

Adopted Levels, Gammas

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Janos Timar and Zoltan Elekes, Balraj Singh		NDS 121, 143 (2014)	31-May-2014

$Q(\beta^-)=4022$ 29; $S(n)=5316$ 26; $S(p)=1375 \times 10^1$ 15; $Q(\alpha)=-9684$ 20 [2012Wa38](#)
 $S(2n)=13279$ 22, $S(2p)=26695$ 23 ([2012Wa38](#)).
[1962Ha16](#): ¹²⁹Sn produced and identified in 170-MeV proton irradiation of uranium target followed by chemical separation; measured half-life. Two activities were reported in this work with half-lives of 1.0 h and 8.8 min, the former has not been confirmed, the latter corresponds to 6.9-min isomer. A 1.8-h activity reported by [1960A103](#) and assigned to ¹²⁹Sn decay has never been confirmed.
[1962Dr01](#): ¹²⁹Sn produced and identified in thermal neutron fission of ²³⁵U followed by chemical separation, measured half-life and gamma spectra. Only a 6.2-min activity identified. No longer-lived activity was found as reported in [1962Ha16](#).
 Later decay studies: [1967Bi15](#), [1972Iz01](#), [1974Fo06](#), [1974Gr29](#), [1980De35](#), [1982Hu09](#).
 Precise mass measurement by Penning-trap system: [2005Si34](#).

¹²⁹Sn Levels

No levels are known from ¹³⁰In β⁻n decays.

Cross Reference (XREF) Flags

A	¹²⁹ In β ⁻ decay (611 ms)	F	¹²⁹ Sn IT decay (217 ns)
B	¹²⁹ In β ⁻ decay (1.23 s)	G	¹³⁰ In β ⁻ n decay (0.29 s)
C	¹²⁹ In β ⁻ decay (0.67 s)	H	¹³⁰ In β ⁻ n decay:mixed
D	¹²⁹ Sn IT decay (3.40 μs)	I	²³⁹ Pu(n,Fγ)
E	¹²⁹ Sn IT decay (2.22 μs)		

E(level) [†]	J ^π	T _{1/2}	XREF	Comments
0.0	3/2 ⁺	2.23 min 4	ABC GHI	$\% \beta^- = 100$ $\mu = +0.754$ 3 (2005Le34,2014StZZ) $Q = +0.05$ 11 (2004Le13,2014StZZ) Evaluated rms charge radius=4.6934 fm 58 (2013An02). $\delta \langle r^2 \rangle$ (relative to ¹²⁰ Sn)=+0.384 fm ² 52; charge radius=4.693 fm 5 (2005Le34). μ, Q : atomic beam laser fluorescence spectroscopy (2005Le34); 2004Le13 and 2002Le30 are conference articles from the same group as 2005Le34 . 2004Le13 give $Q_2 = +0.05$ 11, but this value is not listed in authors' later publication 2005Le34 . J^π : agreement of measured μ with shell model calculations for semi-closed nucleus (2005Le34,2004Le13); 2d _{3/2} neutron orbital. $T_{1/2}$: weighted average of 2.4 min 1 (1982Hu09), 2.16 min 4 (1980De35), 2.23 min 3 (1974Gr29), 2.5 min 3 (1974Fo06) and 2.52 min 12 (1972Iz01).
35.15 5	11/2 ⁻	6.9 min 1	ABCDEF I	$\% \beta^- = 100$; $\% IT < 2 \times 10^{-3}$ $\mu = -1.297$ 5 (2005Le34,2014StZZ) $Q = -0.18$ 17 (2005Le34,2014StZZ) $\delta \langle r^2 \rangle$ (relative to ¹²⁰ Sn)=+0.411 fm ² 53, charge radius=4.696 fm 6 (2005Le34). $\% IT$: Calculated from the upper limit of B(M4)(W.u.)<30 recommended in Nuclear Data Sheets policies. μ, Q : atomic beam laser fluorescence spectroscopy (2005Le34); 2004Le13 and 2002Le30 are conference articles from the same group as 2005Le34 . J^π : agreement of measured μ with shell model calculations for semi-closed nucleus (2005Le34,2004Le13); 1h _{11/2} neutron orbital. $T_{1/2}$: from 1982Hu09 . Others: 6.7 min 4 (1980De35), 7.3 min 2 (1974Fo06), 8.9 min 6 (1974Gr29), 7.5 min 1 (1967Bi15), 6.2 min 12 (1962Dr01), 8.8 min 6 (1962Ha16).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{129}Sn Levels (continued)

E(level) [†]	J ^π	T _{1/2}	XREF	Comments
315.406 19	(1/2) ⁺		AB	J ^π : log ft=6.08 from (1/2 ⁻); E2(+M1) γ to 3/2 ⁺ ; shell model and odd tin systematics.
763.70 5	(9/2 ⁻)		AB	J ^π : three-quasiparticle systematics of odd tin isotopes.
769.07 5	(5/2 ⁺)		AB	J ^π : odd tin systematics (one phonon+d _{3/2} multiplet); weak β feeding from (1/2 ⁻) and (9/2 ⁺) parents.
1043.66 5	(7/2 ⁻)		AB	J ^π : three-quasiparticle systematics of odd tin isotopes; weak β feeding from (1/2 ⁻) parent.
1047.35 6	(7/2 ⁺)		AB	J ^π : log ft=7.12 assuming β feeding from (9/2 ⁺) parent; gammas to 3/2 ⁺ and (5/2 ⁺).
1054.21 8	(7/2 ⁺)		A	J ^π : log ft=6.34 from (9/2 ⁺); M1,E2 γ to (5/2 ⁺); odd tin systematics (one phonon+d _{3/2} multiplet).
1171.48 7	(15/2 ⁻)		CDEF I	J ^π : energy systematics arguments deduced from comparison with the known lighter Sn isotopes and shell model considerations (2000Pi03); νh _{11/2} ⁻¹ ⊗(2 ⁺ core) (2004Ga24).
1222.58 5	(3/2 ⁺)		B	J ^π : log ft=6.83 from (1/2 ⁻); gammas to (7/2 ⁺), 3/2 ⁺ and (1/2 ⁺).
1288.70 8	(3/2 ⁺)		AB	J ^π : log ft=7.24 from (1/2 ⁻); odd tin systematics (one phonon+d _{3/2} multiplet); gammas to (1/2 ⁺), 3/2 ⁺ and (5/2 ⁺).
1359.40 7	(13/2 ⁻)		CDEF I	J ^π : based on the energy systematic arguments deduced from comparison with the known lighter Sn isotopes and shell model considerations (2000Pi03); νh _{11/2} ⁻¹ ⊗(2 ⁺ core) (2004Ga24).
1455.52 9	(5/2 ⁺)		A	J ^π : odd tin systematics (one phonon+d _{3/2} multiplet); weak β feeding from (9/2 ⁺).
1534.35 11	(7/2 ⁻ ,9/2 ⁺)		A	J ^π : log ft=6.85 from (9/2 ⁺); gammas to (5/2 ⁺), (7/2 ⁺) and 11/2 ⁻ .
1613.45 15	(1/2 to 7/2 ⁺)		B	J ^π : γ to 3/2 ⁺ ; 1/2 and 3/2 less likely from no detectable β feeding from (1/2 ⁻) parent.
1701.10 11	(7/2 ⁻)		AB	J ^π : log ft=7.08 from (9/2 ⁺); gammas to (5/2 ⁺), (7/2 ⁻) and (9/2 ⁻).
1741.89 7	(15/2 ⁺)		CDEF I	J ^π : three-quasiparticle systematics of odd tin isotopes.
1761.6 10	(19/2 ⁺)	3.40 μs 13	CDEF I	%IT=100 T _{1/2} : weighted average of values in ¹²⁹ In β ⁻ decay (0.67 s), ¹²⁹ Sn IT decay (0.27 μs) and ²³⁹ Pu(n,Fγ).
1802.6 10	(23/2 ⁺)	2.22 μs 14	C EF I	J ^π : (E2) γ from (23/2 ⁺); (E2) γ to (15/2 ⁺). %IT=100 T _{1/2} : weighted average of values in ¹²⁹ In β ⁻ decay (0.67 s), ¹²⁹ Sn IT decay (0.27 μs) and ²³⁹ Pu(n,Fγ).
1853.62 15	(7/2,9/2)		A	J ^π : log ft=6.53 from (9/2 ⁺); gammas to (7/2 ⁺) and (7/2 ⁻ ,9/2 ⁺).
1865.05 4	(7/2 ⁺)		A	J ^π : log ft=4.85 from (9/2 ⁺); gamma to 3/2 ⁺ .
1906.24 10	(7/2)		A	J ^π : log ft=7.28 from (9/2 ⁺); γ to 3/2 ⁺ .
2118.34 5	(7/2 ⁺)		A	J ^π : log ft=4.64 from (9/2 ⁺); γ to 3/2 ⁺ ; weak γ to 11/2 ⁻ .
2276.5 10	(21/2)		C	J ^π : log ft=5.91 from (23/2 ⁻); gammas to (19/2 ⁺) and (23/2 ⁺).
2407.6 11	(23/2 ⁻)		F	J ^π : shell model and odd tin systematics.
2552.9 11	(27/2 ⁻)	217 ns 19	F	%IT=100 T _{1/2} : from γ(t) in ¹²⁹ Sn IT decay (2011Pi05). Other: 0.27 μs 7 (2008Lo07).
2790.89 20	(7/2,9/2 ⁺)		A	J ^π : shell model and odd tin systematics.
2835.76 9	(7/2 ⁺ ,9/2 ⁺)		A	J ^π : log ft=6.41 from (9/2 ⁺); gammas to (5/2 ⁺) and (7/2 ⁺).
2981.81 17	(7/2 ⁺)		A	J ^π : log ft=5.62 from (9/2 ⁺); γ to (5/2 ⁺).
3079.3 3	(3/2 ⁻)		B	J ^π : log ft=6.14 from (9/2 ⁺); γ to 3/2 ⁺ .
3140.32 17	(7/2 ⁺)		A	J ^π : log ft=6.79 from (1/2 ⁻); gammas to (1/2 ⁺), (7/2 ⁻).
3394.3 3	(1/2,3/2)		B	J ^π : log ft=6.12 from (9/2 ⁺); γ to 3/2 ⁺ .
3590.51 7	(3/2 ⁻)		B	J ^π : log ft=6.95 from (1/2 ⁻).
3992.5 10	(21/2 ⁻)		C	J ^π : log ft=5.51 from (1/2 ⁻); γ to (7/2 ⁻). J ^π : fed by main GT β branch from (23/2 ⁻) parent with log ft=4.4.

† From least-squares fit to the adopted E_γ data.

Adopted Levels, Gammas (continued)

<u>$\gamma(^{129}\text{Sn})$</u>									
$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\dagger	E_f	J_f^π	Mult.	δ	$\alpha^\#$	Comments
315.406	(1/2) ⁺	315.42 2	100	0.0	3/2 ⁺	E2(+M1)	>0.7	0.027 3	$\alpha(\text{K})=0.0230$ 24; $\alpha(\text{L})=0.0031$ 8; $\alpha(\text{M})=0.00060$ 16 $\alpha(\text{N})=0.00011$ 3; $\alpha(\text{O})=9.1\times 10^{-6}$ 9 Mult.: from $\alpha(\text{K})\text{exp}$ and K/L in ¹²⁹ In β^- decay (1.23 s); $\delta(\text{E2/M1})>0.7$ from $\alpha(\text{K})\text{exp}$; M1 or E2 from K/L ratio.
763.70	(9/2) ⁻	728.53 3	100	35.15	11/2 ⁻				
769.07	(5/2) ⁺	769.31 18	100	0.0	3/2 ⁺				
1043.66	(7/2) ⁻	279.93 11	4.2 [±] 6	763.70	(9/2) ⁻				
		1008.53 3	100 [±] 5	35.15	11/2 ⁻				
1047.35	(7/2) ⁺	278.18 9	68 16	769.07	(5/2) ⁺				I_γ : from ¹²⁹ In β^- decay (611 ms).
		1047.41 10	100 8	0.0	3/2 ⁺				I_γ : from ¹²⁹ In β^- decay (611 ms).
1054.21	(7/2) ⁺	285.24 12	33 2	769.07	(5/2) ⁺	M1,E2		0.037 5	$\alpha(\text{K})=0.032$ 4; $\alpha(\text{L})=0.0045$ 10; $\alpha(\text{M})=0.00089$ 21 $\alpha(\text{N})=0.00016$ 4; $\alpha(\text{O})=1.26\times 10^{-5}$ 14 Mult.: from $\alpha(\text{K})\text{exp}$ in ¹²⁹ In β^- decay (611 ms).
		1054.30 16	100 7	0.0	3/2 ⁺				
1171.48	(15/2) ⁻	1136.31 5	100	35.15	11/2 ⁻				E_γ : from ¹²⁹ In β^- decay (0.67 s).
1222.58	(3/2) ⁺	175.13 12	2.2 13	1047.35	(7/2) ⁺				
		907.34 8	74 5	315.406	(1/2) ⁺				
		1222.51 8	100 7	0.0	3/2 ⁺				
1288.70	(3/2) ⁺	519.5 6	36 [±] 6	769.07	(5/2) ⁺				
		973.5 2	80 [±] 5	315.406	(1/2) ⁺				
		1288.64 11	100 [±] 6	0.0	3/2 ⁺				
1359.40	(13/2) ⁻	1324.25 5	100	35.15	11/2 ⁻				E_γ : from ¹²⁹ In β^- decay (0.67 s).
1455.52	(5/2) ⁺	1455.53 11	100	0.0	3/2 ⁺				
1534.35	(7/2 ⁻ ,9/2 ⁺)	480.29 13	100 9	1054.21	(7/2) ⁺				
		765.4 5	69 6	769.07	(5/2) ⁺				
		1499.00 17	99 7	35.15	11/2 ⁻				
1613.45	(1/2 to 7/2 ⁺)	1613.4 2	100	0.0	3/2 ⁺				
1701.10	(7/2) ⁻	657.7 3	75 [±] 6	1043.66	(7/2) ⁻				
		931.96 19	100 [±] 9	769.07	(5/2) ⁺				
		937.54 19	95 [±] 9	763.70	(9/2) ⁻				
1741.89	(15/2) ⁺	382.49 2	75 4	1359.40	(13/2) ⁻				E_γ : from ¹²⁹ In β^- decay (0.67 s).
		570.41 3	100 6	1171.48	(15/2) ⁻				I_γ : weighted average of values in ¹²⁹ In β^- decay (0.67 s) and ¹²⁹ Sn IT decay:0.27 μs .
									E_γ : from ¹²⁹ In β^- decay (0.67 s).
									I_γ : weighted average of values in ¹²⁹ In β^- decay (0.67 s) and ¹²⁹ Sn IT decay:0.27 μs .
1761.6	(19/2) ⁺	19.7 10		1741.89	(15/2) ⁺	(E2)		1.0 $\times 10^3$ 3	$\alpha(\text{L})=7.8\times 10^2$ 23; $\alpha(\text{M})=1.6\times 10^2$ 5; $\alpha(\text{N})=27$ 9; $\alpha(\text{O})=0.58$ 17 B(E2)(W.u.)=1.4 6

Adopted Levels, Gammas (continued)

γ(¹²⁹Sn) (continued)

<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.</u>	<u>α[#]</u>	<u>Comments</u>
1802.6	(23/2 ⁺)	41.0 2		1761.6	(19/2 ⁺)	(E2)	39.9 10	E _γ : from ¹²⁹ In β ⁻ decay (0.67 s). Mult.: half-life is characteristic of an E2 transition (2002Ge07). α(K)=13.64 23; α(L)=21.1 6; α(M)=4.37 12 α(N)=0.756 21; α(O)=0.0195 5 B(E2)(W.u.)=1.39 10 Mult.: from K x ray intensity and L-conversion intensity in ²³⁹ Pu(F,nγ).
1853.62	(7/2,9/2)	319.3 4	32 4	1534.35	(7/2 ⁻ ,9/2 ⁺)			E _γ : from ¹²⁹ In β ⁻ decay (0.67 s).
1865.05	(7/2 ⁺)	799.41 14	100 8	1054.21	(7/2 ⁺)			
		330.8 3	0.66 5	1534.35	(7/2 ⁻ ,9/2 ⁺)			
		409.3 3	0.34 4	1455.52	(5/2 ⁺)			
		576.1 5	0.39 3	1288.70	(3/2 ⁺)			
		821.4 2	2.22 1	1043.66	(7/2 ⁻)			
		1096.00 4	8.5 11	769.07	(5/2 ⁺)			
		1101.39 6	5.7 4	763.70	(9/2 ⁻)			
		1830.1 5	0.32 7	35.15	11/2 ⁻			
		1864.89 6	100 7	0.0	3/2 ⁺			
1906.24	(7/2)	1906.32 15	100	0.0	3/2 ⁺			
2118.34	(7/2 ⁺)	212.17 12	0.64 5	1906.24	(7/2)			
		252.99 16	0.08 2	1865.05	(7/2 ⁺)			
		265.0	0.35 5	1853.62	(7/2,9/2)			
		662.92 16	1.22 8	1455.52	(5/2 ⁺)			
		830.0 3	0.60 10	1288.70	(3/2 ⁺)			
		1071.0 12	0.2 10	1047.35	(7/2 ⁺)			
		1074.71 3	6.1 4	1043.66	(7/2 ⁻)			
		1349.29 7	4.6 3	769.07	(5/2 ⁺)			
		1354.41 8	2.9 3	763.70	(9/2 ⁻)			
		2082.9 4	0.42 4	35.15	11/2 ⁻	[M2]		
		2118.26 10	100 7	0.0	3/2 ⁺			
2276.5	(21/2)	473.99 16	100 8	1802.6	(23/2 ⁺)			
		515.1 6	30 3	1761.6	(19/2 ⁺)			
2407.6	(23/2 ⁻)	605.0 3		1802.6	(23/2 ⁺)			
2552.9	(27/2 ⁻)	145.3 3		2407.6	(23/2 ⁻)	[E2]	0.425 7	α(K)=0.334 6; α(L)=0.0733 12; α(M)=0.01478 25 α(N)=0.00265 5; α(O)=0.0001420 23 B(E2)(W.u.)=0.73 6 E _γ : from ¹²⁹ Sn IT decay.
2790.89	(7/2,9/2 ⁺)	1736.7 6	36 24	1054.21	(7/2 ⁺)			
		2021.8 2	100 7	769.07	(5/2 ⁺)			
2835.76	(7/2 ⁺ ,9/2 ⁺)	1301.7 4	10.2 8	1534.35	(7/2 ⁻ ,9/2 ⁺)			
		1781.54 13	100 7	1054.21	(7/2 ⁺)			
		1791.9 5	7.2 7	1043.66	(7/2 ⁻)			
		2066.64 11	57 4	769.07	(5/2 ⁺)			

Adopted Levels, Gammas (continued)

γ(¹²⁹Sn) (continued)

<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_f</u>	<u>J_f^π</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_f</u>	<u>J_f^π</u>
2835.76	(7/2 ⁺ ,9/2 ⁺)	2072.3 5	3.5 9	763.70	(9/2 ⁻)	3590.51	(3/2 ⁻)	1977.0 2	21 2	1613.45	(1/2 to 7/2 ⁺)
2981.81	(7/2 ⁺)	2212.70 17	100 6	769.07	(5/2 ⁺)			2301.7 2	30 2	1288.70	(3/2 ⁺)
		2982.1 6	9.2 18	0.0	3/2 ⁺			2368.15 17	51 4	1222.58	(3/2 ⁺)
3079.3	(3/2 ⁻)	2035.5 5	90 9	1043.66	(7/2 ⁻)			2546.61 11	100 7	1043.66	(7/2 ⁻)
		2763.9 4	100 8	315.406	(1/2) ⁺			3275.16 15	63 4	315.406	(1/2) ⁺
3140.32	(7/2 ⁺)	2371.5 9	16.2 18	769.07	(5/2 ⁺)			3590.8 4	12.6 11	0.0	3/2 ⁺
		2376.6 6	30 3	763.70	(9/2 ⁻)	3992.5	(21/2 ⁻)	1716.1 3	16.4 14	2276.5	(21/2)
		3140.27 18	100 8	0.0	3/2 ⁺			2189.92 10	100 7	1802.6	(23/2 ⁺)
3394.3	(1/2,3/2)	3078.9 3		315.406	(1/2) ⁺			2230.88 18	41 2	1761.6	(19/2 ⁺)
3590.51	(3/2 ⁻)	1889.6 2	23 2	1701.10	(7/2 ⁻)						

[†] From β⁻ decay datasets, unless otherwise stated.

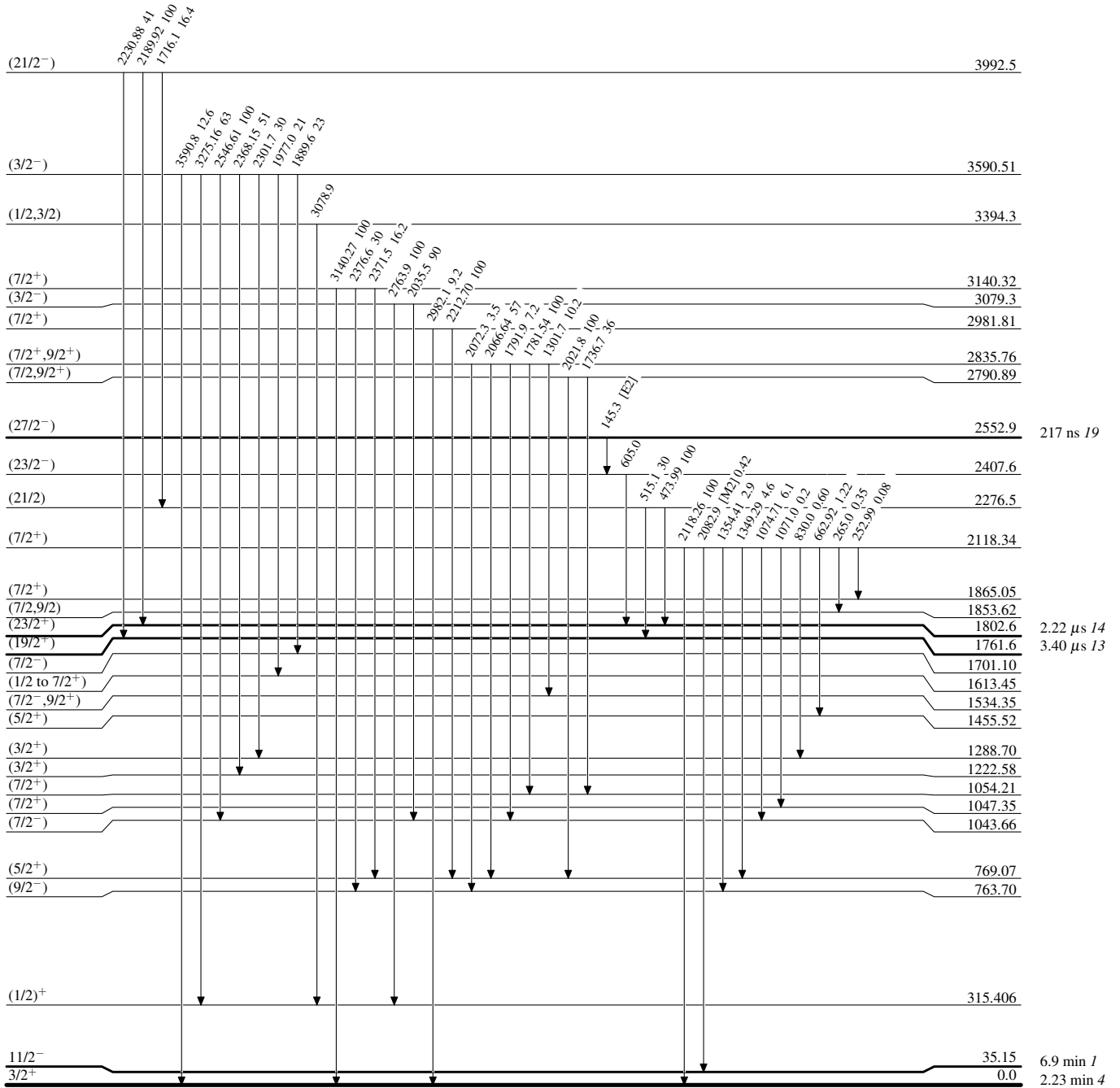
[‡] Weighted average of values in ¹²⁹In β⁻ decay (611 ms) and ¹²⁹In β⁻ decay (1.23 ms).

[#] Value overlaps M1 and E2, when δ not given.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

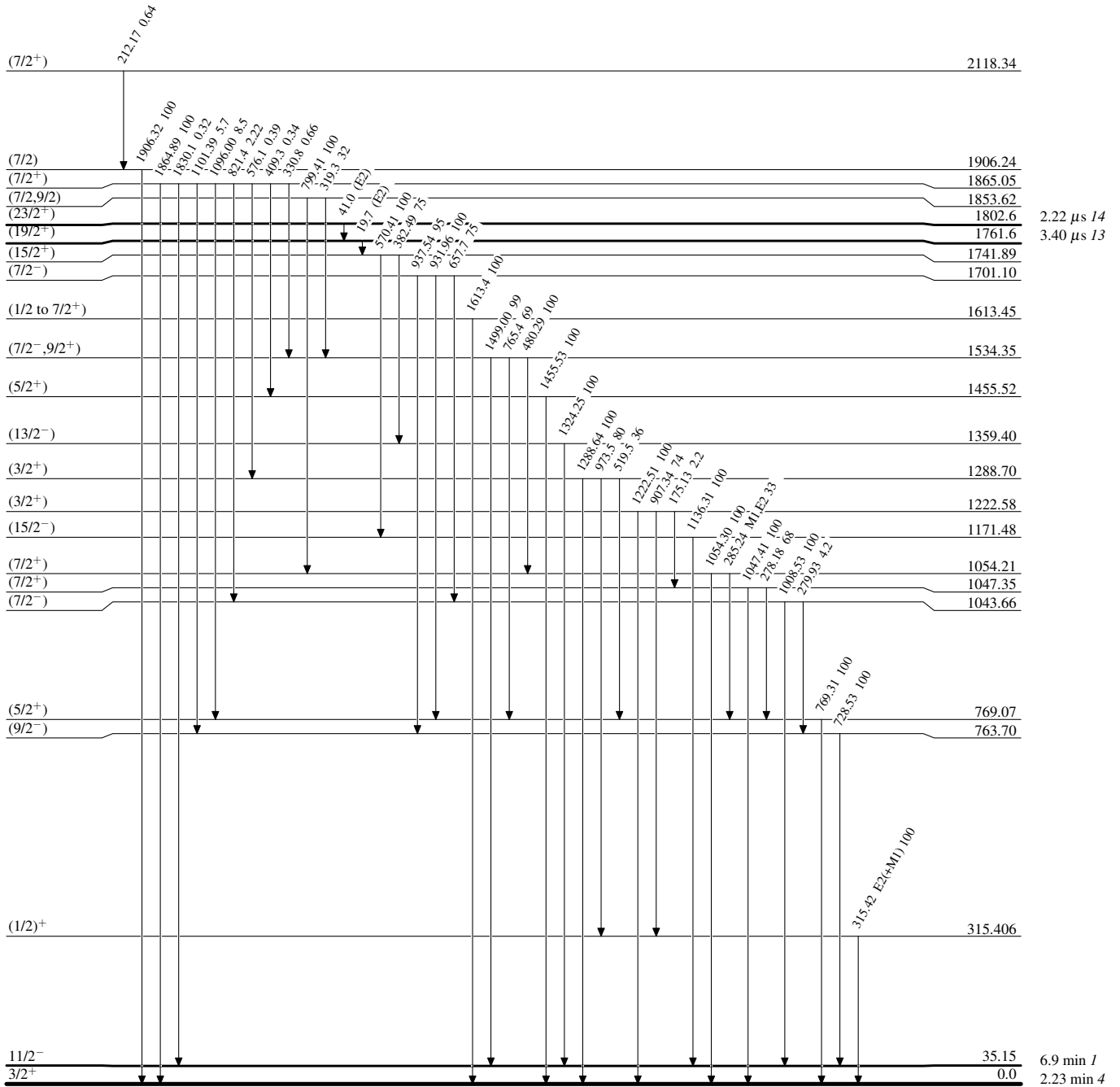


$^{129}_{50}\text{Sn}_{79}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{129}_{50}\text{Sn}_{79}$