Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 154, 1 (2018)	20-Nov-2018

Q(β^-)=−8470 *50*; S(n)=11147 *17*; S(p)=5244 *18*; Q(α)=1318 *17* 2017Wa10

^{140}Sm Levels

Cross Reference (XREF) Flags

- A ^{140}Eu ε decay
- B ^{141}Gd β^+p decay
- C Coulomb excitation
- D (HI,xnγ)

E(level)	J^π	$T_{1/2}$	XREF	Comments
0.0	0^+	14.82 min *12*	ABCD	%ε+%β^+=100 $T_{1/2}$: from 1972De23. Others: 14.7 min *2* (1987De04), 14.75 min *15* (1968Bl14), 13.7 min *8* (1967He23). RMS charge radius $<r^2>^{1/2}$=4.9565 fm *34* (2013An02).
530.68 *10*	2^+†	6.10 ps *32*	ABCD	$T_{1/2}$: weighted average of 6.31 ps *42* from 2015Be25 in (HI,xnγ) dataset by recoil-distance Doppler-shift (RDDS) method and 5.8 ps *5* from Coulex (from B(E2)).
990.37 *12*	2^+‡	7.7 ps *12*	A C	$T_{1/2}$: from Coulex (from B(E2)).
1245.83 *13*	4^+#	1.00 ps *7*	A CD	$T_{1/2}$: from Coulex (from B(E2)).
1420.31 *20*	(1,2)		A	J^π: 0,1,2 from log *ft*≤6.3 *via* 1^+ parent; ≠ 0 from γ to 0^+.
1598.79 *12*	0^+@		A	
1628.39 *22*	0,1,2&		A	
1932.89 *22*	0,1,2&		A	
2014.7 *4*	5[a]		D	
2081.91 *24*	6^+#		D	
2283.89 *13*	2^+†		A	
2289.64 *20*	(1,2)		A	J^π: 0,1,2 from log *ft*≤6.3 *via* 1^+ parent; ≠ 0 from γ to 0^+.
2326.4 *4*	7[a]		D	
2482.06 *17*	$(1,2)^+$		A	J^π: 0^+,1^+,2^+ from log *ft*≤5.5 *via* 1^+ parent; γ to (0^+).
2595.6 *4*	0,1,2&		A	
2959.3 *6*	(6,7,8)		D	J^π: (D) γ to 7.
2969.5 *3*	8^+#		D	
3127.7 *4*	9[a]		D	
3172.1 *4*	10^+	19.4 ns *7*	D	μ=−1.8 *2* (2014StZZ) Q=1.7 *5* (2016St14) $T_{1/2}$: from (HI,xnγ) (1988Ba22); other: 22.3 ns *18* (same dataset, 1988St02). μ: From $\gamma(\theta$,H,t). Q: From $\gamma(\theta$,t,electric field gradient) (1985Be23). μ and analysis of the collective band suggests two neutron configuration [$\nu(h_{11/2})$,$\nu(h_{11/2})$]. J^π: E2 γ to 8^+.
3194.5 *3*	$8^{(+)}$		D	J^π: 8 from Q γ to 6^+ and D+Q γ to 8^+; π=(+) from (deduced) γ from 3211, 10^+.
3210.9 *3*	10^+	5.20 ns *14*	D	μ=+12.7 *9* (2005St24,1988Ba22) $T_{1/2}$: from (HI,xnγ) (1988Ba22); other: 6.2 ns *8* (same dataset, 1988St02). μ: from $\gamma(\theta$,H,t). configuration: μ and the structure of collective band suggests two particle proton

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Adopted Levels, Gammas (continued)

^{140}Sm Levels (continued)

E(level)	J^π	$T_{1/2}$	XREF	Comments
				configuration [$\pi(h_{11/2})$,$\pi(h_{11/2})$].
				J^π: E2 γ to 8^+.
3652.8 *3*	12^+	15.2 ns *21*	D	$T_{1/2}$: from (HI,xnγ) (1991Ca17).
				J^π: E2 γ to 10^+.
3790.8 *4*	12^+	7.6 ns *21*	D	$T_{1/2}$: from (HI,xnγ) (1991Ca17).
				J^π: E2 γ to 10^+.
3892.5 *5*	11		D	J^π: D γ to 10^+.
4024.0 *6*	11[a]		D	
4044.1 *5*	11[a]		D	
4404.1 *4*	14^+	1.2 ps *5*	D	$T_{1/2}$: from (HI,xnγ) (1991Ca17).
				J^π: E2 γ to 3653, 12^+.
4445.8 *5*	(13)		D	J^π: (D) γ to 12^+.
4488.1 *6*			D	
4622.4 *4*	15		D	J^π: D γ to 4404, 14^+.
4683.0 *5*	11,12,13		D	J^π: γ from 4854, 13; γ to 3893, 11.
4854.3 *5*	13		D	J^π: D γ to 3791, 12^+.
4914.3 *5*	$14^{(+)}$		D	J^π: stretched Q to 3791, 12^+, more likely $\Delta\pi$=no.
4946.7 *5*	16		D	J^π: D γ to 4622, 15.
4990.2 *4*	13[a]		D	
5087.8 *5*	(14)		D	J^π: D+Q γ to 4854, 13.
5194.2 *4*	14[a]		D	
5254.4 *4*	15		D	J^π: D γ to 14^+.
5328.6 *6*	17		D	J^π: D γ to 16.
5373.3 *6*	(15)		D	J^π: D+Q γ to (14).
5394.1 *8*			D	
5397.9 *5*	16		D	J^π: Q γ to 14^+.
5479.2 *4*	15[a]		D	
5489.6 *5*	16		D	J^π: Q γ to $14^{(+)}$.
5499.2 *4*	15[a]		D	
5572.0 *5*	15[a]		D	
5706.2 *4*	16		D	J^π: D γ to 5479, 15.
5794.1 *8*	(18)		D	J^π: (D) γ to 5329, 17.
5810.8 *5*	16		D	J^π: Q γ to 14^+.
5892.8 *7*			D	
5998.2 *8*			D	
6023.6 *5*	17		D	J^π: D γ to 5811, 16.
6038.8 *6*	17		D	J^π: D γ to 5398, 16.
6166.3 *6*	16		D	J^π: Q γ to $14^{(+)}$.
6272.1 *6*	18		D	J^π: Q γ to 5490, 16.
6397.1 *6*	18		D	J^π: D γ to 6024, 17.
6420.5 *7*			D	
6436.0 *7*			D	
6549.4 *6*	18		D	J^π: Q γ to 5398, 16.
6725.5 *7*			D	
6755.2 *7*	19		D	J^π: D γ to 6397, 18.
6778.5 *9*			D	
6864.3 *7*	19		D	J^π: Q γ 6039, 17.
7091.6 *8*			D	
7269.2 *7*			D	
7320.5 *7*	(20)		D	J^π: (Q) γ to 6549, 18.
7545.8 *8*			D	
7751.6 *8*			D	
7772.5 *7*	(20)		D	J^π: (Q) γ to 6549, 18.
8041.4 *9*			D	
8100.8 *9*			D	

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Adopted Levels, Gammas (continued)

^{140}Sm Levels (continued)

† $0^+,1^+,2^+$ from log $ft \leq 5.5$ *via* 1^+ parent; Q γ to 0^+.
‡ 0,1,2 from log $ft \leq 6.3$ *via* 1^+ parent; 2^+ from angular correlation measurement in Coulomb excitation dataset (2015Kl01).
# Q γ cascade to 2^+; systematics of yrast levels in even-even nuclei.
@ 0,1,2 from log $ft \leq 6.3$ *via* 1^+ parent; 0^+ from angular correlation measurement in ^{140}Eu ε decay dataset (2015Kl01).
& 0,1,2 from log $ft \leq 6.3$ *via* 1^+ parent.
a π=− in (HI,xnγ) but not strong argument given. 1990Lu04 consider that typical stretched D A2,A4 values are characteristic for E1, which however do not exclude M1.

Adopted Levels, Gammas (continued)

γ(^{140}Sm)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	α[@]	Comments
530.68	2^+	530.7 *1*	100	0.0	0^+	E2	0.01096	α(K)=0.00904 *13*; α(L)=0.001510 *22*; α(M)=0.000330 *5* α(N)=7.40×10^{-5} *11*; α(O)=1.064×10^{-5} *15*; α(P)=5.23×10^{-7} *8* B(E2)(W.u.)=50.5 *27*
990.37	2^+	459.9[‡] *1*	100[‡]	530.68	2^+	E2(+M1)	0.021 *6*	α(K)=0.0179 *48*; α(L)=0.0027 *4*; α(M)=0.00059 *8* α(N)=0.000132 *19*; α(O)=1.9×10^{-5} *4*; α(P)=1.09×10^{-6} *34* Mult.: based on angular correlation measurement for 459γ-531γ cascade in Coulomb excitation dataset (2015Kl01).
1245.83	4^+	715.0 *1*	100	530.68	2^+	E2	0.00524	α(K)=0.00439 *7*; α(L)=0.000667 *10*; α(M)=0.0001443 *21* α(N)=3.25×10^{-5} *5*; α(O)=4.75×10^{-6} *7*; α(P)=2.59×10^{-7} *4* B(E2)(W.u.)=69.8 *49*
1420.31	(1,2)	1420.3[‡] *2*	100[‡]	0.0	0^+			
1598.79	0^+	352.4[‡] *2*	3.6[‡] *18*	1245.83	4^+			
		608.6[‡] *1*	17.3[‡] *18*	990.37	2^+			
		1068.0[‡] *1*	100[‡] *10*	530.68	2^+	E2	0.00217	α(K)=0.00184 *3*; α(L)=0.000257 *4*; α(M)=5.50×10^{-5} *8* α(N)=1.243×10^{-5} *18*; α(O)=1.85×10^{-6} *3*; α(P)=1.095×10^{-7} *16* Mult.: based on angular correlation measurement for 1068γ-531γ cascade in ε decay dataset (2015Kl01).
1628.39	0,1,2	1097.7[‡] *2*	100[‡]	530.68	2^+			
1932.89	0,1,2	1402.2[‡] *2*	100[‡]	530.68	2^+			
2014.7	5	768.8 *3*	100	1245.83	4^+	D		
2081.91	6^+	836.1 *2*	100	1245.83	4^+	Q		
2283.89	2^+	685.1[‡] *2*	47[‡] *16*	1598.79	0^+			
		1293.6[‡] *1*	63[‡] *11*	990.37	2^+			
		1752.8[‡] *2*	100[‡] *16*	530.68	2^+			
		2283.9[‡] *3*	26[‡] *11*	0.0	0^+			
2289.64	(1,2)	1299.4[‡] *2*	75[‡] *25*	990.37	2^+			
		1758.7[‡] *4*	100[‡] *50*	530.68	2^+			
		2289.1[‡] *5*	50[‡] *25*	0.0	0^+			
2326.4	7	311.7 *1*	100	2014.7	5	Q		
2482.06	$(1,2)^+$	882.7[‡] *3*	10[‡] *5*	1598.79	0^+			
		1491.3[‡] *2*	100[‡] *14*	990.37	2^+			
		1952.0[‡] *2*	67[‡] *10*	530.68	2^+			E_γ: differs by 3σ from ΔE_{levels}.
2595.6	0,1,2	2064.9[‡] *3*	100[‡]	530.68	2^+			
2959.3	(6,7,8)	632.9 *4*	100	2326.4	7	(D)		
2969.5	8^+	887.6 *1*	100	2081.91	6^+	Q		
3127.7	9	801.3 *2*	100	2326.4	7	Q		
3172.1	10^+	(44)	25	3127.7	9	[D]		$I_{(\gamma+ce)}$: I(γ+ce)(44γ)/I(γ+ce)(202.6γ)=0.3 from (HI,xnγ) (1988Ba22). Mult.: D from comparison to RUL and ΔJ^π=1.

$^{140}_{62}Sm_{78}$-4

Adopted Levels, Gammas (continued)

γ(^{140}Sm) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[#]	α[@]	$I_{(\gamma+ce)}$	Comments
3172.1	10^+	202.6 *2*	100	2969.5	8^+	E2	0.200		B(E2)(W.u.)=1.36 *7* α(K)=0.1442 *21*; α(L)=0.0433 *7*; α(M)=0.00981 *15* α(N)=0.00217 *4*; α(O)=0.000288 *5*; α(P)=7.17×10^{-6} *11* Mult.: Q from γ(θ) in (HI,xnγ); ≠ M2 from comparison to RUL.
3194.5	$8^{(+)}$	224.9 *2*	82 *24*	2969.5	8^+	D+Q			
		1112.8 *3*	100 *16*	2081.91	6^+	Q			
3210.9	10^+	(16.4)		3194.5	$8^{(+)}$	[E2]	7.58×10^3		α(L)=5.90×10^3 *9*; α(M)=1353 *19* α(N)=294 *5*; α(O)=35.5 *5*; α(P)=0.00981 *14* Mult.: from level scheme, 10^+ to $8^{(+)}$.
		(39)	36	3172.1	10^+	(M1)	4.04	181	B(M1)(W.u.)≤0.0089 *17* ce(L)/(γ+ce)=0.630 *6*; ce(M)/(γ+ce)=0.1355 *23* ce(N)/(γ+ce)=0.0307 *6*; ce(O)/(γ+ce)=0.00459 *9*; ce(P)/(γ+ce)=0.000282 *5* α(L)=3.18 *5*; α(M)=0.682 *10* α(N)=0.1546 *22*; α(O)=0.0231 *4*; α(P)=0.001419 *20* $I_{(\gamma+ce)}$: I(γ+ce)(39γ)/I(γ+ce)(241γ)=1.6 from (HI,xnγ) (1988Ba22). Mult.: D from comparison to RUL; Δπ=no from level scheme.
		241.4 *1*	100	2969.5	8^+	E2	0.1122		B(E2)(W.u.)≤1.05 *13* α(K)=0.0842 *12*; α(L)=0.0218 *3*; α(M)=0.00490 *7* α(N)=0.001087 *16*; α(O)=0.0001467 *21*; α(P)=4.34×10^{-6} *7* Mult.: Q from γ(θ) in (HI,xnγ); ≠ M2 from comparison to RUL.
3652.8	12^+	441.9 *1*	100	3210.9	10^+	E2	0.0180		B(E2)(W.u.)=0.050 *+8−6* α(K)=0.01459 *21*; α(L)=0.00263 *4*; α(M)=0.000578 *8* α(N)=0.0001293 *19*; α(O)=1.84×10^{-5} *3*; α(P)=8.29×10^{-7} *12* Mult.: Q from γ(θ) in (HI,xnγ); ≠ M2 from comparison to RUL.
3790.8	12^+	618.7 *1*		3172.1	10^+	E2	0.00742		B(E2)(W.u.)=0.019 *+7−4* α(K)=0.00618 *9*; α(L)=0.000979 *14*; α(M)=0.000213 *3* α(N)=4.78×10^{-5} *7*; α(O)=6.94×10^{-6} *10*; α(P)=3.61×10^{-7} *5* Mult.: Q from γ(θ) in (HI,xnγ); ≠ M2 from comparison to RUL.
3892.5	11	681.7 *5*	100	3210.9	10^+	D			
4024.0	11	896.3 *4*	100	3127.7	9	Q			
4044.1	11	916.4 *3*	100	3127.7	9	Q			
4404.1	14^+	751.3 *2*	100	3652.8	12^+	E2	0.00467		B(E2)(W.u.)=45 *+33−14* α(K)=0.00392 *6*; α(L)=0.000588 *9*; α(M)=0.0001270 *18* α(N)=2.86×10^{-5} *4*; α(O)=4.20×10^{-6} *6*; α(P)=2.31×10^{-7} *4* Mult.: Q from γ(θ) in (HI,xnγ); ≠ M2 from comparison to RUL.
4445.8	(13)	792.6 *4*	100	3652.8	12^+	(D)			
4488.1		835.3 *5*	100	3652.8	12^+				
4622.4	15	218.3 *2*	100	4404.1	14^+	D			
4683.0	11,12,13	790.5 *4*	100	3892.5	11				

$^{140}_{62}Sm_{78}$-5

Adopted Levels, Gammas (continued)

γ(^{140}Sm) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.#
4854.3	13	171.3 *3*	36 *9*	4683.0	11,12,13	D
		1063.4 *3*	100 *9*	3790.8	12^+	D
4914.3	$14^{(+)}$	1123.5 *3*	100	3790.8	12^+	Q
4946.7	16	324.3 *2*	100	4622.4	15	D
4990.2	13	1337.4 *2*	100	3652.8	12^+	D
5087.8	(14)	233.5 *3*	100	4854.3	13	D+Q
5194.2	14	204.2 *3*	100 *27*	4990.2	13	
		790.2 *4*	18 *5*	4404.1	14^+	
5254.4	15	808.3 *3*	24 *7*	4445.8	(13)	(Q)
		850.5 *3*	100 *9*	4404.1	14^+	D
5328.6	17	381.9 *3*	100	4946.7	16	D
5373.3	(15)	285.5 *3*	100	5087.8	(14)	D+Q
5394.1		906.0 *5*	100	4488.1		(Q)
5397.9	16	993.8 *3*	100	4404.1	14^+	Q
5479.2	15	1075.0 *2*	100	4404.1	14^+	D
5489.6	16	575.3 *2*	100	4914.3	$14^{(+)}$	Q
5499.2	15	305.0 *3*	78 *17*	5194.2	14	D
		1095.1 *2*	100 *10*	4404.1	14^+	D
5572.0	15	377.9 *3*	100	5194.2	14	D
5706.2	16	134.3 *3*	62 *7*	5572.0	15	
		206.9 *3*	25 *7*	5499.2	15	D
		226.9 *3*	100 *20*	5479.2	15	D
5794.1	(18)	465.5 *5*	100	5328.6	17	(D)
5810.8	16	1322.8 *7*	100 *13*	4488.1		Q
5810.8	16	1406.6 *4*	23 *10*	4404.1	14^+	Q
5892.8		519.5 *3*	100	5373.3	(15)	
5998.2		604.1 *2*	100	5394.1		
6023.6	17	317.4 *2*	100	5706.2	16	D
6038.8	17	640.9 *3*	100	5397.9	16	D
6166.3	16	1252.0 *4*	100	4914.3	$14^{(+)}$	Q
6272.1	18	782.5 *2*	100	5489.6	16	Q
6397.1	18	373.5 *4*	100	6023.6	17	D
6420.5		254.1 *3*	100	6166.3	16	
6436.0		269.7 *3*	100	6166.3	16	
6549.4	18	1151.5 *3*	100	5397.9	16	Q
6725.5		289.6 *3*	88 *24*	6436.0		
		305.0 *3*	100 *24*	6420.5		
6755.2	19	358.1 *2*	100	6397.1	18	D
6778.5		780.3 *4*	100	5998.2		(D)
6864.3	19	825.5 *3*	100	6038.8	17	Q
7091.6		366.1 *3*	100	6725.5		(Q)
7269.2		514.0 *3*	100	6755.2	19	
7320.5	(20)	771.1 *3*	100	6549.4	18	(Q)
7545.8		454.2 *3*	100	7091.6		(D)
7751.6		482.4 *3*	100	7269.2		
7772.5	(20)	1223.1 *4*	100	6549.4	18	(Q)
8041.4		495.6 *4*	100	7545.8		
8100.8		349.2 *3*	100	7751.6		

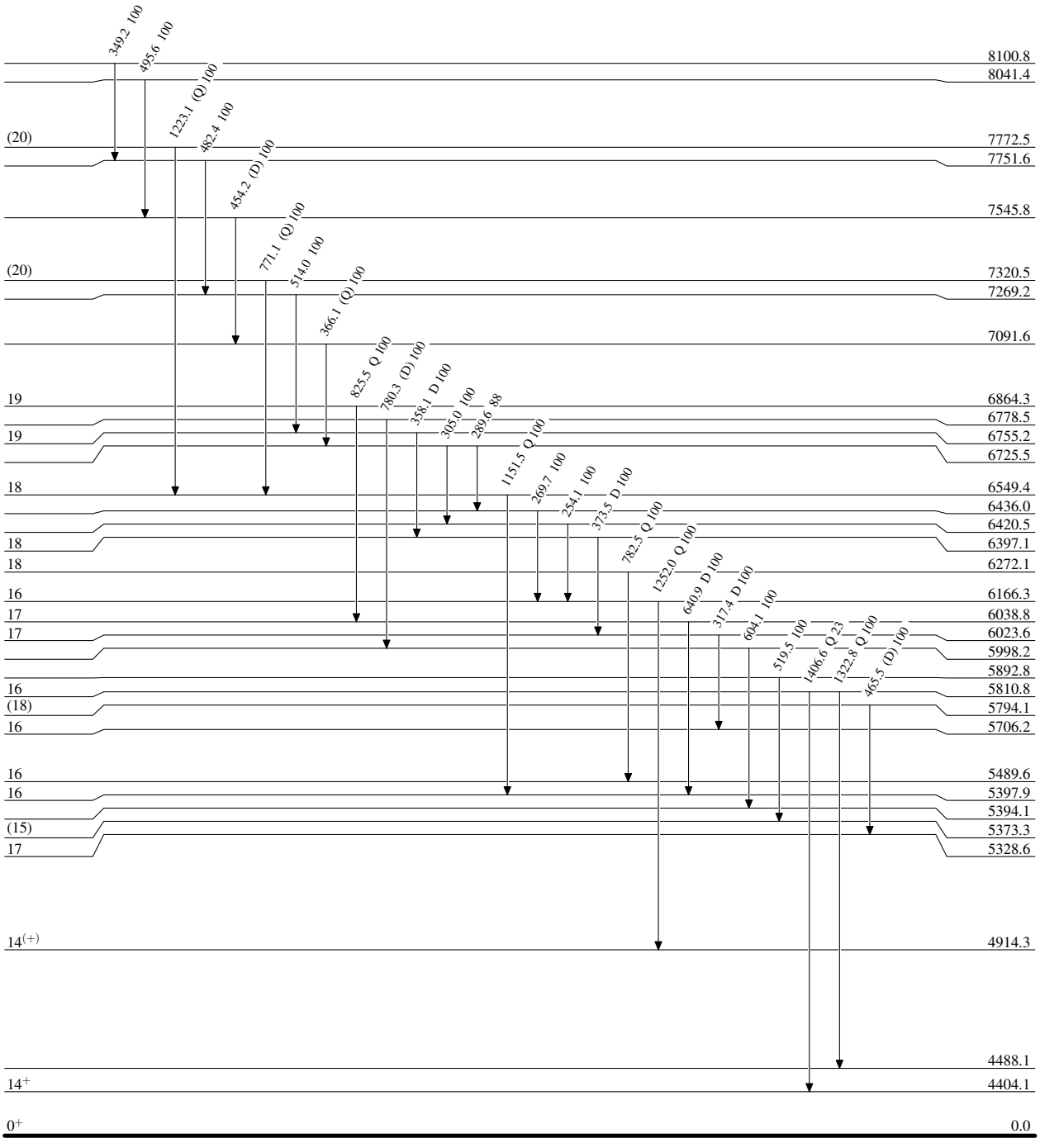
† From (HI,xnγ), except where noted.
‡ From ^{140}Eu ε.
# From γ(θ) in (HI,xnγ) (1990Lu04), except where noted.
@ Additional information 1.

$^{140}_{62}Sm_{78}$-6

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{140}_{62}Sm_{78}$

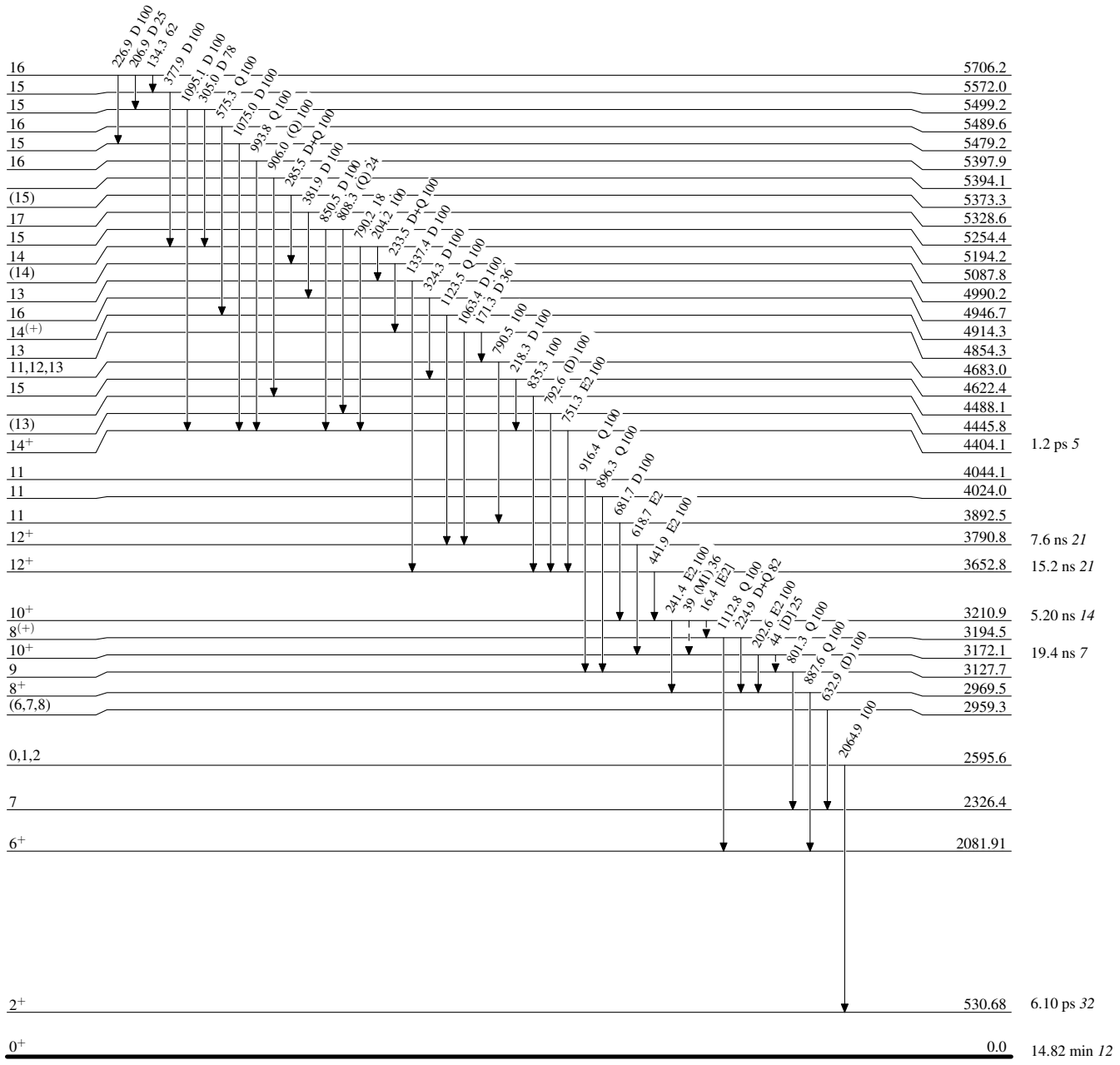
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

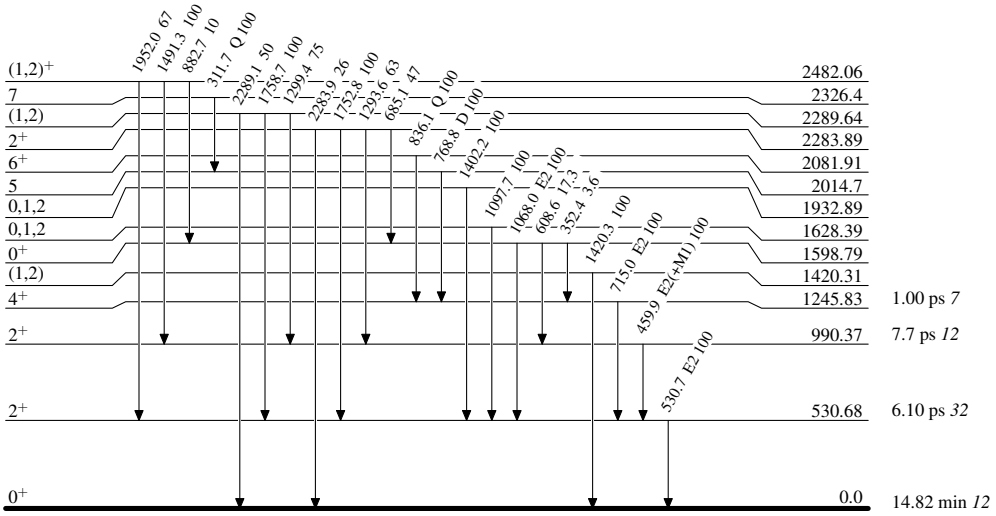


$^{140}_{62}Sm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{140}_{62}Sm_{78}$