^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

Parent: ^{139}I: E=0.0; J^π=(7/2$^+$); $T_{1/2}$=2.280 s *11*; Q(β^-)=7186 *29*; %β^- decay=100.0

^{139}I-J^π,$T_{1/2}$: From ^{139}I Adopted Levels.

^{139}I-Q(β^-): From 2012Wa38.

Tentative Decay Scheme due to many transitions unplaced and lack of information about accurate multipolarities of low-energy transitions.

1987RoZW, 1985Ro13, 1985WaZQ: TRISTAN. Measured Eγ, Iγ.

Out of a total 110 γ rays reported, 41 remain unplaced. Iγ(unplaced)/Iγ(placed)≈0.16. The decay scheme (from 1985Ro13), constructed on the basis of energy sums, is therefore treated as tentative, by evaluators.

Others: 1982Al01, 1975Kr17, 1971Kr22.

Additional information 1.

1992Gr06: measured $\beta\gamma$-coin; deduced Q(β^-) value; plastic scintillation detector telescope.

1975Al11: measured total absorption γ-spectrum and deduced β-strength function.

Delayed neutron measurements (1974Ru07,1974Kr21,1975As04,1976Lu02, 1981Ho07):

1974Ru07: measured neutron spectra up to at least 1600 keV.

1981Ho07: OSIRIS. measured Eγ for seven transitions, Iγ/In (^{3}He detectors in paraffin shielded by boron-paraffin and cadmium); Iγ/In=6.81 *6*.

Beta spectra: 1973Ad04, 1974Gr29, 1975As04.

Beta-strength function: 1972Pa11, 1974JoZT.

1980KeZQ: LOHENGRIN, OSTIS. Measured $\beta\gamma$-coin; scin or Ge, Ge(Li).

^{139}Xe Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[‡]	Comments
0.0	3/2$^-$	39.68 s *14*	$T_{1/2}$: from Adopted Levels.
22.73 *8*	(7/2$^-$)		
31.703 *20*	(5/2$^-$)		
559.40 *10*	(9/2$^-$)		
593.99 *10*	(11/2$^-$)		
624.26 *10*	(5/2$^-$)		
670.02 *12*	(3/2$^-$,5/2,7/2$^-$)[#]		
678.79 *9*	(9/2$^-$)		
1008.27 *10*	(5/2,7/2,9/2)		
1059.02 *15*	(3/2$^-$,5/2,7/2)[#]		
1193.33 *11*	(3/2$^-$,5/2,7/2)[#]		
1312.70 *17*			
1399.46 *10*	(3/2$^-$,5/2,7/2)[#]		
1444.15 *13*	(7/2,9/2)		
1448.53 *11*	(7/2,9/2)		
1493.35 *17*			
1684.03 *9*	(5/2,7/2,9/2)		
1771.43 *9*			
1894.43 *15*			
2307.94 *13*			
2740.18 *14*			
2898.45 *12*			
3744+x			Additional information 2. E(level): set of neutron decaying levels above S(n)(^{139})Xe=3744 *4*, where x<3442.

[†] From least-squares fit to Eγ data. Reduced χ^2 of 2.5 is somewhat larger than critical χ^2=1.6. The 849.5 and 969.4 γ rays

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^{139}Xe Levels (continued)

deviate by about three times the quoted uncertainty.
‡ From the Adopted Levels. Additional arguments for J^π assignments from this dataset are given as footnotes.
# $\neq 3/2^+$ from log *ft*.

β^- radiations

<Eβ> ≥ 2.01 MeV *29* (1982Al01,Si(Li)) compared to 2.786 MeV *11* from the decay scheme.
1980KeZQ suggested that there is no direct feeding of the g.s. based on agreement of E_β from singles and from β-528γ. This seems to be confirmed by <E_β> and would be consistent with J^π(^{139}I g.s.)=(7/2$^+$) from systematics and J^π(^{139}Xe g.s.)=3/2$^-$.
9.9% *8* feeding to unbound levels above 3.64 MeV. (1983ReZX,1984Ma39).
The $\beta\gamma$-coin data are from 1985Ro13 and 1992Gr06.

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(1.7×10^3‡ *17*)	3744+x	10.0 *3*		Iβ^-: from Adopted Levels of ^{139}I, %β^-n=10.0 *3* which represents total β feeding to neutron decaying levels above the neutron separation energy of ^{139}Xe.
(4.29×10^3 *3*)	2898.45	0.36 *3*	6.9	av Eβ=1839 *14*
(4.45×10^3 *3*)	2740.18	1.52 *4*	6.3	av Eβ=1913 *14*
(4.88×10^3 *3*)	2307.94	0.85 *3*	6.7	av Eβ=2117 *14*
(5.29×10^3 *3*)	1894.43	0.32 *2*	7.3	av Eβ=2311 *14*
(5.41×10^3 *3*)	1771.43	0.11 *2*	7.8	av Eβ=2369 *14*
(5.50×10^3 *3*)	1684.03	2.52 *10*	6.5	av Eβ=2411 *14*
(5.69×10^3 *3*)	1493.35	0.44 *2*	7.3	av Eβ=2500 *14*
(5.74×10^3 *3*)	1448.53	6.2 *2*	6.2	av Eβ=2522 *14* E(decay): 5520 *150* from $\beta\gamma$-coincidences (1985Ro13). E(decay): 5352 *44* from β(1426γ) coin (1992Gr06); 5520 *150* from $\beta\gamma$-coincidences (1985Ro13).
(5.74×10^3 *3*)	1444.15	1.65 *5*	6.8	av Eβ=2524 *14* E(decay): 5520 *150* from $\beta\gamma$-coincidences (1985Ro13).
(5.79×10^3 *3*)	1399.46	1.48 *5*	6.8	av Eβ=2545 *14*
(5.87×10^3 *3*)	1312.70	0.33 *2*	7.5	av Eβ=2586 *14*
(5.99×10^3 *3*)	1193.33	0.71 *4*	7.2	av Eβ=2642 *14*
(6.13×10^3 *3*)	1059.02	2.0 *1*	6.8	av Eβ=2705 *14*
(6.18×10^3 *3*)	1008.27	5.5 *2*	6.4	av Eβ=2729 *14*
(6.51×10^3 *3*)	678.79	3.6 *3*	6.7	av Eβ=2884 *14*
(6.52×10^3 *3*)	670.02	0.29 *3*	7.8	av Eβ=2888 *14* Iβ^-: it should be noted that tentative placement of 389γ from 1059 level leads to negative β feeding of −0.34%. It is possible this γ is either multiply placed, or only from the 1448 level.
(6.56×10^3 *3*)	624.26	3.2 *2*	6.7	av Eβ=2910 *14*
(6.59×10^3 *3*)	593.99	2.6 *4*	8.9^{1u}	av Eβ=2905 *14*
(6.63×10^3 *3*)	559.40	12.3 *4*	6.2	av Eβ=2940 *14* E(decay): 6340 *120* from β(528γ) coin; 6210 *150* from singles (1985Ro13).
(7.15×10^3 *3*)	31.703	≈22	≈6.1	av Eβ=3188 *14* Iβ^-: see comment for β feeding of 22.85 level. Other: <30% from log *ft*>5.9 for first-forbidden transition.
(7.16×10^3 *3*)	22.73	≈21	≈6.1	av Eβ=3193 *14* Iβ^-: total β feeding to 22.85 and 31.86 levels is 43% *2* from the present decay scheme with Iγ normalization=0.0826 *70* and %β^-n=10.0 *3*. This feeding is assumed (by evaluators) as equally divided between the two levels. Other: <30% from log *ft*>5.9 for first-forbidden transition.

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^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ (continued)

β^- radiations (continued)

† Absolute intensity per 100 decays.
‡ Estimated for a range of levels.

^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ (continued)

$\gamma(^{139}Xe)$

Iγ normalization, I(γ+ce) normalization: From Iγ(571γ)/I_n=0.81 *6* (1981Ho07) and %β^-n=10.0 *3* (from Adopted Levels of ^{139}I).

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ	α[&]	$I_{(\gamma+ce)}$[@]	Comments
22.8 *2*	≈0.85	22.73	(7/2$^-$)	0.0	3/2$^-$	[E2]		6.9×10^2 *4*	≈590	ce(L)/(γ+ce)=0.792 *24*; ce(M)/(γ+ce)=0.171 *11*; ce(N)/(γ+ce)=0.0332 *22*; ce(O)/(γ+ce)=0.00311 *21*; Particle normalization/$T_{1/2}$=0.0363 *24* $I_{(\gamma+ce)}$: deduced by the evaluators from β feeding of ≈21% and total γ feeding. Other: I(γ+ce)<292 from Iγ<0.4 deduced from estimate by 1985Ro13 and mult=E2 is low since γ feeding from higher levels gives I(γ+ce)=332 *5*. In addition, from systematics of neighboring nuclides, strong β feeding is expected to this level.
31.70 *2*	8.0 *3*	31.703	(5/2$^-$)	0.0	3/2$^-$	M1+E2	≈0.9	≈62.5		α(L)≈49.5; α(M)≈10.69; α(N)≈2.09; α(O)≈0.199 α(exp): >27 from intensity balance at 31.86 level, if no β feeding. $I_{(\gamma+ce)}$: 226 *4* from intensity balancing at the 32 level, if no direct β feeding to this level. With 22% β feeding, I(γ+ce)≈500. Mult.,δ: from γ intensity balance at 31.9 level, using β feeding of ≈22% and Iγ=8.0 *3*. Assumption of no β feeding to 31.86 level rules out E1 and implies δ(E2/M1)>0.48.
84.80 *2*	2.0 *1*	678.79	(9/2$^-$)	593.99	(11/2$^-$)	[M1,E2]		2.3 *10*		α(K)=1.6 *5*; α(L)=0.6 *5*; α(M)=0.12 *10*; α(N)=0.024 *19*; α(O)=0.0025 *18*
87.40 *2*	1.0 *1*	1771.43		1684.03	(5/2,7/2,9/2)					
[x]165.8 *2*										
[x]249.5 *2*	0.6 *1*									
329.6 *2*	1.1 *1*	1008.27	(5/2,7/2,9/2)	678.79	(9/2$^-$)					
384.0 *2*	0.9 *1*	1008.27	(5/2,7/2,9/2)	624.26	(5/2$^-$)					
389.1[#b] *2*	7.6 *2*	1059.02	(3/2$^-$,5/2,7/2)	670.02	(3/2$^-$,5/2,7/2$^-$)					
[x]427.2 *2*										
440.0 *2*	0.6 *1*	1448.53	(7/2,9/2)	1008.27	(5/2,7/2,9/2)					
448.9 *2*	1.2 *1*	1008.27	(5/2,7/2,9/2)	559.40	(9/2$^-$)					
[x]467.0 *2*	1.3 *1*									
[x]473.0 *2*	3.0 *1*									
[x]512.9 *2*	3.6 *1*									

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^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ (continued)

$\gamma(^{139}Xe)$ (continued)

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π	Comments
527.7 *2*	100 *3*	559.40	(9/2$^-$)	31.703	(5/2$^-$)	
536.6 *2*	67 *2*	559.40	(9/2$^-$)	22.73	(7/2$^-$)	
571.2 *3*	98 *3*	593.99	(11/2$^-$)	22.73	(7/2$^-$)	
592.6 *2*	29 *1*	624.26	(5/2$^-$)	31.703	(5/2$^-$)	
601.5 *2*	22 *1*	624.26	(5/2$^-$)	22.73	(7/2$^-$)	
624.3 *2*	1.8 *1*	624.26	(5/2$^-$)	0.0	3/2$^-$	
634.0#b *2*	1.6 *1*	1312.70		678.79	(9/2$^-$)	
638.5 *2*	6.4 *2*	670.02	(3/2$^-$,5/2,7/2$^-$)	31.703	(5/2$^-$)	
647.1ab *2*	a	670.02	(3/2$^-$,5/2,7/2$^-$)	22.73	(7/2$^-$)	
647.1a *2*	14.2a *5*	678.79	(9/2$^-$)	31.703	(5/2$^-$)	I_γ: total intensity for doublet=14.2 *5*. Based on Iγ(647)/Iγ(656)=0.38 *15* from SF decay (2002Ur04), almost all the intensity of 647.1γ belongs with the decay of 678 level, and almost none from the decay of 670 level.
656.0 *2*	58 *2*	678.79	(9/2$^-$)	22.73	(7/2$^-$)	
670.4 *2*	3.0 *1*	670.02	(3/2$^-$,5/2,7/2$^-$)	0.0	3/2$^-$	
675.7 *2*	0.8 *1*	1684.03	(5/2,7/2,9/2)	1008.27	(5/2,7/2,9/2)	
719.1 *2*	2.6 *1*	1312.70		593.99	(11/2$^-$)	
730.0 *2*	5.8 *2*	1399.46	(3/2$^-$,5/2,7/2)	670.02	(3/2$^-$,5/2,7/2$^-$)	
752.9 *2*	1.5 *1*	1312.70		559.40	(9/2$^-$)	
763.3 *2*	2.0 *1*	1771.43		1008.27	(5/2,7/2,9/2)	
769.8 *2*	13.0 *4*	1448.53	(7/2,9/2)	678.79	(9/2$^-$)	
774.1#b *2*	6.8 *2*	1399.46	(3/2$^-$,5/2,7/2)	624.26	(5/2$^-$)	
x781.9 *2*	2.2 *1*					
x808.4 *2*	0.8 *1*					
x822.8 *2*	4.0 *1*					
824.8 *2*	3.0 *1*	1448.53	(7/2,9/2)	624.26	(5/2$^-$)	
x837.4 *2*	0.9 *1*					
849.5 *2*	3.2 *1*	1444.15	(7/2,9/2)	593.99	(11/2$^-$)	E_γ: poor fit, level-energy difference=850.2.
854.4 *2*	50 *2*	1448.53	(7/2,9/2)	593.99	(11/2$^-$)	
859.4 *2*	3.8 *1*	2307.94		1448.53	(7/2,9/2)	
x869.7 *2*	2.4 *1*					
x894.4 *9*	9.2 *3*					
899.4 *2*	1.3 *1*	1493.35		593.99	(11/2$^-$)	
933.9 *2*	4.2 *1*	1493.35		559.40	(9/2$^-$)	
x942.5 *1*	0.7 *1*					
969.4 *2*	4.4 *1*	2740.18		1771.43		E_γ: poor fit, level-energy difference=968.8.
976.4 *2*	50 *2*	1008.27	(5/2,7/2,9/2)	31.703	(5/2$^-$)	
985.4 *2*	18 *1*	1008.27	(5/2,7/2,9/2)	22.73	(7/2$^-$)	
x1001.1 *3*	2.8 *1*					
1005.6 *2*	5.2 *2*	1684.03	(5/2,7/2,9/2)	678.79	(9/2$^-$)	
1027.3 *2*	3.0 *1*	1059.02	(3/2$^-$,5/2,7/2)	31.703	(5/2$^-$)	
1036.3 *2*	22 *1*	1059.02	(3/2$^-$,5/2,7/2)	22.73	(7/2$^-$)	
1059.4#b *2*	1.7 *1*	1059.02	(3/2$^-$,5/2,7/2)	0.0	3/2$^-$	

^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ (continued)

$\gamma(^{139}Xe)$ (continued)

E_γ †	I_γ †@	E_i(level)	J_i^π	E_f	J_f^π
x1077.0 2	2.0 1				
1124.5 2	1.8 1	1684.03	(5/2,7/2,9/2)	559.40	(9/2$^-$)
x1129.9 2	1.8 1				
x1137.2 2	0.8 1				
1146.9 2	1.8 1	1771.43		624.26	(5/2$^-$)
x1149.8 2	5.6 2				
1161.4 2	9.2 3	1193.33	(3/2$^-$,5/2,7/2)	31.703	(5/2$^-$)
1170.4 2	3.4 1	1193.33	(3/2$^-$,5/2,7/2)	22.73	(7/2$^-$)
x1181.7 1	0.8 1				
1193.3 2	3.8 1	1193.33	(3/2$^-$,5/2,7/2)	0.0	3/2$^-$
1212.2 2	0.9 1	1771.43		559.40	(9/2$^-$)
x1268.8 2	1.2 1				
x1272.2 2	2.0 1				
x1280.9 2	1.2 1				
x1282.9 2	2.0 1				
x1293.2 2	0.9 1				
x1304.7 2	6.8 2				
x1351.2 2	1.5 1				
1367.4 2	5.4 2	1399.46	(3/2$^-$,5/2,7/2)	31.703	(5/2$^-$)
1376.9 2	4.6 2	1399.46	(3/2$^-$,5/2,7/2)	22.73	(7/2$^-$)
1399.6 2	3.0 1	1399.46	(3/2$^-$,5/2,7/2)	0.0	3/2$^-$
x1403.7 3	2.6 1				
1412.6 2	13.0 4	1444.15	(7/2,9/2)	31.703	(5/2$^-$)
1421.9 2	4.2 2	1444.15	(7/2,9/2)	22.73	(7/2$^-$)
1425.6 2	14.0 4	1448.53	(7/2,9/2)	22.73	(7/2$^-$)
x1431.5 2	5.8 2				
x1441.5 2	1.7 1				
x1458.2 2	0.8 1				
x1468.1 2	2.6 1				
x1486.5 2	0.7 1				
1499.5 2	≤1	2898.45		1399.46	(3/2$^-$,5/2,7/2)
1546.4 2	7.6 2	2740.18		1193.33	(3/2$^-$,5/2,7/2)
x1577.2 2	1.7 1				
1628.7 2	≤1.0	2307.94		678.79	(9/2$^-$)
1652.5 2	4.4 2	1684.03	(5/2,7/2,9/2)	31.703	(5/2$^-$)
1661.5 2	20 1	1684.03	(5/2,7/2,9/2)	22.73	(7/2$^-$)
1714.1 2	1.8 1	2307.94		593.99	(11/2$^-$)
1748.8 2	4.4 1	2307.94		559.40	(9/2$^-$)
x1755.9 2	1.8 1				
x1786.1 2	1.6 1				
x1800.5 2	5.4 2				
x1823.5 2	2.4 1				
x1829.1 2	3.0 1				
1862.8 2	3.6 1	1894.43		31.703	(5/2$^-$)
1871.6 2	0.4 1	1894.43		22.73	(7/2$^-$)
x1947.0 2	1.9 1				
x2023.4 2	3.2 1				
2115.7 2	6.8 2	2740.18		624.26	(5/2$^-$)
x2151.4 2	1.8 1				
x2261.6 2	3.2 1				
x2429.9 2	2.2 1				
x2735.5 2	1.4 1				
2866.5 2	2.0 1	2898.45		31.703	(5/2$^-$)
2898.1 2	2.0 1	2898.45		0.0	3/2$^-$
x3285.8 2	4.0 1				

† From 1987RoZW. Uncertainties in energy are stated as 0.02 keV for Eγ>100 keV and 0.2 keV for Eγ<100 keV, which to the evaluators seems a reverse statement. Evaluators assign 0.02 keV for Eγ<100 keV and 0.2 keV for Eγ>100 keV. Intensity uncertainty is stated as 10% for Iγ<1 and 3% for Iγ>1. Evaluators round off the intensity uncertainties as suggested by the significant figures to which the intensities are listed in 1987RoZW.

‡ From Adopted Gammas.

From the least-squares analysis, alternative placements are possible for some of the γ rays: 389.1γ could deexcite the 1448 level; 1059.4γ, the 1684 level; 634.0γ, the 1193.3 level; and 774.1γ, the 1444.3 level.

@ For absolute intensity per 100 decays, multiply by 0.0826 *70*.

& 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 Multiply placed with intensity suitably divided.

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$\gamma(^{139}$Xe) (continued)

[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

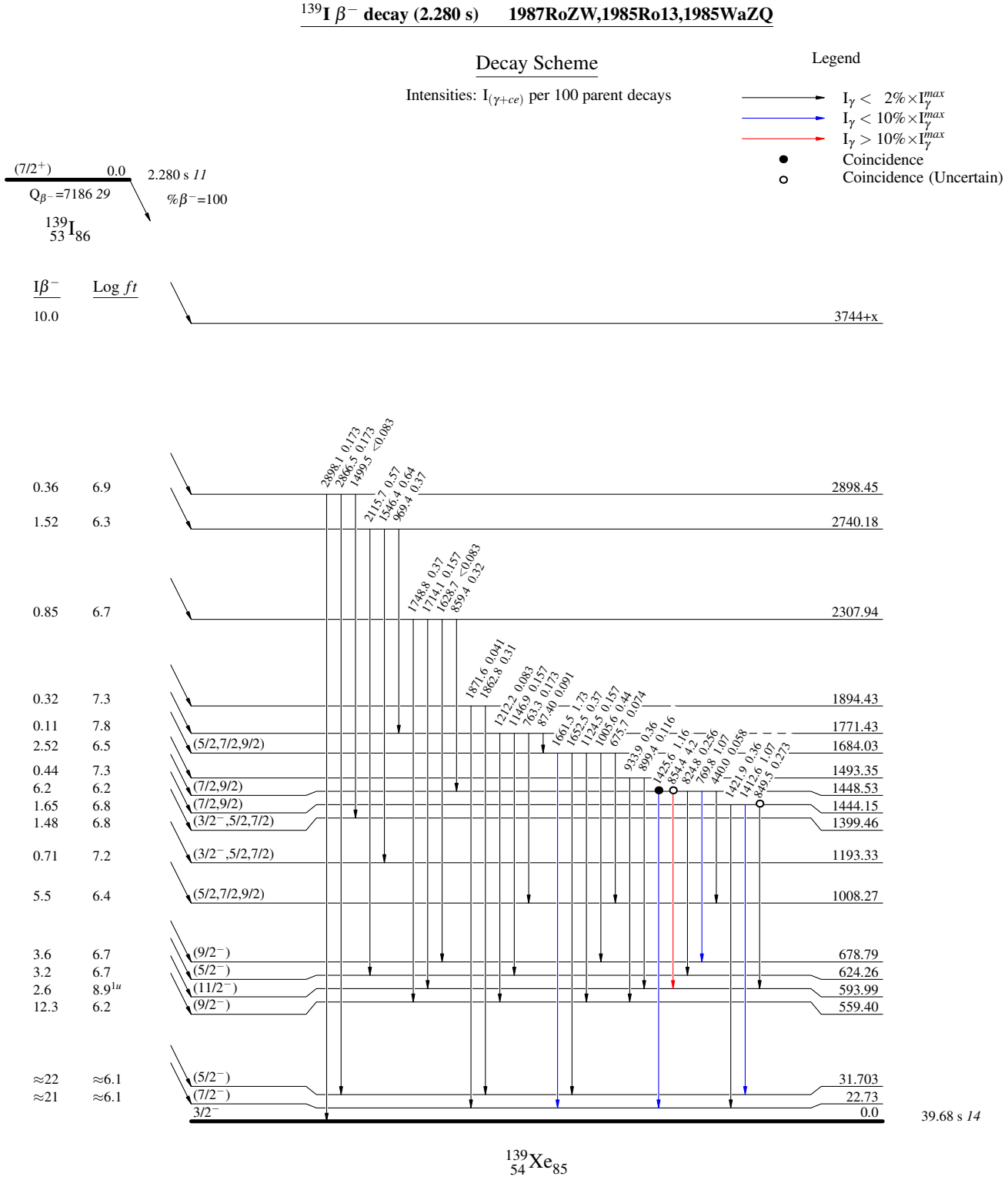
$^{139}_{54}$Xe$_{85}$-7

^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ

Decay Scheme

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

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



$^{139}_{54}Xe_{85}$

^{139}I β^- decay (2.280 s) 1987RoZW,1985Ro13,1985WaZQ

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence