# $^{113}$Sb ε decay 1976Wi10,1975WiZX

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Jean Blachot | NDS 111, 1471 (2010) | 1-May-2009 |

Parent: $^{113}$Sb: E=0.0; $J^\pi=5/2^+$; $T_{1/2}$=6.67 min *7*; Q(ε)=3913 *17*; %ε+%$β^+$ decay=100.0

Chemical and mass separation. γ singles with escape-suppression spectrometer and semi, γγ coin, γ(t), 1976Wi10, 1975WiZX.
Others: 1969Ki16, 1972Si28.

## $^{113}$Sn Levels

New levels are proposed only if they could be based on coincidence relations.

| E(level) | $J^\pi$ | $T_{1/2}$ † | E(level) | $J^\pi$ |
|---|---|---|---|---|
| 0.0 | $1/2^+$ | 115.09 d *4* | 1646.18 *13* | $3/2^+,5/2^+$ |
| 77.39 *2* | $7/2^+$ | 21.4 min *4* | 1651.75 *20* | $5/2^+$ |
| 409.77 *4* | $5/2^+$ | | 1731.90 *17* | $(3/2^+,5/2^+)$ |
| 498.01 *5* | $3/2^+$ | | 1743.94 *14* | $3/2^+,5/2^+$ |
| 1013.22 *5* | $3/2^+$ | | 1957.02 *16* | 3/2,5/2 |
| 1018.09 *4* | $5/2^+$ | | 2045.39 *23* | $(5/2^+,5/2^+)$ |
| 1283.17 *12* | $5/2^+$ | | 2128.08 *21* | $3/2^+,5/2^+$ |
| 1314.04 *14* | $3/2^+$ | | 2540.3 *4* | $3/2^+,5/2^+$ |
| 1556.36 *9* | $3/2^+$ | | 2931.9 *5* | |

† From Adopted Levels.

## ε,$β^+$ radiations

ε branches were obtained from (γ+ce) imbalance at each level.

| E(decay) | E(level) | Iβ+ † | Iε† | Log *ft* | I(ε+β+)† | Comments |
|---|---|---|---|---|---|---|
| (981 *17*) | 2931.9 | | 0.040 *6* | 6.42 *7* | 0.040 *6* | εK=0.8560 *2*; εL=0.11450 *9*; εM+=0.02954 *3* |
| (1373 *17*) | 2540.3 | 0.00036 *8* | 0.131 *11* | 6.20 *4* | 0.131 *11* | av Eβ=164.7 *75*; εK=0.8555 *5*; εL=0.1128 *1*; εM+=0.02903 *3* |
| (1785 *17*) | 2128.08 | 0.0112 *15* | 0.213 *24* | 6.22 *5* | 0.224 *25* | av Eβ=343.9 *75*; εK=0.816 *4*; εL=0.1066 *5*; εM+=0.02741 *12* |
| (1868 *17*) | 2045.39 | 0.0067 *18* | 0.088 *23* | 6.64 *12* | 0.095 *25* | av Eβ=380.0 *75*; εK=0.798 *4*; εL=0.1042 *6*; εM+=0.02679 *15* |
| (1956 *17*) | 1957.02 | 0.017 *4* | 0.16 *4* | 6.42 *10* | 0.18 *4* | av Eβ=418.7 *75*; εK=0.776 *5*; εL=0.1012 *7*; εM+=0.02600 *17* |
| (2169 *17*) | 1743.94 | 0.090 *10* | 0.42 *4* | 6.10 *5* | 0.51 *5* | av Eβ=512.6 *76*; εK=0.707 *7*; εL=0.0919 *9*; εM+=0.02362 *22* |
| (2181 *17*) | 1731.90 | 0.10 *1* | 0.46 *5* | 6.06 *5* | 0.56 *6* | av Eβ=518.0 *76*; εK=0.703 *7*; εL=0.0914 *9*; εM+=0.02347 *22* |
| (2261 *17*) | 1651.75 | 0.037 *9* | 0.13 *3* | 6.63 *11* | 0.17 *4* | av Eβ=553.5 *76*; εK=0.672 *7*; εL=0.0873 *9*; εM+=0.02243 *23* |
| (2267 *17*) | 1646.18 | 0.11 *2* | 0.37 *5* | 6.19 *7* | 0.48 *7* | av Eβ=556.0 *76*; εK=0.670 *7*; εL=0.0870 *9*; εM+=0.02236 *23* |
| (2357 *17*) | 1556.36 | 0.47 *3* | 1.32 *8* | 5.67 *3* | 1.79 *10* | av Eβ=596.0 *76*; εK=0.634 *7*; εL=0.0823 *10*; εM+=0.02114 *24* |
| (2599 *17*) | 1314.04 | 0.047 *8* | 0.076 *13* | 7.00 *8* | 0.123 *21* | av Eβ=704.6 *77*; εK=0.534 *7*; εL=0.0691 *10*; εM+=0.01776 *24* |
| (2630 *17*) | 1283.17 | 0.058 *8* | 0.088 *12* | 6.94 *6* | 0.146 *20* | av Eβ=718.5 *77*; εK=0.521 *7*; εL=0.0675 *9*; εM+=0.01733 *24* |

Continued on next page (footnotes at end of table)

## $^{113}$Sb ε decay 1976Wi10,1975WiZX (continued)

### ε,β+ radiations (continued)

| E(decay) | E(level) | Iβ+ † | Iε† | Log *ft* | I(ε+β+)† | Comments |
|---|---|---|---|---|---|---|
| (2895 *17*) | 1018.09 | 1.76 *9* | 1.67 *8* | 5.750 *24* | 3.43 *16* | av Eβ=838.5 *78*; εK=0.419 *7*; εL=0.0541 *8*; εM+=0.01390 *21* |
| (2900 *17*) | 1013.22 | 1.34 *7* | 1.26 *7* | 5.874 *25* | 2.60 *13* | av Eβ=840.7 *78*; εK=0.417 *7*; εL=0.0539 *8*; εM+=0.01384 *21* |
| (3415 *17*) | 498.01 | 60.3 *19* | 26.7 *9* | 4.691 *18* | 87.0 *26* | av Eβ=1076.7 *79*; εK=0.265 *4*; εL=0.0341 *6*; εM+=0.00875 *14* |
| (3503 *17*) | 409.77 | 4.2 *19* | 1.7 *7* | 5.92 *20* | 5.9 *26* | av Eβ=1117.5 *79*; εK=0.245 *4*; εL=0.0315 *5*; εM+=0.00809 *13* |
| (3836‡ *17*) | 77.39 | <2 | <0.4 | >6.6 | <2.4 | av Eβ=1271.8 *80*; εK=0.184 *3*; εL=0.0236 *4*; εM+=0.00607 *9* |

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

## $^{113}$Sb ε decay 1976Wi10,1975WiZX (continued)

### γ($^{113}$Sn)

Iγ normalization: Calculated from measured annihilation radiation intensity and theoretical $\varepsilon/\beta^+$ ratios by assuming no ε decay to g.s., since I($\varepsilon+\beta^+$) to g.s.<$8\times10^{-5}$% from log *ft*>11 for a second-forbidden transition.
Measured Iγ of annihilation radiation is 168 *4*, 1976Wi10.

| $E_\gamma$ | $I_\gamma$[†] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult. | δ | α[‡] | $I_{(\gamma+ce)}$[†] | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 77.38 *2* | 0.13 *1* | 77.39 | 7/2$^+$ | 0.0 | 1/2$^+$ | M3+E4 | 0.13 *2* | 181 *5* | 23 *1* | B(M3)(W.u.)=0.0309 *14*; B(E4)(W.u.)=1.6×10$^2$ *5*<br>$I_\gamma$: from I(γ+ce) and α (from Adopted Levels).<br>$I_{(\gamma+ce)}$: deduced from decay scheme. |
| 88.25 *2* | 3.4 *4* | 498.01 | 3/2$^+$ | 409.77 | 5/2$^+$ | M1,E2 | | 1.7 *9* | | α(K)=1.2 *6*; α(L)=0.35 *26*; α(M)=0.07 *5*; α(N+..)=0.015 *11*<br>α: 88γ is M1,E2 from spin difference. |
| 242.6 *3* | 0.029 *6* | 1556.36 | 3/2$^+$ | 1314.04 | 3/2$^+$ | | | | | |
| 273.4 *2* | 0.047 *5* | 1556.36 | 3/2$^+$ | 1283.17 | 5/2$^+$ | | | | | |
| 332.0 *4* | 0.030 *14* | 1646.18 | 3/2$^+$,5/2$^+$ | 1314.04 | 3/2$^+$ | | | | | |
| 332.41 *5* | 18.5 *8* | 409.77 | 5/2$^+$ | 77.39 | 7/2$^+$ | | | | | |
| 409.9 *2* | 0.16 *2* | 409.77 | 5/2$^+$ | 0.0 | 1/2$^+$ | | | | | |
| 420.7 *2* | 0.3 *2* | 498.01 | 3/2$^+$ | 77.39 | 7/2$^+$ | | | | | |
| 448.3 *5* | 0.027 *11* | 1731.90 | (3/2$^+$,5/2$^+$) | 1283.17 | 5/2$^+$ | | | | | |
| 497.96 *9* | 100 | 498.01 | 3/2$^+$ | 0.0 | 1/2$^+$ | | | | | |
| 538.2 *2* | 0.073 *5* | 1556.36 | 3/2$^+$ | 1018.09 | 5/2$^+$ | | | | | |
| 603.0 *4* | 0.014 *3* | 1013.22 | 3/2$^+$ | 409.77 | 5/2$^+$ | | | | | |
| 608.4 *1* | 0.50 *3* | 1018.09 | 5/2$^+$ | 409.77 | 5/2$^+$ | | | | | |
| 718.4 *3* | 0.04 *2* | 1731.90 | (3/2$^+$,5/2$^+$) | 1013.22 | 3/2$^+$ | | | | | |
| 725.3 *10* | 0.015 *8* | 1743.94 | 3/2$^+$,5/2$^+$ | 1018.09 | 5/2$^+$ | | | | | |
| 785.2 *3* | 0.019 *4* | 1283.17 | 5/2$^+$ | 498.01 | 3/2$^+$ | | | | | |
| [x]801.0 *2* | 0.034 *4* | | | | | | | | | |
| 816.3 *3* | 0.033 *4* | 1314.04 | 3/2$^+$ | 498.01 | 3/2$^+$ | | | | | |
| [x]886.5 *2* | 0.10 *2* | | | | | | | | | |
| 935.77 *6* | 2.14 *11* | 1013.22 | 3/2$^+$ | 77.39 | 7/2$^+$ | | | | | |
| 940.63 *6* | 3.27 *16* | 1018.09 | 5/2$^+$ | 77.39 | 7/2$^+$ | | | | | |
| 1013.28 *6* | 1.14 *7* | 1013.22 | 3/2$^+$ | 0.0 | 1/2$^+$ | | | | | |
| 1018.12 *6* | 0.60 *3* | 1018.09 | 5/2$^+$ | 0.0 | 1/2$^+$ | | | | | |
| 1058.3 *2* | 0.068 *6* | 1556.36 | 3/2$^+$ | 498.01 | 3/2$^+$ | | | | | |
| [x]1128.8 *2* | 0.034 *4* | | | | | | | | | |
| 1146.6 *4* | 0.56 *4* | 1556.36 | 3/2$^+$ | 409.77 | 5/2$^+$ | | | | | |
| 1148.4 *4* | 0.14 *4* | 1646.18 | 3/2$^+$,5/2$^+$ | 498.01 | 3/2$^+$ | | | | | |
| 1205.7 *3* | 0.027 *4* | 1283.17 | 5/2$^+$ | 77.39 | 7/2$^+$ | | | | | |
| 1234.2 *3* | 0.56 *7* | 1731.90 | (3/2$^+$,5/2$^+$) | 498.01 | 3/2$^+$ | | | | | |
| 1236.8 *7* | 0.21 *7* | 1646.18 | 3/2$^+$,5/2$^+$ | 409.77 | 5/2$^+$ | | | | | |
| 1242.8 *8* | 0.14 *5* | 1651.75 | 5/2$^+$ | 409.77 | 5/2$^+$ | | | | | |
| 1246.2 *3* | 0.27 *5* | 1743.94 | 3/2$^+$,5/2$^+$ | 498.01 | 3/2$^+$ | | | | | |
| 1283.3 *2* | 0.21 *2* | 1283.17 | 5/2$^+$ | 0.0 | 1/2$^+$ | | | | | |





$^{113}_{50}Sn_{63}$-3

## $^{113}$Sb $\varepsilon$ decay 1976Wi10,1975WiZX (continued)

### $\gamma(^{113}Sn)$ (continued)

| $E_\gamma$ | $I_\gamma$[†] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|
| 1314.0 *2* | 0.18 *2* | 1314.04 | $3/2^+$ | 0.0 | $1/2^+$ |
| 1334.0 *2* | 0.21 *2* | 1743.94 | $3/2^+,5/2^+$ | 409.77 | $5/2^+$ |
| [x]1355.9 *3* | 0.036 *4* | | | | |
| [x]1390.7 *2* | 0.058 *5* | | | | |
| 1458.9 *2* | 0.060 *6* | 1957.02 | 3/2,5/2 | 498.01 | $3/2^+$ |
| 1478.8 *2* | 0.15 *2* | 1556.36 | $3/2^+$ | 77.39 | $7/2^+$ |
| 1547.2 *5* | 0.07 *4* | 1957.02 | 3/2,5/2 | 409.77 | $5/2^+$ |
| 1547.9 *5* | 0.06 *3* | 2045.39 | $(5/2^+,5/2^+)$ | 498.01 | $3/2^+$ |
| 1556.3 *2* | 1.31 *10* | 1556.36 | $3/2^+$ | 0.0 | $1/2^+$ |
| 1568.9 *2* | 0.055 *6* | 1646.18 | $3/2^+,5/2^+$ | 77.39 | $7/2^+$ |
| 1574.3 *2* | 0.070 *7* | 1651.75 | $5/2^+$ | 77.39 | $7/2^+$ |
| 1635.3 *3* | 0.038 *5* | 2045.39 | $(5/2^+,5/2^+)$ | 409.77 | $5/2^+$ |
| 1646.0 *2* | 0.16 *2* | 1646.18 | $3/2^+,5/2^+$ | 0.0 | $1/2^+$ |
| 1654.6 *3* | 0.073 *7* | 1731.90 | $(3/2^+,5/2^+)$ | 77.39 | $7/2^+$ |
| 1666.4 *3* | 0.12 *2* | 1743.94 | $3/2^+,5/2^+$ | 77.39 | $7/2^+$ |
| 1718.3 *2* | 0.28 *3* | 2128.08 | $3/2^+,5/2^+$ | 409.77 | $5/2^+$ |
| 1744.4 *4* | 0.026 *4* | 1743.94 | $3/2^+,5/2^+$ | 0.0 | $1/2^+$ |
| [x]1806.1 *3* | 0.035 *4* | | | | |
| 1880.1 *4* | 0.024 *3* | 1957.02 | 3/2,5/2 | 77.39 | $7/2^+$ |
| [x]1889.4 *3* | 0.078 *7* | | | | |
| 1918.7 *8* | 0.010 *4* | 2931.9 | | 1013.22 | $3/2^+$ |
| 1956.9 *4* | 0.071 *7* | 1957.02 | 3/2,5/2 | 0.0 | $1/2^+$ |
| 1968.3 *5* | 0.021 *3* | 2045.39 | $(5/2^+,5/2^+)$ | 77.39 | $7/2^+$ |
| [x]2006.7 *6* | 0.033 *4* | | | | |
| [x]2014.7 *6* | 0.044 *6* | | | | |
| 2042.7 *6* | 0.056 *7* | 2540.3 | $3/2^+,5/2^+$ | 498.01 | $3/2^+$ |
| 2130.1 *6* | 0.047 *6* | 2540.3 | $3/2^+,5/2^+$ | 409.77 | $5/2^+$ |
| [x]2304.8 *7* | 0.016 *3* | | | | |
| [x]2337.2 *7* | 0.015 *3* | | | | |
| 2433.9 *8* | 0.027 *5* | 2931.9 | | 498.01 | $3/2^+$ |
| 2540.1 *7* | 0.061 *8* | 2540.3 | $3/2^+,5/2^+$ | 0.0 | $1/2^+$ |
| [x]2624.6 *6* | 0.015 *3* | | | | |
| [x]2791.5 *13* | 0.011 *3* | | | | |
| 2854.4 *8* | 0.013 *3* | 2931.9 | | 77.39 | $7/2^+$ |
| [x]3143.7 *12* | 0.016 *3* | | | | |
| [x]3192.5 *12* | 0.014 *3* | | | | |
| [x]3605.6 *13* | 0.021 *5* | | | | |

[†] For absolute intensity per 100 decays, multiply by 0.80 *2*.

[‡] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on $\gamma$-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[x] $\gamma$ ray not placed in level scheme.



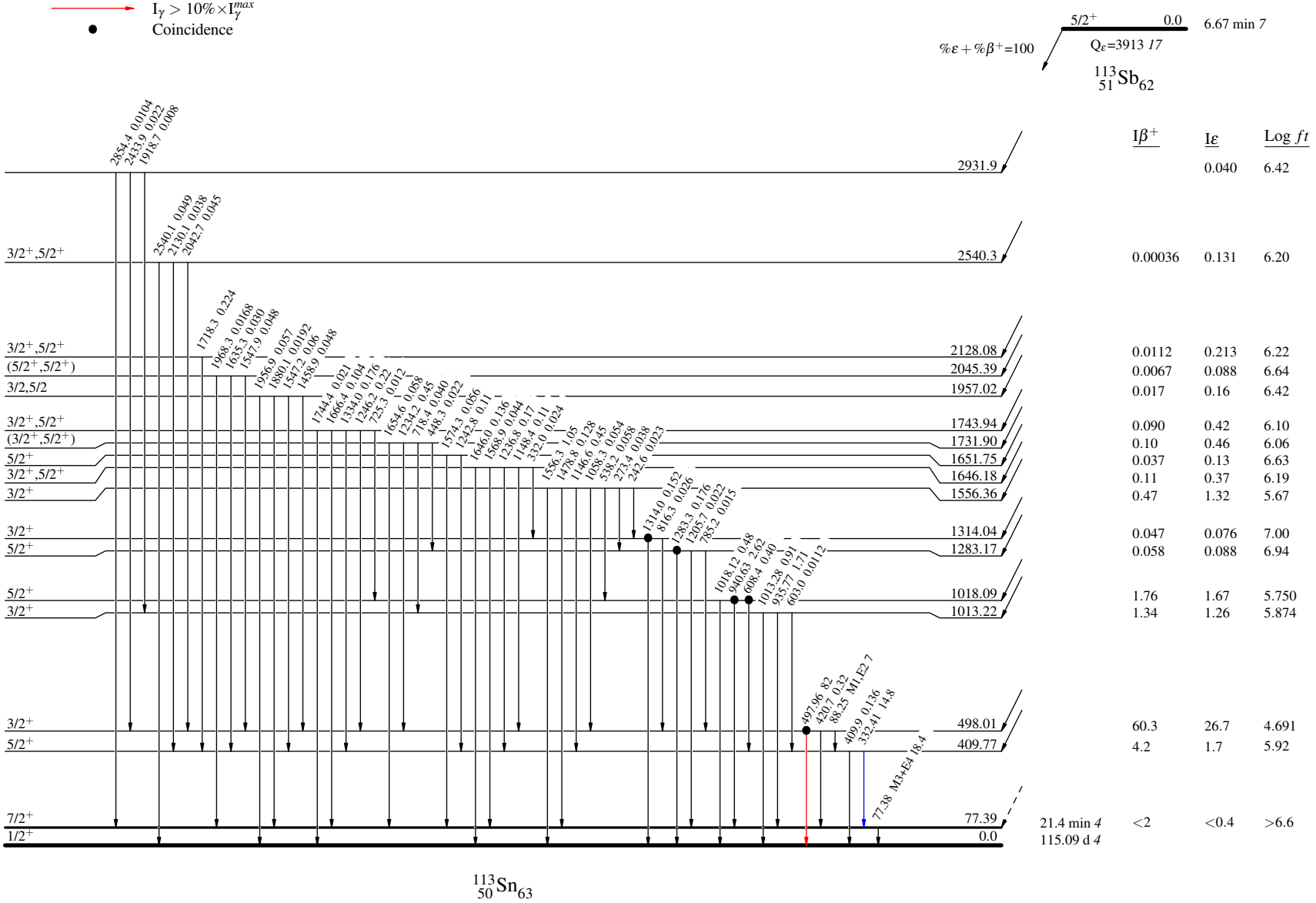


$^{113}_{50}Sn_{63}$-4

## $^{113}$Sb ε decay 1976Wi10,1975WiZX

### Decay Scheme

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




$^{113}_{50}Sn_{63}$





$^{113}_{50}Sn_{63}$-5