]2007.2 *7*	0.19 *7*					%Iγ≈0.17
2034.74 *14*	0.025 *5*	2633.635	(4⁻)	598.695	2⁺	%Iγ≈0.022 E_γ: likely a sum peak.
[x]2051.8 *4*	0.21 *6*					%Iγ≈0.19
2077.7 *6*	0.17 *6*	5351.05		3272.718	(3,4⁺)	%Iγ≈0.15
2082.34 *18*	0.50 *7*	4715.70		2633.635	(4⁻)	%Iγ≈0.45
2100.29 *20*	0.54 *7*	5373.25		3272.718	(3,4⁺)	%Iγ≈0.48
2112.37 *19*	0.68 *13*	5345.66		3233.259	(3⁻,4⁻)	%Iγ≈0.61
2140.46 *7*	1.01 *5*	2739.23	(3⁺)	598.695	2⁺	%Iγ≈0.9
2145.64 *8*	1.41 *9*	4959.35		2813.790	(4⁺,5)	%Iγ≈1.3
2156.57 *19*	0.86 *13*	4423.09		2266.484	(2⁺)	%Iγ≈0.77
[x]2158.4 *6*	0.28 *14*					%Iγ≈0.25
2217.85 *9*	1.36 *7*	3514.38		1296.498	(4⁺)	%Iγ≈1.2
2224.91 *9*	3.19 *24*	4858.67		2633.635	(4⁻)	%Iγ≈2.8 E_γ: other: 2225.4 *3* (2021Ch56), unplaced and in coincidence with 1337γ.
2266.38 *4*	2.65 *6*	2266.484	(2⁺)	0.00	0⁺	%Iγ≈2.4 E_γ,I_γ: other: 2266 *3* with Iγ=3.4 *6* (2005Va19).
[x]2281.6 *7*	0.17 *7*					%Iγ≈0.15
2287.5 *4*	0.22 *7*	5560.55		3272.718	(3,4⁺)	%Iγ≈0.2
2300.2 *3*	0.31 *5*	5317.43		3017.08	(1)	%Iγ≈0.28
2308.38 *18*	0.50 *6*	3604.97		1296.498	(4⁺)	%Iγ≈0.45
2315.9 *6*	0.17 *8*	5921.5		3604.97		%Iγ≈0.15
2325.57 *19*	0.46 *6*	4959.35		2633.635	(4⁻)	%Iγ≈0.41
2351.07 *11*	1.01 *7*	2949.80		598.695	2⁺	%Iγ≈0.9
2368.91 *21*	1.27 *16*	5002.59		2633.635	(4⁻)	%Iγ≈1.1
2375.80 *8*	1.01 *6*	2974.563	(3⁻)	598.695	2⁺	%Iγ≈0.9

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^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

$\gamma(^{76}Zn)$ (continued)

E_γ†	I_γ†@	E_i(level)	J^π_i	E_f	J^π_f	Comments
2413.99 11	0.80 6	3710.57		1296.498	(4+)	%Iγ≈0.71
2418.19 8	1.56 7	3017.08	(1)	598.695	2+	%Iγ≈1.4
x2456.5 3	0.29 6					%Iγ≈0.26
2480.91 14	0.49 4	3079.65		598.695	2+	%Iγ≈0.44
x2504.5 6	0.23 12					%Iγ≈0.21
2506.4 6	0.23 11	5523.6		3017.08	(1)	%Iγ≈0.21
2512.43 19	0.44 6	5146.07		2633.635	(4−)	%Iγ≈0.39
2516.5 4	0.27 6	4866.2		2349.663	(6+)	%Iγ≈0.24
2519.89 16	0.73 9	5494.50		2974.563	(3−)	%Iγ≈0.65
2555.62 19	0.37 9	3154.64	(2+,3)	598.695	2+	%Iγ≈0.33
2585.56 18	0.62 9	5560.55		2974.563	(3−)	%Iγ≈0.55
2613.35 17	1.06 13	3212.13		598.695	2+	%Iγ≈0.94 E_γ: unresolved doublet with background γ ray.
x2626.75 19	0.58 7					%Iγ≈0.52
2670.6 3	0.23 5	3967.15		1296.498	(4+)	%Iγ≈0.21
2716.71 30	0.27 4	4013.26		1296.498	(4+)	%Iγ≈0.24
2742.69 15	0.78 10	5717.31		2974.563	(3−)	%Iγ≈0.69
x2748.3 7	0.12 5					%Iγ≈0.11
2826.95 15	0.63 5	4123.84		1296.498	(4+)	%Iγ≈0.56
2913.4 5	0.7 3	3512.2		598.695	2+	%Iγ≈0.62
3016.81 9	1.17 5	3017.08	(1)	0.00	0+	%Iγ≈1.0
x3080.0 6	0.21 6					%Iγ≈0.19
x3092.3 5	0.16 5					%Iγ≈0.14
x3101.5 7	0.24 9					%Iγ≈0.21
3111.89 16	0.52 5	3710.57		598.695	2+	%Iγ≈0.46
x3154.1 3	0.46 8					%Iγ≈0.41
3156.8 6	0.21 7	3756.25		598.695	2+	%Iγ≈0.19
x3272.7 5	0.15 6					%Iγ≈0.13
x3318.3 4	0.17 5					%Iγ≈0.15
x3348.16 19	0.40 5					%Iγ≈0.36
x3371.0 6	0.17 6					%Iγ≈0.15
3381.61 15	0.63 5	3980.39		598.695	2+	%Iγ≈0.56
x3451.6 7	0.17 6					%Iγ≈0.15
x3510.9 5	0.12 4					%Iγ≈0.11
3562.72 24	0.61 6	4858.67		1296.498	(4+)	%Iγ≈0.54
x3579.8 3	0.35 5					%Iγ≈0.31
x3631.7 9	0.16 7					%Iγ≈0.14
x3634.8 8	0.16 8					%Iγ≈0.14
x3640.6 3	0.33 6					%Iγ≈0.29
3662.10 21	0.48 7	4959.35		1296.498	(4+)	%Iγ≈0.43
x3711.7 3	0.34 5					%Iγ≈0.3
3718.66 15	0.91 5	4317.38		598.695	2+	%Iγ≈0.81
3770.0 3	0.31 4	4368.80		598.695	2+	%Iγ≈0.28
x3782.7 8	0.11 4					%Iγ≈0.098
x3805.3 4	0.18 5					%Iγ≈0.16
x3822.0 4	0.22 4					%Iγ≈0.2
3831.8 4	0.23 4	5128.4		1296.498	(4+)	%Iγ≈0.21
3849.46 19	0.58 5	5146.07		1296.498	(4+)	%Iγ≈0.52
x3918.2 3	0.12 3					%Iγ≈0.11
3941.06 17	1.00 5	4539.87		598.695	2+	%Iγ≈0.89
x4022.3 8	0.20 8					%Iγ≈0.18
4054.50 20	1.12 6	5351.05		1296.498	(4+)	%Iγ≈1.0
4078.0 4	0.33 5	5373.25		1296.498	(4+)	%Iγ≈0.29
4163.4 4	0.24 5	5460.0		1296.498	(4+)	%Iγ≈0.21
x4166.8 5	0.19 5					%Iγ≈0.17

Continued on next page (footnotes at end of table)

^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12 (continued)

γ(^{76}Zn) (continued)

E_γ [†]	I_γ [†@]	E_i(level)	E_f	J^π_f	Comments
[x]4260.8 *3*	1.00 *8*				%Iγ≈0.89
4264.59 *25*	1.35 *8*	5560.55	1296.498	(4$^+$)	%Iγ≈1.2
[x]4333.2 *3*	0.20 *4*				%Iγ≈0.18
4361.1 *7*	0.06 *3*	4959.35	598.695	2$^+$	%Iγ≈0.053
[x]4433.8 *7*	0.20 *6*				%Iγ≈0.18
[x]4465.6 *9*	0.14 *5*				%Iγ≈0.13
[x]4481.8 *5*	0.24 *5*				%Iγ≈0.21
[x]4507.0 *7*	0.13 *4*				%Iγ≈0.12
[x]4516.6 *5*	0.23 *5*				%Iγ≈0.21
[x]4531.3 *3*	0.53 *5*				%Iγ≈0.47
[x]4540.4 *7*	0.13 *4*				%Iγ≈0.12
4585.7 *4*	0.68 *5*	5184.5	598.695	2$^+$	%Iγ≈0.61
4590.1 *4*	0.51 *6*	5886.70	1296.498	(4$^+$)	%Iγ≈0.45
[x]4620.0 *8*	0.16 *5*				%Iγ≈0.14
4625.7 *7*	0.14 *4*	5921.5	1296.498	(4$^+$)	%Iγ≈0.13
4639.3 *4*	0.31 *4*	5238.2	598.695	2$^+$	%Iγ≈0.28
4675.8 *5*	0.51 *6*	5973.1	1296.498	(4$^+$)	%Iγ≈0.45
4719.0 *6*	0.12 *3*	5317.43	598.695	2$^+$	%Iγ≈0.11
[x]4755.7 *5*	0.19 *4*				%Iγ≈0.17
4773.6 *5*	0.49 *6*	5373.25	598.695	2$^+$	%Iγ≈0.44
4925.0 *11*	0.23 *8*	5523.6	598.695	2$^+$	%Iγ≈0.21
[x]4946.7 *10*	0.23 *10*				%Iγ≈0.21
4963.0 *7*	0.37 *8*	5560.55	598.695	2$^+$	%Iγ≈0.33
[x]4995.7 *6*	0.61 *11*				%Iγ≈0.54
5126.1 *6*	0.22 *7*	5725.0	598.695	2$^+$	%Iγ≈0.2
[x]5327.7 *9*	0.36 *9*				%Iγ≈0.32
5375.4 *7*	0.52 *8*	5973.1	598.695	2$^+$	%Iγ≈0.46
[x]5795.1 *10*	1.23 *24*				%Iγ≈1.1
[x]5921.0 *11*	1.26 *25*				%Iγ≈1.1

[†] From 2022Si25. Values are also available from 2005Va19 and and 1990Wi12, but much less complete and less precise.

[‡] From Adopted Gammas.

[#] 2022Si25 have chosen to indicate firm placement of the 2350 level as well as the 464-1053 cascade based on unpublished results of an high-spin experiment (Ref[38] in 2022Si25). The same ordering of the 464-1053 cascade is proposed by 2005Va19 based on marginally higher intensity of 1053γ, while 1990Wi12 showed a reverse ordering in their level scheme making a level at E=1716.

[@] For absolute intensity per 100 decays, multiply by ≈0.89.

[&] 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.

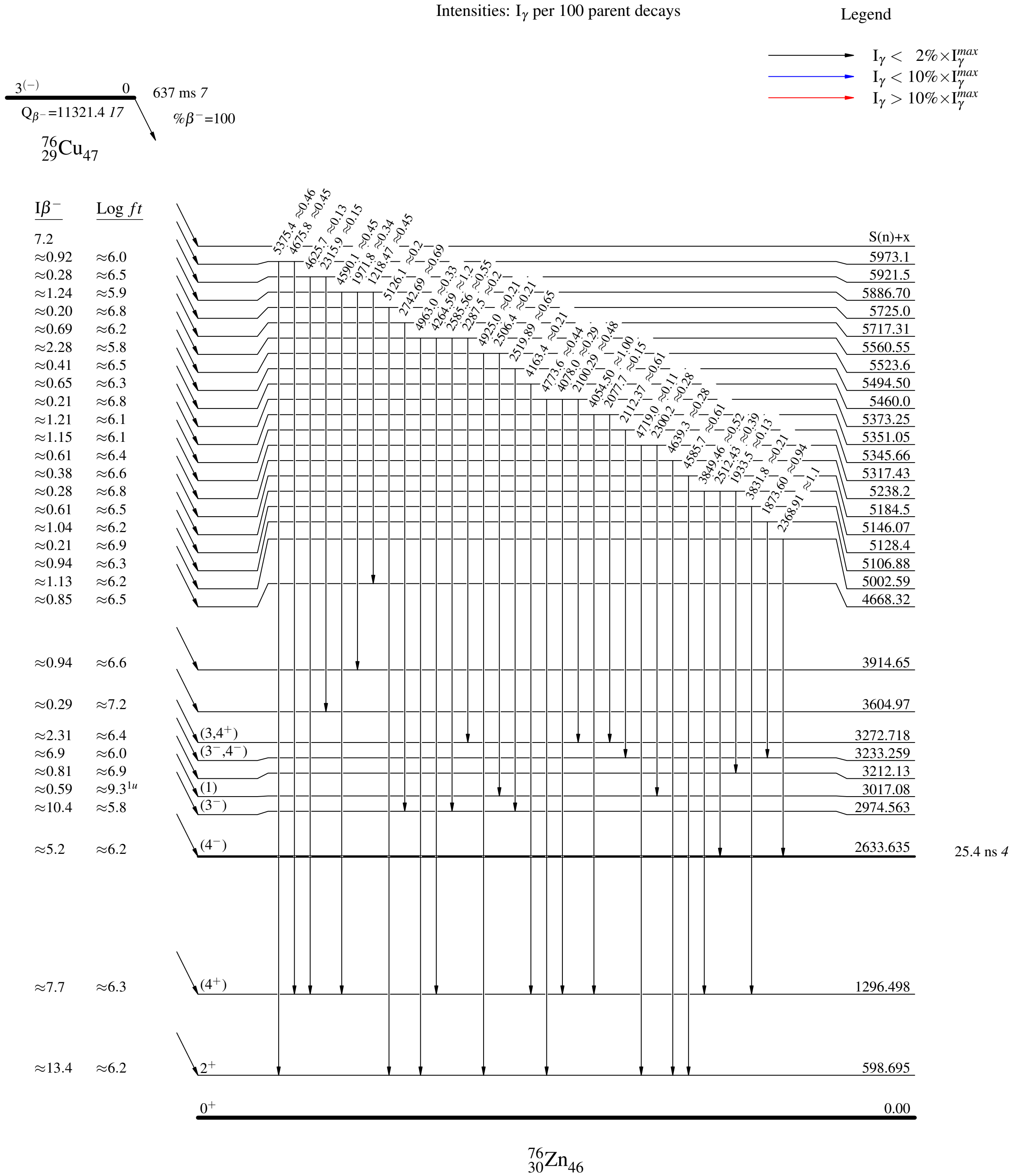
[a] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12

Decay Scheme

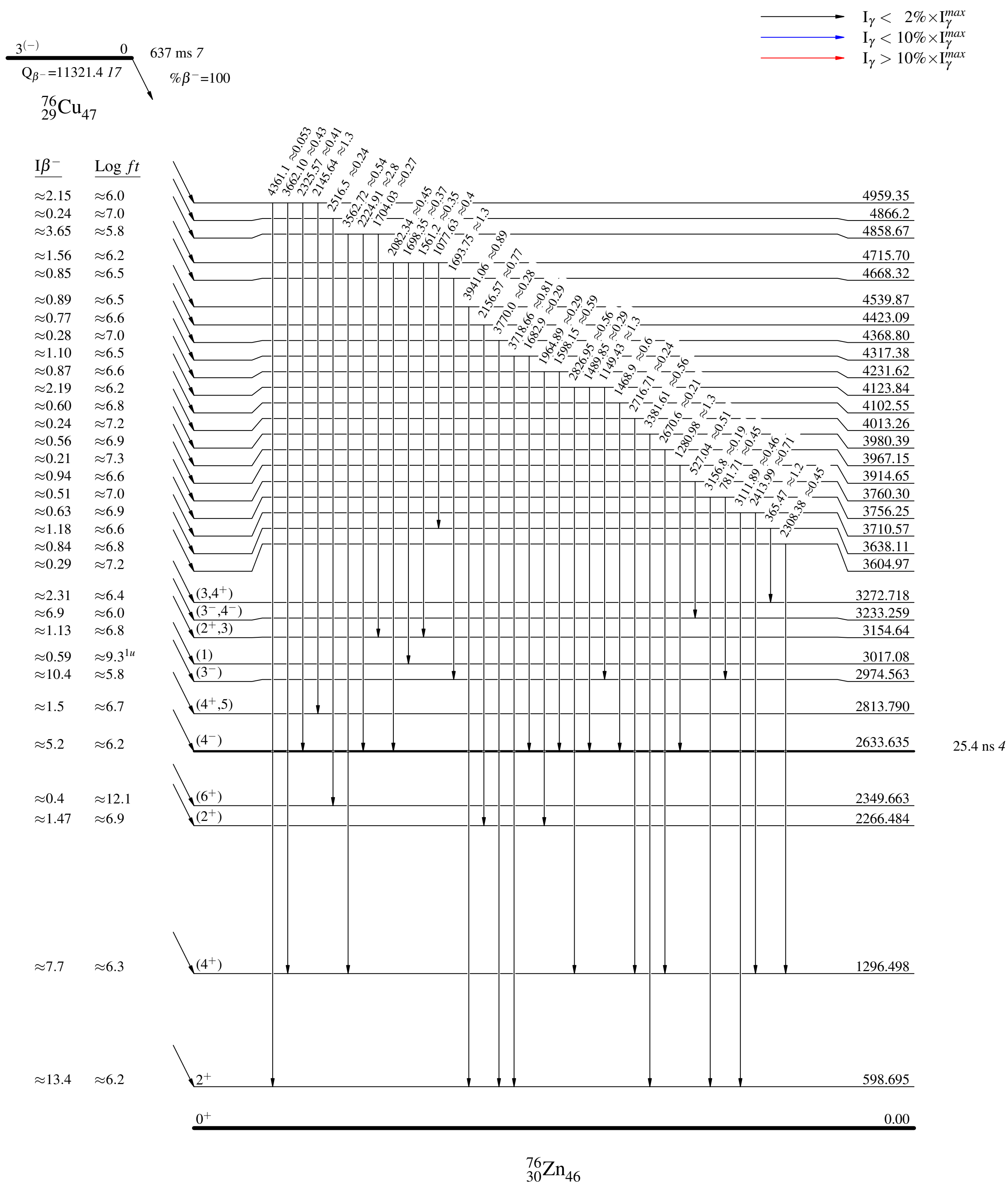
Intensities: I_γ per 100 parent decays



^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays



^{76}Cu β^- decay (637 ms) 2022Si25,2005Va19,1990Wi12

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays