^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	31-Aug-2014

Parent: ^{80}Zn: E=0; $J^\pi=0^+$; $T_{1/2}$=0.54 s *2*; Q(β^-)=7575 *4*; %β^- decay=100.0

^{80}Zn-$T_{1/2}$: From ^{80}Zn Adopted Levels.

^{80}Zn-Q(β^-): From 2012Wa38.

2014Li32: ^{80}Zn isotope produced in U(p,F),E=1 GeV; and in U(n,F), E=fast neutrons from a proton beam hitting a neutron converter. Resonant laser ionization was used to produce pure Zn ion beam, then accelerated to 40 keV at ISOLDE-CERN facility. Measured Eγ, Iγ, β particles, $\gamma\gamma$-coin, level half-life by $\beta\gamma$(t). For γ rays, two HPGe detectors and two $LaBr_3$(Ce) crystals were used; and for β particles, a plastic scintillator was used. Deduced levels, J,π, level half-life, multipolarity, beta feedings, log *ft* values.

1987Wi13 (also 1986Gi07): ^{80}Zn produced by mass separation of A=80 fission fragments from ^{235}U(n,F). Measured Eγ, Iγ, $\gamma\gamma$, $\beta\gamma$, $T_{1/2}$ and Q(β^-) value. A total of 28 γ rays reported by 1987Wi13, two of which were unplaced. The 0.55-s activity was assigned to ^{80}Zn and not to an isomer of ^{80}Ga, based on several strong arguments given by 1987Wi13. The γ spectrum was heavily contributed by impurities from decays of ^{80}Ga, ^{80}Ge and ^{80}As.

1986Ek01: ^{80}Zn produced by mass separation of fission fragments from ^{235}U(n,F). Measured Eγ, Iγ, $\gamma\gamma$, $\beta\gamma$, $T_{1/2}$ and Q(β^-). A total of 13 γ rays were reported, nine of which were assigned in a decay scheme; four of the γ rays were tentative. The γ spectrum was contributed by A=80 isobaric activities.

1981Ru07, 1981Ho24: thermo-chromatographic technique used to identify the isotope produced in neutron-induced fission of ^{235}U.

Others: 1988BaZX (yield measurement), 1988Kr08 (theory), 1991Kr15 ($T_{1/2}$ and %β^-n measurement).

Additional information 1.

^{80}Ga Levels

Levels of 1863 and 2478 keV in 1986Ek01, and 312, 387 and 486 keV in 1987Wi13 have been omitted. The γ rays associated with these levels have been reassigned to other levels in 2014Li32 based on their extensive $\gamma\gamma$-coin data. Levels at 685, 712, 889, 964, 1171, 1334, 1427, 1503, 2070 and 2655 keV proposed in 1987Wi13 and 1986Ek01 have been confirmed by 2014Li32, but all pushed upwards by 22.5 keV, based on discovery of ^{80}Ga isomer by 2013Ve13.

The level scheme is from 2014Li32, based on previous level schemes proposed by 1987Wi13 and 1986Ek01 from about 25 γ rays, except that a large number of weak γ rays are identified by 2014Li32 from extensive $\gamma\gamma$-coin data, and that most levels in 1987Wi13 and 1986Ek01 are now higher by 22.5 keV, the location of 1.3-s isomer proposed by 2013Ve03 and its energy by 2014Li32.

Levels at 1863 and 2478 keV in 1986Ek01, and 312, 386 and 485 keV in 1987Wi13 are omitted here since no evidence was found for such levels in the extensive $\gamma\gamma$-coin data of 2014Li32. The γ rays from these levels are now assigned to other levels.

E(level)[†]	J^π[‡]	$T_{1/2}$	Comments
0.0	$6^{(-)}$	1.9[@] s *1*	
22.45 *10*	$3^{(-)}$	1.3[@] s *2*	%$\beta^-\approx$100; %β^-n=?; %IT=?
97.20 *8*	(4)		
403.48 *3*			
577.42 *8*			
707.90 *11*	(1^+)	18.3 ns *5*	$T_{1/2}$: from $\beta(685\gamma)$(t) (2014Li32).
734.76 *10*			
911.39 *10*			
951.34 *12*	$(1^-,2^-)$		
987.20 *10*	$(1^-,2^-)$		
990.15 *11*			
1141.79 *11*			
1152.79 *11*			
1193.90 *10*			
1213.95 *10*			

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^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01 (continued)

^{80}Ga Levels (continued)

E(level)†	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
1290.32 *12*	1449.92 *10*	$1^{+\#}$	2092.21 *10*	$1^{+\#}$	2822.11 *16*	(1^+)
1300.39 *13*	1526.06 *10*		2560.40 *12*	$1^{+\#}$	3329.5 *4*	
1356.47 *10*	2044.42 *11*		2676.94 *12*	$1^{+\#}$	3380.0 *4*	

† From least-squares fit to Eγ data, reduced χ^2=0.76.
‡ From Adopted Levels, unless otherwise stated.
# From allowed log *ft* value from 0^+ parent.
@ From Adopted Levels.

β^- radiations

Q(β^-) value deduced from several β-gated singles γ-ray spectra (1987Wi13) and $\beta\gamma$ (1986Ek01).

E(decay)	E(level)	Iβ⁻†‡	Log *ft*†	Comments
(4195 *4*)	3380.0	0.21 *5*	6.1 *1*	av Eβ=1854.9 *20* Additional information 2.
(4246 *4*)	3329.5	0.33 *9*	5.9 *1*	av Eβ=1879.3 *20* Additional information 3.
(4753 *4*)	2822.11	2.5 *4*	5.3 *1*	av Eβ=2124.9 *20* Additional information 4.
(4898 *4*)	2676.94	13.6 *12*	4.59 *5*	av Eβ=2195.2 *20* Additional information 5.
(5015 *4*)	2560.40	7.4 *7*	4.90 *5*	av Eβ=2251.7 *20* Additional information 6.
(5483 *4*)	2092.21	21.6 *18*	4.61 *4*	av Eβ=2478.9 *20* E(decay): 5710 *200* from (642γ)(5710β) (1986Ek01). Additional information 7.
(5531 *4*)	2044.42	0.5 *3*	6.3 *3*	av Eβ=2502.1 *20* Additional information 8.
(6049# *4*)	1526.06	1.3 *13*	>5.8	av Eβ=2754.0 *20* Additional information 9.
(6125 *4*)	1449.92	34 *4*	4.6 *1*	av Eβ=2791.0 *20* E(decay): 5490 *140* from (715γ)(5490β) (1986Ek01). Additional information 10.
(6219# *4*)	1356.47	0.7 *7*	>6.1	av Eβ=2836.4 *20* Iβ⁻: 2.0 *5* in 2014Li32 is in disagreement.
(6285 *4*)	1290.32	0.8 *4*	6.3 *2*	av Eβ=2868.5 *20* Iβ⁻: no β feeding given in 2014Li32.
(6381# *4*)	1193.90	0.5 *4*	6.5 *4*	av Eβ=2915.4 *20* Iβ⁻: no β feeding given in 2014Li32.
(6422 *4*)	1152.79	0.08 *6*	7.4 *4*	av Eβ=2935.4 *20* Iβ⁻: no β feeding given in 2014Li32.
(6433 *4*)	1141.79	1.3 *3*	6.2 *1*	av Eβ=2940.7 *20* Additional information 11.
(6585 *4*)	990.15	0.9 *2*	6.4 *1*	av Eβ=3014.5 *20*
(6588 *4*)	987.20	4.3 *14*	5.7 *2*	av Eβ=3015.9 *20* Additional information 12.
(6624 *4*)	951.34	4.5 *7*	5.7 *1*	av Eβ=3033.3 *20* Additional information 13.

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^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ⁻†‡	Log *ft*†	Comments
(6664 *4*)	911.39	1.1 *6*	6.3 *3*	av Eβ=3052.7 *20* Iβ⁻: 3.8 *6* in 2014Li32 is in disagreement.
(6840# *4*)	734.76	<7	>5.5	av Eβ=3138.6 *20* Additional information 14.
(6867 *4*)	707.90	2.2 *19*	6.1 *4*	av Eβ=3151.7 *20*
(6998 *4*)	577.42	0.7 *4*	6.6 *3*	av Eβ=3215.1 *20* Iβ⁻: no β feeding given in 2014Li32.

† In evaluator's opinion, all values should be considered as approximate since in the present level scheme there is a gap of about 4.2 MeV between the Q(β^-) value and the highest known level in ^{80}Ga at 3380 keV. There may be additional unobserved transitions which could affect the quoted β feedings and associated log *ft* values, especially those for weakly fed levels.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

γ(^{80}Ga)

Iγ normalization: Deduced from summed γ transition intensity to g.s.+22.45 level=99.0 *5*, allowing for %β^-n=1.0 *5* (from ^{80}Ga Adopted Levels. 2014Li32 give normalization factor of 0.41 *6*.

Following tentative γ rays with Eγ(Iγ) reported by 1986Ek01 are omitted here for lack of confirmation in later studies: 123.0 *3* (4.3 *15*), 527.8 *3* (12.7 *20*), 758.2 *3* (12.3 *30*). 1987Wi13 reported Iγ<12 for 123.0γ, and 5.6 for 527.8γ but with probable assignment to ^{80}Ga decay.

E_γ†	I_γ†#	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α@	Comments
74.8 *1*	10.8 *11*	97.20	(4)	22.45	3(−)	D	0.154	I_γ: uncertainty of 0.2 (1.9%) in 2014Li32 seems too low in view of uncertainties assigned to other γ rays. Evaluator assigns 10% uncertainty. Additional information 15. Mult.: from α(exp)≤0.40 (2014Li32); estimated from intensity balance considerations and γγ coincidence intensities. α: value taken from BrIcc code to overlap M1 and E1.
75.8‡& *1*	<0.2	1526.06		1449.92	1+			
93.4 *1*	3.2 *6*	1449.92	1+	1356.47				Additional information 29.
151.7‡& *1*	<0.2	1141.79		990.15				
154.7‡ *1*	0.3 *1*	1141.79		987.20	(1−,2−)			
159.5‡ *1*	1.2 *3*	1449.92	1+	1290.32				
169.6 *1*	1.4 *3*	1526.06		1356.47				Additional information 33.
174.0 *1*	5.6 *6*	577.42		403.48				Additional information 17.
176.6 *1*	10.1 *10*	911.39		734.76				Additional information 20.
190.5‡ *1*	2.3 *2*	1141.79		951.34	(1−,2−)			
203.6‡ *1*	0.3 *1*	1193.90		990.15				
225.7‡ *1*	1.2 *2*	1526.06		1300.39				
243.5‡ *1*	0.9 *2*	951.34	(1−,2−)	707.90	(1+)			
282.21 *5*	4.1 *4*	990.15		707.90	(1+)			Additional information 24.
282.7‡ *1*	0.6 *2*	1193.90		911.39				

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^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01 (continued)

$\gamma(^{80}Ga)$ (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
306.4[‡] *1*	0.2 *1*	403.48		97.20	(4)		
308.3[‡] *1*	0.4 *1*	1449.92	1^+	1141.79			
312.13 *5*	12.4 *2*	1526.06		1213.95			Additional information 34.
332.17 *5*	2.6 *4*	1526.06		1193.90			Additional information 35.
373.2[‡] *1*	0.2 *1*	1526.06		1152.79			
403.47 *3*	4.3 *5*	403.48		0.0	$6^{(-)}$		Additional information 16.
406.9[‡] *2*	0.8 *2*	1141.79		734.76			
433.9[‡] *1*	2.2 *4*	1141.79		707.90	(1^+)		
444.9[‡] *1*	0.8 *1*	1356.47		911.39			
459.9[‡&] *1*	<0.2	1449.92	1^+	990.15			
462.72 *2*	11.1 *11*	1449.92	1^+	987.20	$(1^-,2^-)$		I_γ: uncertainty of 0.1 (0.9%) in 2014Li32 seems too high in view of uncertainties assigned to other strong γ rays. Evaluator assigns 5% uncertainty. Additional information 30.
468.3[‡] *1*	2.2 *6*	2560.40	1^+	2092.21	1^+		
480.1[‡] *1*	0.7 *1*	577.42		97.20	(4)		
518.3[‡] *1*	1.0 *2*	2044.42		1526.06			
538.87[‡] *5*	1.3 *2*	1526.06		987.20	$(1^-,2^-)$		
566.20 *5*	10 *1*	2092.21	1^+	1526.06			Additional information 39.
575.3[‡] *1*	0.4 *1*	1152.79		577.42			
577.7[‡] *2*	0.2 *1*	577.42		0.0	$6^{(-)}$		
594.9[‡&] *1*	0.3 *1*	2044.42		1449.92	1^+		
614.66 *5*	13.3 *4*	1526.06		911.39			Additional information 36.
621.8[‡] *1*	1.7 *3*	1356.47		734.76			
632.5[‡] *1*	3.5 *4*	2676.94	1^+	2044.42			
636.6 *1*	4.5 *5*	1213.95		577.42			Additional information 26.
642.3 *1*	30 *3*	2092.21	1^+	1449.92	1^+		Additional information 40.
685.4 *1*	36 *4*	707.90	(1^+)	22.45	$3^{(-)}$	(M2)	B(M2)(W.u.)=0.60 *2* (2014Li32) Additional information 18.
688.0[‡] *1*	1.8 *3*	2044.42		1356.47			
712.3 *1*	100 *10*	734.76		22.45	$3^{(-)}$		Additional information 19.
715.2 *1*	77 *8*	1449.92	1^+	734.76			I_γ: uncertainty of 21 (27%) in 2014Li32 seems too high in view of uncertainties assigned to other strong γ rays. Evaluator assigns 10% uncertainty. Additional information 31.
723.2[‡&] *8*	<0.2	1300.39		577.42			
735.6 *1*	2.2 *4*	2092.21	1^+	1356.47			Additional information 41.
742.0 *1*	21 *2*	1449.92	1^+	707.90	(1^+)		Additional information 32.
791.3 *1*	4.0 *6*	1526.06		734.76			Additional information 37.
802.0[‡] *1*	0.8 *2*	2092.21	1^+	1290.32			
814.2[‡] *1*	1.6 *2*	911.39		97.20	(4)		
818.2[‡] *1*	1.1 *3*	1526.06		707.90	(1^+)		
878.2[‡] *2*	1.0 *2*	2092.21	1^+	1213.95			
888.9 *1*	5.7 *6*	911.39		22.45	$3^{(-)}$		Additional information 21.
928.8 *2*	13.6 *15*	951.34	$(1^-,2^-)$	22.45	$3^{(-)}$		Additional information 22.
950.5[‡] *2*	1.3 *3*	2092.21	1^+	1141.79			
964.8 *2*	32 *3*	987.20	$(1^-,2^-)$	22.45	$3^{(-)}$		Additional information 23.
1034.3[‡] *2*	9.2 *10*	2560.40	1^+	1526.06			
1057.3[‡] *3*	0.6 *2*	2044.42		987.20	$(1^-,2^-)$		

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^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01 (continued)

$\gamma(^{80}Ga)$ (continued)

E_γ [†]	I_γ [†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
1104.9[‡] *2*	5.4 *7*	2092.21	1^+	987.20	$(1^-,2^-)$		
1110.3[‡] *2*	1.8 *6*	2560.40	1^+	1449.92	1^+		
1116.7 *2*	9.0 *10*	1213.95		97.20	(4)		Additional information 27.
1150.9 *2*	22 *2*	2676.94	1^+	1526.06			Additional information 42.
1171.5 *2*	3.9 *5*	1193.90		22.45	$3^{(-)}$		Additional information 25.
1203.3[‡] *2*	1.1 *2*	1300.39		97.20	(4)		
1226.9[‡] *2*	3.2 *8*	2676.94	1^+	1449.92	1^+		
1267.9[‡] *2*	5.9 *7*	1290.32		22.45	$3^{(-)}$		
1296.2[‡] *2*	1.7 *6*	2822.11	(1^+)	1526.06			
1320.6[‡] *2*	2.0 *5*	2676.94	1^+	1356.47			
1334.0 *2*	9.9 *11*	1356.47		22.45	$3^{(-)}$		Additional information 28.
1357.2[‡] *2*	2.1 *4*	2092.21	1^+	734.76			
1366.4[‡] *2*	1.0 *4*	2560.40	1^+	1193.90			
1372.0[‡] *2*	1.6 *3*	2822.11	(1^+)	1449.92	1^+		
1384.3[‡] *2*	1.4 *3*	2092.21	1^+	707.90	(1^+)		
1386.6[‡] *2*	1.9 *4*	2676.94	1^+	1290.32			
1418.4[‡] *2*	0.8 *1*	2560.40	1^+	1141.79			
1427.5[‡] *2*	3.8 *8*	1449.92	1^+	22.45	$3^{(-)}$	[M2]	
1503.6 *3*	9.6 *11*	1526.06		22.45	$3^{(-)}$		Additional information 38.
1570.2[‡] *3*	1.6 *2*	2560.40	1^+	990.15			
1573.5[‡] *3*	0.4 *2*	2560.40	1^+	987.20	$(1^-,2^-)$		
1608.8[‡&] *3*	<0.2	2560.40	1^+	951.34	$(1^-,2^-)$		
1726.5[‡&] *3*	<0.2	2676.94	1^+	951.34	$(1^-,2^-)$		
1825.5[‡] *3*	0.7 *2*	2560.40	1^+	734.76			
1834.9[‡] *3*	2.6 *2*	2822.11	(1^+)	987.20	$(1^-,2^-)$		
1871.3[‡&] *3*	<0.2	2822.11	(1^+)	951.34	$(1^-,2^-)$		
2021.8[‡] *3*	1.3 *3*	2044.42		22.45	$3^{(-)}$		
2378.1[‡] *3*	0.8 *2*	3329.5		951.34	$(1^-,2^-)$		
2428.6[‡] *3*	0.5 *1*	3380.0		951.34	$(1^-,2^-)$		

[†] From 2014Li32. Data from 1987Wi13 and 1986Ek01 are generally consistent but are less complete. The source purity, in the form of extracted ^{80}Zn bean, is the best in 2014Li32 of all the studies. For this reason all γ-ray data are adopted from this paper, even though some of the Eγ values are given to a higher precision in 1987Wi13. In 2014Li32, strong γ transitions were measured using singles γ spectra and weaker lines from $\gamma\gamma$-coin spectra. Statistical and peak fitting uncertainties are assigned.

[‡] From 2014Li32 only.

[#] For absolute intensity per 100 decays, multiply by 0.416 *21*.

[@] 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.

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

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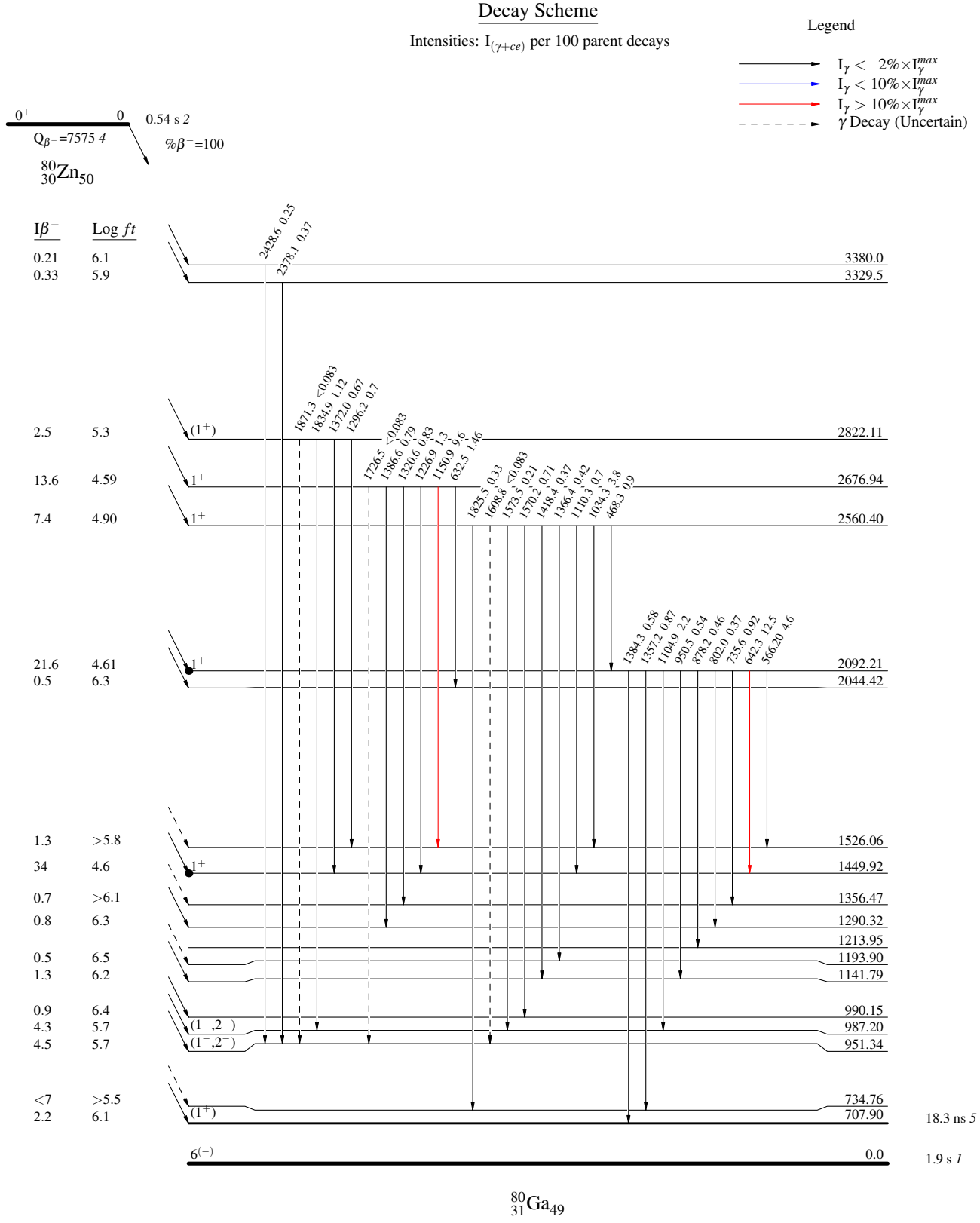
Decay Scheme

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



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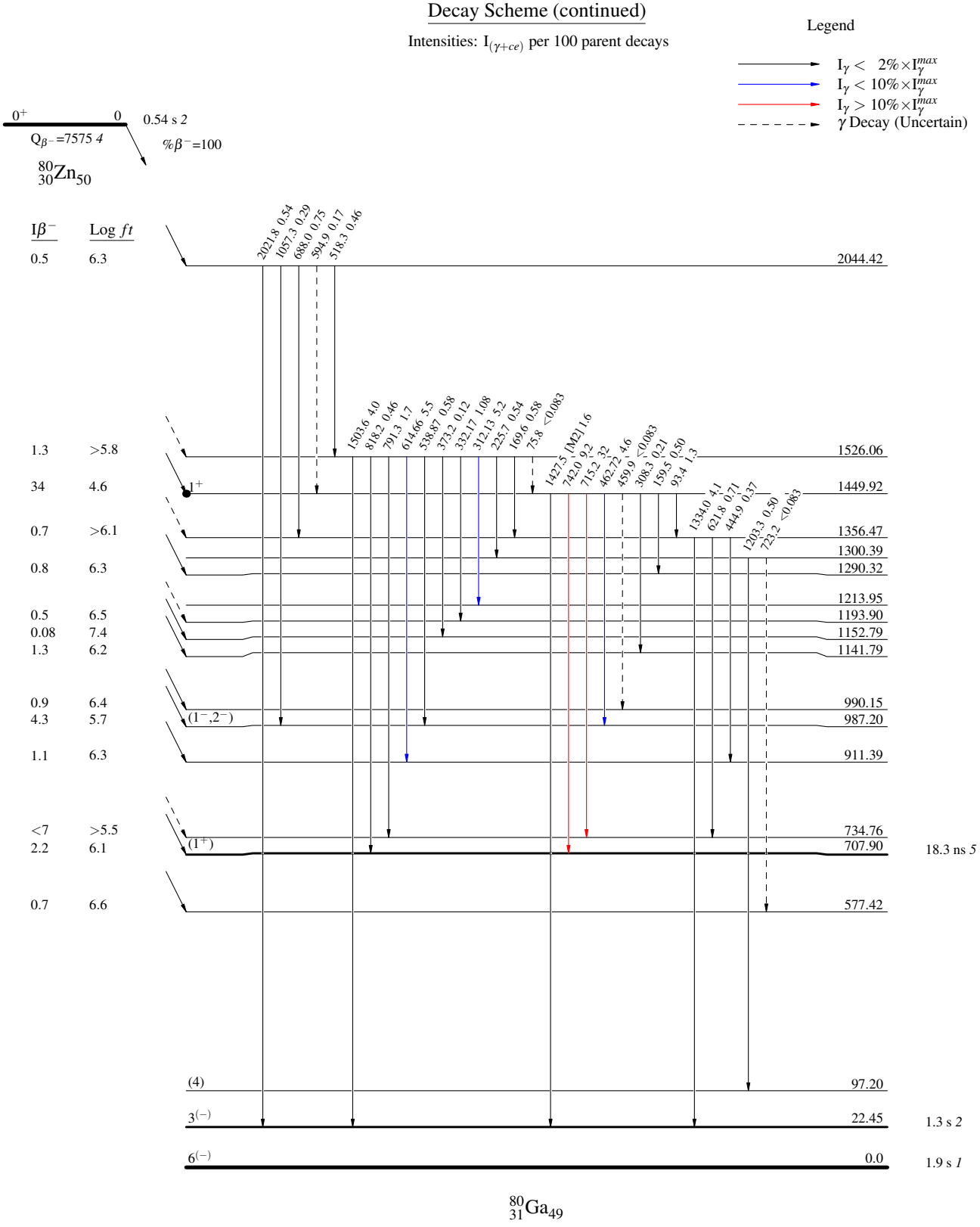
Decay Scheme (continued)

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



^{80}Zn β^- decay (0.54 s) 2014Li32,1987Wi13,1986Ek01

Decay Scheme (continued)

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