

193 81 Tl

Δ : (-27430) S_n : (9600) S_p : (2700)

Q_{EC} : (3640) Q_α : (3800)

Populating Reactions and Decay Modes

- A ^{193}Tl IT decay (2.11 m) ([63Di10](#), [76GoZP](#), [76Ha25](#))
 B ^{193}Pb EC decay (5.8 m) ([61An03](#), [63Di10](#), [74Ne16](#), [75Ha25](#), [76GoZP](#), [76Ha25](#))
 C ^{197}Bi α decay (9.33 m)
 D ^{197}Bi α decay (5.04 m) ([50Ne77](#), [70Ta14](#), [72Ga27](#), [74Le02](#), [85Co06](#), [91Ry01](#), [95Ch27](#))
 E (HI,xn γ) ([74Ne16](#), [92Re08](#), [96SaZU](#))
 F (HI,xn γ): sd ([90Ch24](#), [90Fe07](#), [90Ja13](#), [90KeZW](#), [91Ch36](#), [91Sa12](#), [92Be25](#), [92Wu01](#), [92Wu05](#), [93Ch43](#), [93Hu06](#), [93Pi03](#), [94Ch60](#), [94Zh40](#), [95Ci05](#), [95Sz03](#), [95Wy02](#), [96Bo02](#), [96Bo15](#), [96Di03](#), [96Ha18](#), [96Si11](#), [96Su01](#), [96WiZY](#), [97De32](#), [97Hu13](#), [97Su18](#), [97Wu06](#), [98He01](#))

Levels and γ -ray branchings:

- 0, $1/2^+$, 21.6 8 m, [ABDE], %EC+% β^+ =100, μ =+1.5912 22
365.2, $3/2^+$, [ABE]
 γ_0 **365.2** (\dagger_{γ} 100) M1+E2: $\delta=1.7 \frac{+5}{-4}$
365.2+x, $9/2^-$, 2.11 15 m, [ABE], %IT=75, %EC+% β^+ =25, μ =+3.948 4, $Q=-2.20$ 2
 γ_{365}^X
 $\gamma_{365} < 13$ ($\dagger_{\gamma+e}$ 100)
757.51+x 24, $11/2^-$, [BE]
 γ_{365+x} **392.2** 3 (\dagger_{γ} 100) M1+E2: $\delta=-0.59$ 14
1081.10+x 24, $13/2^-$, [BE]
 γ_{758+x} **323.8** 3 (\dagger_{γ} 83.1 11) M1+E2: $\delta=0.6$ 4
 γ_{365+x} **716.0** 3 (\dagger_{γ} 100.0 5) E2
1163.7+x, [B]
 γ_{758+x} **406.5** (\dagger_{γ} 100) M1
 γ_{758+x} **406.5** (\dagger_{γ} 100) M1
1423.7+x, [B]
 γ_{758+x} **666.2**

- 1493.4+x** 3, $(13/2)^+$, [BE]
 γ_{1081+x} **412.6** 3 (\dagger_{γ} 15 5)
 γ_{758+x} **735.5** 3 (\dagger_{γ} 100.0 5) E1
1512.1+x 3, $15/2^-$, [BE]
 γ_{1081+x} **430.9** 3 (\dagger_{γ} 50 11) M1(+E2)
 γ_{758+x} **754.7** 3 (\dagger_{γ} 100 5) E2
1833.2+x 3, $17/2^-$, [E]
 γ_{1512+x} **320.9** 3 (\dagger_{γ} 56.0 13) D
 γ_{1081+x} **752.4** 3 (\dagger_{γ} 100.0 13) E2
1871.0+x, [B]
 γ_{758+x} **1113.5** (\dagger_{γ} 100)
1899.6+x 4, $(15/2)^+$, [BE]
 γ_{1493+x} **406.2** 3 (\dagger_{γ} 100) M1
1928.4+x 4, $(17/2^-)$, [E]
 γ_{1512+x} **416.4** 3 (\dagger_{γ} 93 90) D
 γ_{1081+x} **847.1** 3 (\dagger_{γ} 100 79) (Q)
1960.0+x 5, $(15/2)^+$, [BE]
 γ_{1493+x} **466.6** 3 (\dagger_{γ} 100) M1
2006.4+x 4, $(15/2^+)$, [E]
 γ_{1960+x} **46.4**
 γ_{1900+x} **106.7** 3 (\dagger_{γ} 56 23)
 γ_{1512+x} **494.3** 3 (\dagger_{γ} 100 28)
2056.4+x 6, $(15/2^+)$, [E]
 γ_{1960+x} **96.4** 3 (\dagger_{γ} 100)
2131.7+x 5, $(17/2^+)$, [E]
 γ_{2056+x} **75.3**
 γ_{2006+x} **125.3** 3 D
2303.2+x 4, $(19/2^-)$, [E]
 γ_{1833+x} **470.0** 3 (\dagger_{γ} 62 23) D
 γ_{1512+x} **790.9** 3 (\dagger_{γ} 100 11) (E2)
2351.9+x 6, $(19/2^+)$, [E]
 γ_{2132+x} **220.2** 3 (\dagger_{γ} 100)
2392.0+x 5, $(19/2^-)$, [E]
 γ_{1928+x} **463.6** 3 (\dagger_{γ} 100) D+Q
2400.8+x 6, $(19/2^+)$, [E]
 γ_{2132+x} **269.1** 3 (\dagger_{γ} 100) D
2448.2+x 5, $(19/2^+)$, [E]
 γ_{2132+x} **316.4** 3 (\dagger_{γ} 100) (M1+E2)
 γ_{2056+x} **391.5**

- 2505.2+x** 4, $(21/2^-)$, [E]
 γ_{2303+x} **201.9** 3 (\dagger_{γ} 24 12)
 γ_{1833+x} **672.1** 3 (\dagger_{γ} 100.0 8) (Q)
2574.9+x 4, $(21/2^-)$, [E]
 γ_{2303+x} **271.6** 3 (\dagger_{γ} 49 27)
 γ_{1833+x} **741.7** 3 (\dagger_{γ} 100 36) (E2)
2609.4+x 5, $(19/2^+)$, [E]
 γ_{2448+x} **161.3** 3 (\dagger_{γ} >35)
 γ_{2132+x} **478.1** 3 (\dagger_{γ} 100 30) (Q)
2611.2+x 7, $(21/2^+)$, [E]
 γ_{2352+x} **259.3** 3 (\dagger_{γ} 100) D
2621.0+x 7, $(21/2^+)$, [E]
 γ_{2448+x} **172.8**
 γ_{2401+x} **220.2** 3 (\dagger_{γ} 100)
2764.8+x 5, $(21/2^+)$, [E]
 γ_{2609+x} **155.8** 3 (\dagger_{γ} 21 12) D
 γ_{2448+x} **316.4** 3 (\dagger_{γ} 100 5) (M1+E2)
 γ_{2132+x} **632.8** 3 (\dagger_{γ} 88 5) (E2)
2774.3+x 5, $(23/2^-)$, [E]
 γ_{2505+x} **268.9** 3 (\dagger_{γ} 100) D
2858.8+x 7, $(23/2^+)$, [E]
 γ_{2765+x} **94.2**
 γ_{2621+x} **237.8** 3 (\dagger_{γ} 100) D
2888.2+x 5, $(21/2)$, [E]
 γ_{2505+x} **383.3** 3 (\dagger_{γ} 100)
2982.3+x 5, $(25/2^-)$, [E]
 γ_{2774+x} **207.9** 3 (\dagger_{γ} 100 7) D
 γ_{2505+x} **477.1** 3 (\dagger_{γ} 97 11) (E2)
3005.5+x 6, $(25/2^-)$, [E]
 γ_{2774+x} **231.2** 3 (\dagger_{γ} 100) (M1+E2)
3143.6+x 5, $(23/2)$, [E]
 γ_{2888+x} **255.6** 3 (\dagger_{γ} 100 89) D
 γ_{2774+x} **368.9** 3 (\dagger_{γ} <86)
3144.5+x 6, $(23/2^+)$, [E]
 γ_{2765+x} **379.6** 3 (\dagger_{γ} 100 18) D
 γ_{2448+x} **696.2** 3 (\dagger_{γ} 70 13) (E2)
3184.5+x 8, $(25/2^+)$, [E]
 γ_{2859+x} **325.7** 3 (\dagger_{γ} 100) D

(continued on next page)

193
81 **Tl** (continued)

3342.6+x 5, (25/2), [E] γ_{3144+x} 198.9 3 (\dagger_{γ} 100 57) D γ_{2774+x} 568.3 3 (\dagger_{γ} <30)	4320.0+x 7(?), (31/2), [E] γ_{3964+x} 355.8 3(?) (\dagger_{γ} 100) D	325.6+y , J+3, [F] γ_{207+y} 118.9 3 γ_{98+y} 227.3 3
3374.6+x 5, (27/2 ⁻), [E] γ_{2982+x} 392.2 3 (\dagger_{γ} >52) D γ_{2774+x} 600.4 3 (\dagger_{γ} 100 27) (E2)	4324.3+x 7, (33/2 ⁻), [E] γ_{3548+x} 776.1 3 (\dagger_{γ} 100)	454.0+y , J+4, [F] γ_{326+y} 128.3 3 γ_{207+y} 247.3 3
3483.9+x 6, (25/2 ⁺), [E] γ_{3145+x} 339.5 3 (\dagger_{γ} 96 17) D γ_{2765+x} 719.3 3 (\dagger_{γ} 100 10) (E2)	4463.1+x 6, (33/2 ⁻), [E] γ_{4124+x} 339.7 3 (\dagger_{γ} 59 22) D γ_{3667+x} 795.9 3 (\dagger_{γ} 100 13) (E2)	593.4+y , J+5, [F] γ_{454+y} 139.2 3 (M1) γ_{326+y} 267.9 3
3521.8+x 8, (27/2 ⁺), [E] γ_{3185+x} 337.2 3 (\dagger_{γ} 100 54) D γ_{2859+x} 663.0 3 (\dagger_{γ} 62 58) (E2)	4539.2+x 8, (35/2 ⁺), [E] γ_{4260+x} 279.0 3 (\dagger_{γ} 100 13) D γ_{4054+x} 485.2 3 (\dagger_{γ} 27 22) (E2)	741.6+y , J+6, [F] γ_{593+y} 148.2 3 (M1) γ_{454+y} 287.7 3
3548.2+x 6, (29/2 ⁻), [E] γ_{3006+x} 542.7 3 (\dagger_{γ} 100) (E2)	4858.9+x 8, (37/2 ⁺), [E] γ_{4539+x} 319.9 3 (\dagger_{γ} 100 67) D γ_{4260+x} 598.5 3 (\dagger_{γ} >28) (E2)	901.6+y , J+7, [F] γ_{742+y} 160.1 3 (M1) γ_{593+y} 308.2 3
3667.1+x 5, (29/2 ⁻), [E] γ_{3375+x} 292.5 3 (\dagger_{γ} 73 15) D γ_{2982+x} 684.7 3 (\dagger_{γ} 100.0 20) (E2)	4941.4+x 6, (35/2 ⁻), [E] γ_{4463+x} 478.3 3 (\dagger_{γ} 100 60) D γ_{4124+x} 817.8 3 (\dagger_{γ} 100 80)	1069.0+y , J+8, [F] γ_{902+y} 167.4 3 (M1) γ_{742+y} 327.4 3
3711.4+x 6, (27/2), [E] γ_{3343+x} 368.9 3 (\dagger_{γ} 100) D	5016.0+x 8, (37/2 ⁻), [E] γ_{4179+x} 836.9 3 (\dagger_{γ} 100) (E2)	1249.6+y , J+9, [F] γ_{1069+y} 180.6 3 (M1) γ_{902+y} 348.0 3
3744.0+x 6, (27/2 ⁺), [E] γ_{3484+x} 260.4 3 (\dagger_{γ} 100 12) D γ_{3145+x} 599.3 3 (\dagger_{γ} 77 17) (E2)	5086.4+x 9(?), >3 ps, [E] γ_{4539+x} 547.2 3(?) (\dagger_{γ} 100)	1435.3+y , J+10, [F] γ_{1250+y} 185.8 3 (M1) γ_{1069+y} 366.4 3
3905.3+x 7, (29/2 ⁺), [E] γ_{3744+x} 161.3 3 (\dagger_{γ} 100)	5224.5+x 9, (41/2 ⁺), [E] γ_{4859+x} 365.6 3 (\dagger_{γ} 100)	1636.7+y , J+11, [F] γ_{1435+y} 201.4 3 (M1) γ_{1250+y} 387.0 3
3964.2+x 6, (29/2), [E] γ_{3711+x} 252.9 3 (\dagger_{γ} 93 86) D γ_{3343+x} 621.6 3 (\dagger_{γ} 100 62) (E2)	5286.8+x 6, (37/2 ⁻), [E] γ_{4941+x} 345.5 3 (\dagger_{γ} 100 50) D γ_{4463+x} 823.6 3 (\dagger_{γ} 100 83)	1840.4+y , J+12, [F] γ_{1637+y} 203.5 3 γ_{1435+y} 405.3 4
4054.1+x 8, (31/2 ⁺), [E] γ_{3905+x} 148.8 3 (\dagger_{γ} 100) D	5670.6+x 7(?), (39/2 ⁻), [E] γ_{5287+x} 383.8 3(?) (\dagger_{γ} 100 27) D γ_{4941+x} 728.9 3(?) (\dagger_{γ} 39 16)	2062.0+y , J+13, [F] γ_{1840+y} 221.5 3 γ_{1637+y} 425.4 3
4123.5+x 5, (31/2 ⁻), [E] γ_{3667+x} 456.5 3 (\dagger_{γ} 100 19) D γ_{3375+x} 749.0 3 (\dagger_{γ} >27) (E2)	6088.3+x 7(?), (41/2 ⁻), [E] γ_{5671+x} 417.8 3(?) (\dagger_{γ} 80 60) D γ_{5287+x} 801.5 3(?) (\dagger_{γ} 100 80)	2283.3+y , J+14, [F] γ_{1840+y} 442.9 3
4179.1+x 7, (33/2 ⁻), [E] γ_{3548+x} 630.9 3 (\dagger_{γ} 100) (E2)	y , J, [F]	2525.7+y , J+15, [F] γ_{2062+y} 463.7 3
4260.2+x 8, (33/2 ⁺), [E] γ_{4054+x} 205.9 3 (\dagger_{γ} 100) D	98.4+y , J+1, [F]	
	206.6+y , J+2, [F] γ_{98+y} 108.0 3 γ_{γ} 206.6 3	

193
81 **Tl** (continued)

2763.0+y, J+16, [F]
 γ_{2283+y} **479.7**³
 3026.8+y, J+17, [F]
 γ_{2526+y} **501.1**³
 3279.1+y, J+18, [F]
 γ_{2763+y} **516.1**³
 3564.3+y, J+19, [F]
 γ_{3027+y} **537.5**³
 3830.8+y, J+20, [F]
 γ_{3279+y} **551.6**³
 4137.7+y, J+21, [F]
 γ_{3564+y} **573.4**³
 4417.3+y, J+22, [F]
 γ_{3831+y} **586.5**³
 4746.5+y, J+23, [F]
 γ_{4138+y} **608.8**³
 5037.6+y, J+24, [F]
 γ_{4417+y} **620.3**³
 5390.3+y, J+25, [F]
 γ_{4747+y} **643.8**³
 5691.2+y, J+26, [F]
 γ_{5038+y} **653.6**⁴
 6069.0+y, J+27, [F]
 γ_{5390+y} **678.7**⁴
 6377.3+y, J+28, [F]
 γ_{5691+y} **686.1**⁴
 6782.2+y, J+29, [F]
 γ_{6069+y} **713.2**⁵
 7096.0+y, J+30, [F]
 γ_{6377+y} **718.7**⁵
 7529.7+y, J+31, [F]
 γ_{6782+y} **747.5**⁵
 7847.3+y, J+32, [F]
 γ_{7096+y} **751.3**⁵
 8311.6+y, J+33, [F]
 γ_{7530+y} **781.9**⁵
 8630.7+y, J+34, [F]
 γ_{7847+y} **783.4**⁵

z, J, [F]
 187.7+z, J+2, [F]
 γ_z **187.7**³
 418.3+z, J+4, [F]
 γ_{188+z} **230.6**²
 691.0+z, J+6, [F]
 γ_{418+z} **272.7**²
 1005.1+z, J+8, [F]
 γ_{691+z} **314.1**²
 1360.1+z, J+10, [F]
 γ_{1005+z} **355.0**²
 1755.2+z, J+12, [F]
 γ_{1360+z} **395.1**²
 2189.7+z, J+14, [F]
 γ_{1755+z} **434.5**²
 2662.6+z, J+16, [F]
 γ_{2190+z} **472.9**²
 3173.0+z, J+18, [F]
 γ_{2663+z} **510.4**²
 3720.2+z, J+20, [F]
 γ_{3173+z} **547.2**²
 4303.6+z, J+22, [F]
 γ_{3720+z} **583.4**²
 4922.1+z, J+24, [F]
 γ_{4304+z} **618.5**³
 5575.3+z, J+26, [F]
 γ_{4922+z} **653.2**³
 6261.9+z, J+28, [F]
 γ_{5575+z} **686.6**³
 6975.5+z, J+30, [F]
 γ_{6262+z} **713.6**⁴
 7709.0+z, J+32, [F]
 γ_{6976+z} **733.5**¹⁰
 u, J, [F]
 250.6+u, J+2, [F]
 γ_0 **250.6**²
 542.8+u, J+4, [F]
 γ_{251+u} **292.2**²

875.3+u, J+6, [F]
 γ_{543+u} **332.5**²
 1248.3+u, J+8, [F]
 γ_{875+u} **373.0**²
 1660.3+u, J+10, [F]
 γ_{1248+u} **412.0**²
 2110.9+u, J+12, [F]
 γ_{1660+u} **450.6**²
 2598.9+u, J+14, [F]
 γ_{2111+u} **488.0**²
 3124.2+u, J+16, [F]
 γ_{2599+u} **525.3**²
 3685.9+u, J+18, [F]
 γ_{3124+u} **561.7**²
 4282.9+u, J+20, [F]
 γ_{3686+u} **597.0**²
 4914.6+u, J+22, [F]
 γ_{4283+u} **631.7**²
 5580.9+u, J+24, [F]
 γ_{4915+u} **666.3**²
 6285.7+u, J+26, [F]
 γ_{5581+u} **704.8**³
 7032.2+u, J+28, [F]
 γ_{6286+u} **746.5**⁵
 v, J, [F]
 231.0+v, J+2, [F]
 γ_0 **231.0**⁷
 501.5+v, J+4, [F]
 γ_{231+v} **270.5**⁴
 814.9+v, J+6, [F]
 γ_{502+v} **313.4**⁴
 1168.9+v, J+8, [F]
 γ_{815+v} **354.0**⁴
 1561.9+v, J+10, [F]
 γ_{1169+v} **393.0**⁴
 1994.0+v, J+12, [F]
 γ_{1562+v} **432.1**⁴

$^{193}_{81}\text{Tl}$ (continued)

2464.0+v, J+14, [F]

γ_{1994+v} 470.04

2971.2+v, J+16, [F]

γ_{2464+v} 507.24

3514.8+v, J+18, [F]

γ_{2971+v} 543.64

4094.4+v, J+20, [F]

γ_{3515+v} 579.64

4708.6+v, J+22, [F]

γ_{4094+v} 614.24

5358.1+v, J+24, [F]

γ_{4709+v} 649.54

6041.9+v, J+26, [F]

γ_{5358+v} 683.84

6759.9+v, J+28, [F]

γ_{6042+v} 718.04

γ from ^{193}Tl (2.11 m) IT decay < for $I\gamma\%$ multiply by <0.75>

<13 († _{γ} 100)

365.2 († _{γ} 90.2 16) M1+E2: $\delta=1.7^{+5}_{-4}$

$\gamma(^{193}\text{Hg})$ from ^{193}Tl (21.6 m) EC+ β^+ decay :

39.513 M1

49.5 11 († _{γ} 10.5 50) (M1)

207.7420 († _{γ} 19.5 10) (E2)

274.3914 († _{γ} 13.5 13) (E2)

284.8913 († _{γ} 21.6 10) (M1)

294.0825 († _{γ} 4.3 5) (M1)

324.3710 († _{γ} 100) (M1)

335.1110 († _{γ} 26.1 11) (M1)

343.9910 († _{γ} 41.7 18) (M1+E2): $\delta=1.7^{+17}_{-6}$

369.85(u) († _{γ} 1.6 8)

374.5822 († _{γ} 7.6 9) (E2)

398.64(u) († _{γ} 6.9 10) (M1,E2)

493.5215(u) († _{γ} 12.1 7) (E2)

543.37(u) († _{γ} 3.8 9) (M1,E2)

574.95(u) († _{γ} 3.8 6)

636.43(u) († _{γ} 18 7) (M1)

652.93(u) († _{γ} 10 4)

655.05(u) († _{γ} 7 4)

676.1019(u) († _{γ} 48 4) (M1)

692.34(u) († _{γ} 20.9 16) (M1)

713.04 († _{γ} 6.0 7) (E2)

720.05(u) († _{γ} 1.7 8)

752.54 († _{γ} 11.6 17) (M1)

759.17(u) († _{γ} 6.5 15) (M1,E2)

770.44 († _{γ} 12.9 8) (M1+E2): $\delta=0.9^{+10}_{-5}$

773.96(u) († _{γ} 1.6 7)

783.015(u) († _{γ} 4.0 16)

821.22(u) († _{γ} 9.4 5) (M1+E2): $\delta=1.2^{+13}_{-5}$

942.15(u) († _{γ} 1.8 8)

994.7525(u) († _{γ} 11.0 11)

1014.43(u) († _{γ} 8.9 10)

1044.73(u) († _{γ} 59 6)

1064.34(u) († _{γ} 7.1 5)

1086.26(u) († _{γ} 1.6 8)

1130.33(u) († _{γ} 12.3 13)

1145.84(u) († _{γ} 4.2 8)

1152.04(u) († _{γ} 4.9 9)

1205.43 († _{γ} 10.2 12)

1229.26(u) († _{γ} 2.5 10)

1236.14(u) († _{γ} 4.6 12)

1256.03 († _{γ} 10.3 19)

1337.64(u) († _{γ} 5.6 10)

1360.84(u) († _{γ} 4.8 9)

1430.74(u) († _{γ} 4.5 9)

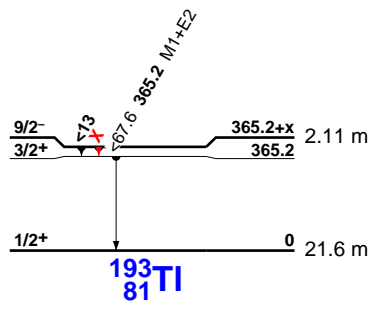
1474.77(u) († _{γ} 2.6 10)

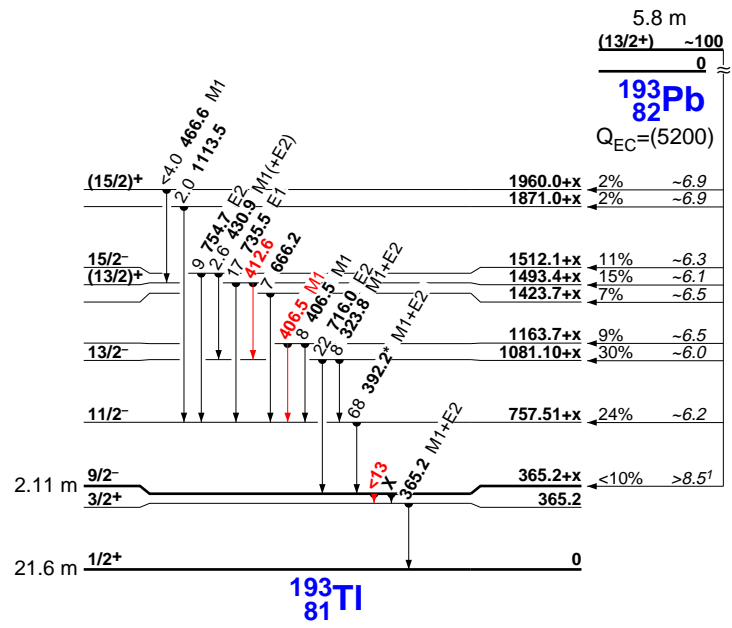
1484.17 († _{γ} 3.4 10)

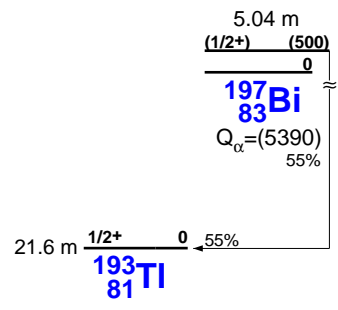
1523.44 († _{γ} 8.0 19)

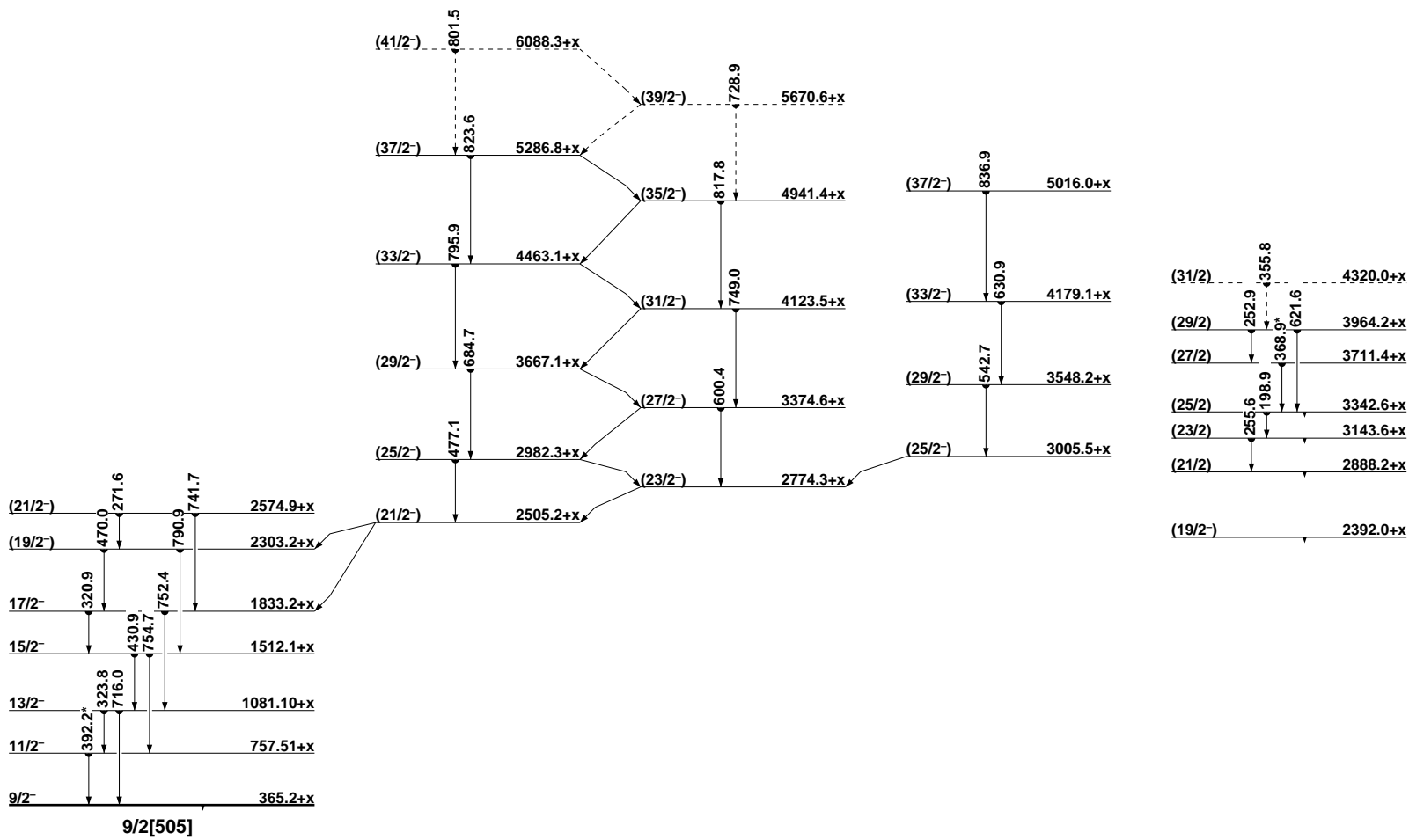
1539.410 († _{γ} 8.8 20)

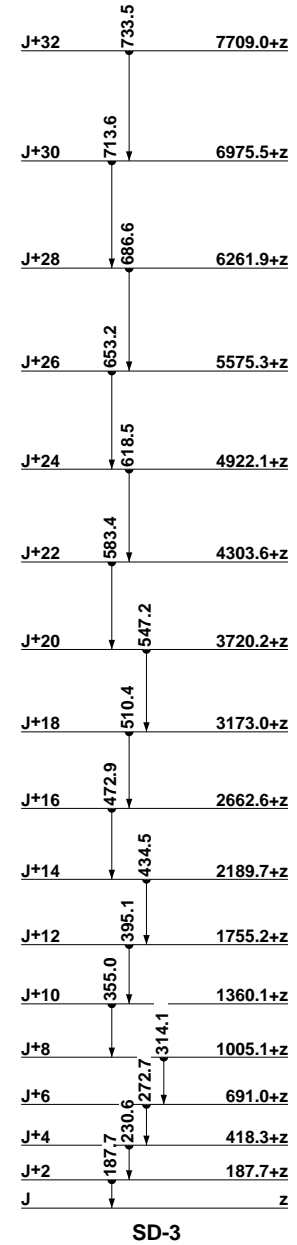
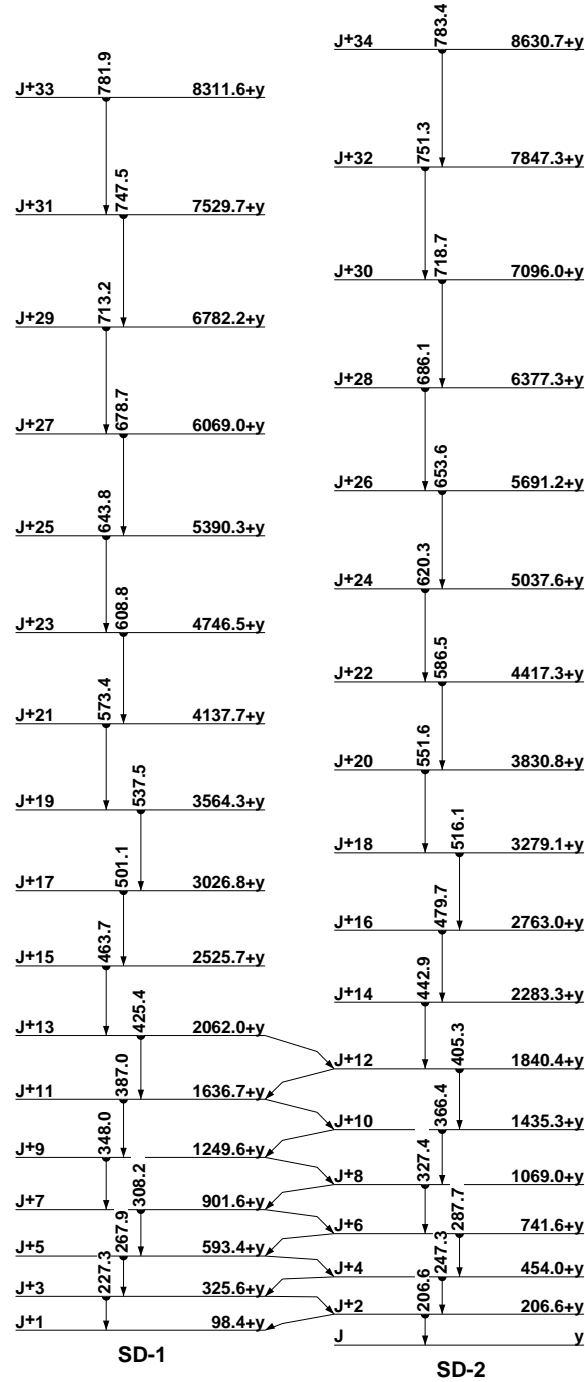
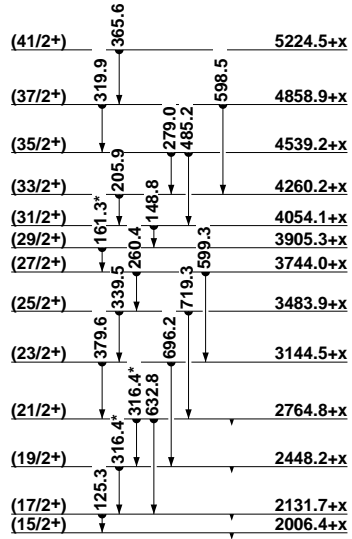
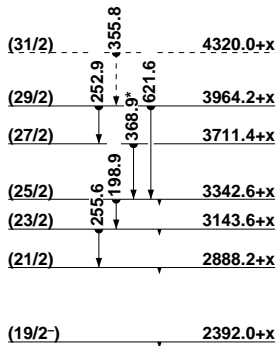
1579.310 († _{γ} 45 10)

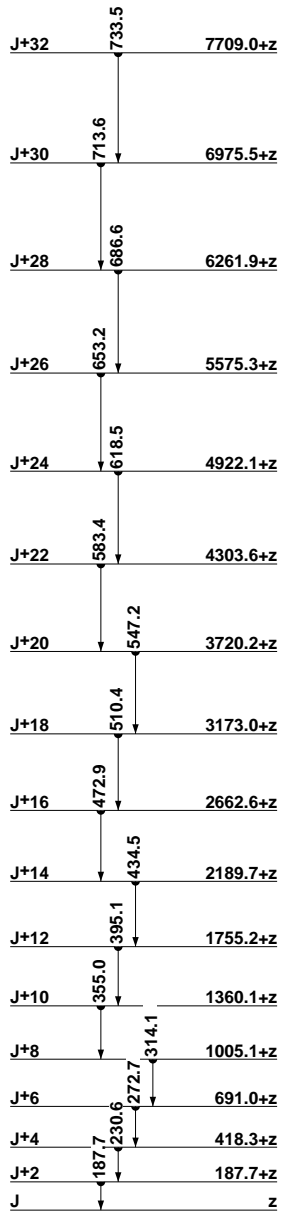




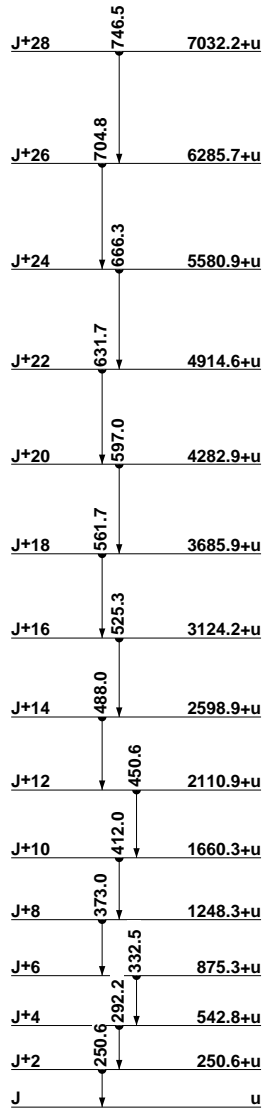




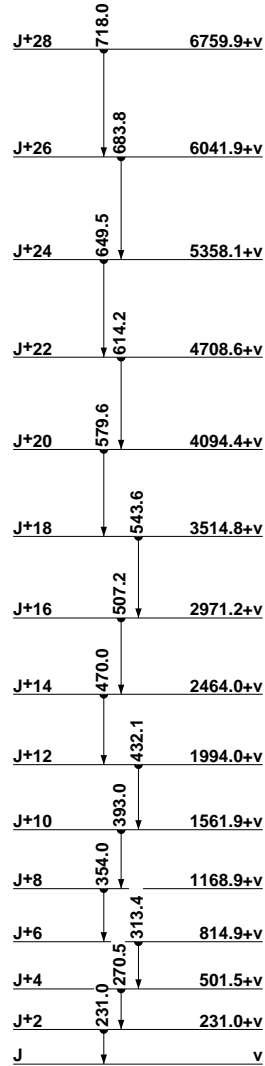




SD-3



SD-4



SD-5