# $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17

History

| Type | Author | Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Balraj Singh | ENSDF | 30-Nov-2021 |

Parent: $^{89}$Br: E=0; $J^\pi$=(5/2$^-$); $T_{1/2}$=4.357 s *22*; Q($\beta^-$)=8262 *4*; %$\beta^-$ decay=100.0

$^{89}$Br-$J^\pi$,$T_{1/2}$: From $^{89}$Br Adopted Levels.

$^{89}$Br-Q($\beta^-$): From 2021Wa16.

1981Ho17: $^{89}$Br produced from $^{235}$U(n,F), chem, AlBr+. Measured E$\gamma$, I$\gamma$, $\gamma\gamma$, $\beta\gamma$, $\beta$ strength functions.

Q($\beta^-$)=8155 *30* ($\beta\gamma$, 1992GrZX).

$\beta^-$n measurements: 1993Ru01, 1987PfZX, 1984Ew01, 1981Ho07, 1981Ho17, 1980ReZQ, 1980Lu04, 1980Al15, 1978Kr15, 1977Re06, 1977Re05, 1976Ru01, 1974Ru07, 1974NoZR, 1974Kr21, 1972Sc48, 1971Ch38, 1966Si09, 1965Sh07, 1964Ar24.

Others: 1975Kr17, 1974Gr29, 1971BrYH.

Pre-1960 references for production from fission and/or half-life measurements by neutron counting: 1959Pe28, 1949Su14, 1948Hu33, 1947Re02, Snell et al., Phys Rev 72, 541 (1947); Sugarman et al., J Chem Phys 15, 544 (1947).

Measurement of $\beta$ strength functions: 1982Al01, 1981Ho17, 1979Al05, 1975Al11.

Additional information 1.

Energy balance: total decay energy of 7245 keV *176* deduced (using RADLIST code) from proposed decay scheme is lower than the expected value of 8262 keV *4*, indicating that the decay scheme is incomplete.

## $^{89}$Kr Levels

| E(level)[†] | $J^\pi$[‡] | $T_{1/2}$[#] | Comments |
|---|---|---|---|
| 0.0 | 3/2$^{(+)}$ | 3.15 min *4* | $T_{1/2}$: from the Adopted Levels. |
| 28.59 *3* | (5/2$^+$) | 21 ns *2* | $T_{1/2}$: $\beta\gamma$(t) (1987Ka02). 1987KaZW is the same as 1987Ka02. |
| 411.42 *3* | | | |
| 982.07 *4* | (9/2$^+$) | | |
| 991.36 *4* | | | |
| 1026.54 *3* | | | |
| 1097.835 *25* | | | |
| 1379.90 *3* | | | |
| 1482.94 *3* | | | |
| 1536.37 *4* | | | |
| 1833.89 *8* | | | |
| 1887.63 *5* | | | |
| 1894.59[&] *7* | | | |
| 1957.19 *9* | | | |
| 2038.82 *5* | | | |
| 2062.76 *6* | | | |
| 2104.43 *6* | | | |
| 2108.15 *6* | | | |
| 2146.99 *6* | | | |
| 2216.64 *7* | | | |
| 2298.48[b] *8* | | | |
| 2373.72 *6* | | | |
| 2426.32 *14* | | | |
| 2468.2[a] *10* | | | |
| 2735.45 *21* | | | |
| 2976.50 *11* | | | |
| 3318.4 *3* | | | |
| 3753.91 *10* | | | |
| 3992.16 *11* | | | |
| 4114.72 *7* | | | |
| 4165.89 *10* | | | |
| 4185.66[@] *18* | | | |

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## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17 (continued)

### $^{89}$Kr Levels (continued)

| E(level)[†] | Comments |
|---|---|
| 4232.48[@] *8* | |
| 4238.45 *22* | |
| 4248.8 *3* | |
| 4288.86 *23* | |
| 4319.1[@] *3* | |
| 4381.70 *7* | |
| 4403.0[@] *4* | |
| 4510.5[@] *4* | |
| 4515.97[b] *18* | |
| 4530.3[&] *3* | |
| 4610.7[b] *4* | |
| 4673.1[b] *4* | |
| 4707.3[@] *4* | |
| 4916+x | E(level): level introduced by evaluator to account for population of neutron-unbound levels to account for %$\beta^-$n decay of $^{89}$Br x<3346 *5* (from Q($\beta^-$)-S(n)($^{89}$Kr), where Q($\beta^-$)=8262 *4* and S(n)=4916 *3* (2021Wa16). |

[†] From least-squares fit to E$\gamma$ data. Due to mismatch in energy sums, the following E$\gamma$ data were not included: 1487.25, 1697.0, 1915.23.
[‡] From Adopted Levels.
[#] For levels connected by transitions observed in $\gamma\gamma$ coin, $T_{1/2}$<15-20 ns from coincidence resolving time.
[@] If the deexciting transition feeds the 28.6 level, E(level) should be increased by 28.6 keV.
[&] If the deexciting transition feeds the g.s., E(level) should be lowered by 28.6 keV.
[a] From average of values deduced from energies of feeding (1697.0, 1915.23) and deexciting (1487.25) $\gamma$ rays. Mismatch in energy sums/differences leads to large uncertainty in E(level). If the placement of 1697.0$\gamma$ from 4165.9 level is correct, then the energy of 1915.23$\gamma$ is too high by ≈2.5 keV. Otherwise either the 1915.23$\gamma$ or the 1487.25$\gamma$ is too high by ≈2.5 keV.
[b] According to 1981Ho17, g.s. transition feeds g.s. or the 28.6 level, but another connecting transition supports this level energy.

### $\beta^-$ radiations

| E(decay) | E(level) | I$\beta^-$[†#] | Log *ft*[†] | Comments |
|---|---|---|---|---|
| (1.7×10$^3$[&] *17*) | 4916+x | 13.7 *6* | | I$\beta^-$: from %$\beta^-$n=13.7 *6* of $^{89}$Br decay (from $^{89}$Br Adopted Levels). |
| (3555 *4*) | 4707.3 | 0.49 *6* | 6.4 | av E$\beta$=1536.3 *19* |
| (3589 *4*) | 4673.1 | 0.32 *8* | 6.6 | av E$\beta$=1552.7 *19* |
| (3651 *4*) | 4610.7 | 0.55 *20* | 6.3 | av E$\beta$=1582.6 *19* |
| (3732 *4*) | 4530.3 | 0.93 *12* | 6.2 | av E$\beta$=1621.1 *19*<br>E(decay): 3680 *440* from $\beta$(4502$\gamma$) (1981Ho17). |
| (3746 *4*) | 4515.97 | 0.84 *10* | 6.3 | av E$\beta$=1628.0 *19*<br>E(decay): 3570 *460* from $\beta$(4517$\gamma$) (1981Ho17). |
| (3752 *4*) | 4510.5 | 0.32 *5* | 6.7 | av E$\beta$=1630.6 *19* |
| (3859 *4*) | 4403.0 | 0.38 *5* | 6.7 | av E$\beta$=1682.2 *19* |
| (3880 *4*) | 4381.70 | 3.3 *3* | 5.7 | av E$\beta$=1692.4 *19*<br>E(decay): 3860 *440* from $\beta$(4354$\gamma$) (1981Ho17). |
| (3943 *4*) | 4319.1 | 0.95 *12* | 6.3 | av E$\beta$=1722.5 *19*<br>E(decay): 3650 *340* from $\beta$(4319$\gamma$) (1981Ho17). |
| (3973 *4*) | 4288.86 | 1.12 *13* | 6.2 | av E$\beta$=1737.0 *19* |
| (4013 *4*) | 4248.8 | 0.49 *7* | 6.6 | av E$\beta$=1756.2 *19* |
| (4024 *4*) | 4238.45 | 0.80 *9* | 6.4 | av E$\beta$=1761.2 *19* |
| (4030 *4*) | 4232.48 | 1.39 *12* | 6.1 | av E$\beta$=1764.1 *19* |

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## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17 (continued)

### $\beta^-$ radiations (continued)

| E(decay) | E(level) | I$\beta^-$[†][#] | Log *ft*[†] | Comments |
|---|---|---|---|---|
| (4076 *4*) | 4185.66 | 0.84 *10* | 6.4 | av E$\beta$=1786.6 *19* |
| (4096 *4*) | 4165.89 | 5.2 *6* | 5.6 | av E$\beta$=1796.1 *19*<br>E(decay): 3850 *260* from $\beta$(4166$\gamma$) (1981Ho17). |
| (4147 *4*) | 4114.72 | 4.2 *4* | 5.8 | av E$\beta$=1820.7 *19*<br>E(decay): 4180 *450* from $\beta$(4086$\gamma$) (1981Ho17). |
| (4270 *4*) | 3992.16 | 1.25 *13* | 6.3 | av E$\beta$=1879.7 *19*<br>E(decay): 4470 *410* from $\beta$(2894$\gamma$) (1981Ho17). |
| (4508 *4*) | 3753.91 | 0.58 *6* | 6.8 | av E$\beta$=1994.4 *19* |
| (4944 *4*) | 3318.4 | 0.64 *10* | 6.9 | av E$\beta$=2204.5 *19* |
| (5286 *4*) | 2976.50 | 0.66 *9* | 7.0 | av E$\beta$=2369.6 *19* |
| (5527 *4*) | 2735.45 | 0.27 *4* | 7.5 | av E$\beta$=2486.0 *19* |
| (5794[@] *4*) | 2468.2 | <0.04 | >8.4 | I$\beta^-$: 0.00 *4* from $\gamma$-intensity balance. |
| (5836 *4*) | 2426.32 | 0.26 *4* | 7.6 | av E$\beta$=2635.5 *19* |
| (5888[@] *4*) | 2373.72 | | | I$\beta^-$: −0.11 *8* from $\gamma$-intensity balance. |
| (5964 *4*) | 2298.48 | 0.72 *9* | 7.2 | av E$\beta$=2697.3 *19* |
| (6045 *4*) | 2216.64 | 0.60 *9* | 7.3 | av E$\beta$=2736.9 *19* |
| (6115 *4*) | 2146.99 | 1.40 *17* | 7.0 | av E$\beta$=2770.5 *19* |
| (6154 *4*) | 2108.15 | 0.79 *22* | 7.3 | av E$\beta$=2789.3 *19* |
| (6158 *4*) | 2104.43 | 0.42 *5* | 7.5 | av E$\beta$=2791.1 *19* |
| (6199 *4*) | 2062.76 | 0.55 *6* | 7.4 | av E$\beta$=2811.3 *19* |
| (6223 *4*) | 2038.82 | 0.73 *7* | 7.3 | av E$\beta$=2822.9 *19* |
| (6305 *4*) | 1957.19 | 0.08 *5* | 8.3 | av E$\beta$=2862.3 *19* |
| (6367 *4*) | 1894.59 | 0.85 *8* | 7.3 | av E$\beta$=2892.6 *19* |
| (6374 *4*) | 1887.63 | 0.45 *5* | 7.6 | av E$\beta$=2896.0 *19* |
| (6428 *4*) | 1833.89 | 0.52 *8* | 7.5 | av E$\beta$=2922.0 *19* |
| (6726 *4*) | 1536.37 | 1.48 *20* | 7.2 | av E$\beta$=3065.9 *19* |
| (6779 *4*) | 1482.94 | 3.4 *3* | 6.8 | av E$\beta$=3091.7 *19* |
| (6882 *4*) | 1379.90 | 2.9 *3* | 6.9 | av E$\beta$=3141.5 *19* |
| (7164 *4*) | 1097.835 | 4.6 *5* | 6.8 | av E$\beta$=3277.9 *19* |
| (7235 *4*) | 1026.54 | 3.3 *4* | 7.0 | av E$\beta$=3312.4 *19* |
| (7271 *4*) | 991.36 | 1.69 *17* | 7.3 | av E$\beta$=3329.4 *19* |
| (7280 *4*) | 982.07 | 1.57 *20* | 9.4[1u] | av E$\beta$=3333.9 *19* |
| (7851 *4*) | 411.42 | 1.35 *19* | 7.5 | av E$\beta$=3609.8 *19* |
| (8233 *4*) | 28.59 | 16[‡] *2* | 6.5 | av E$\beta$=3794.8 *19* |
| (8262 *4*) | 0.0 | 16[‡] *2* | 6.5 | av E$\beta$=3808.6 *19* |

[†] These values are not considered (evaluator) as firm since the $\beta$ fed levels are reported only up to 4707, whereas, from Q($\beta^-$)=8262 keV, $\gamma$-decaying levels above this energy are possible. For this reason, uncertainties are not given for log *ft* values. Neutron decaying levels above 5104 account for 13.8% decay.

[‡] From intensity balance, I$\beta$(g.s.+28.6 level)=32 *2*. Arbitrarily, equal intensity is assigned to g.s. and 28.6 level.

[#] Absolute intensity per 100 decays.

[@] Existence of this branch is questionable.

[&] Estimated for a range of levels.

## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17 (continued)

### $\gamma(^{89}Kr)$

I$\gamma$ normalization: From %$\beta^-$n($^{89}$Br)=13.7 *6* (from $^{89}$Br Adopted Levels) and I$\gamma$(1098$\gamma$)/I(n)=0.46 *3* (1981Ho07), I$\gamma$(1098$\gamma$)/100 decays=6.3 *5* (1980Lu04).

| $E_\gamma$ | $I_\gamma$[&] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult. | $\delta$ | $\alpha$[a] | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 28.51 *10* | 85 *30* | 28.59 | (5/2$^+$) | 0.0 | 3/2$^{(+)}$ | [M1+E2] | <0.24 | 6.9 *22* | $\alpha$(K)=5.4 *13*; $\alpha$(L)=1.2 *8*; $\alpha$(M)=0.20 *13*; $\alpha$(N)=0.017 *10*<br>$\delta$: from RUL(E2)=300.<br>$I_\gamma$: from intensities of feeding $\gamma$ rays, I$\beta$(28.6)=16 and $\alpha$=6.9 *22* for $\delta$(28.5$\gamma$)<0.24. |
| 282.1 *2* | 1.0 *3* | 1379.90 | | 1097.835 | | | | | |
| 353.08 *20* | 1.8 *4* | 1379.90 | | 1026.54 | | | | | |
| [x]356.27 *19* | 2.2 *4* | | | | | | | | |
| 382.87 *5* | 6.0 *3* | 411.42 | | 28.59 | (5/2$^+$) | | | | |
| 385.11 *5* | 4.8 *3* | 1482.94 | | 1097.835 | | | | | |
| 397.94 *5* | 1.54 *11* | 1379.90 | | 982.07 | (9/2$^+$) | | | | |
| 411.49 *4* | 33 *2* | 411.42 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 456.3 *2* | 1.0 *3* | 1482.94 | | 1026.54 | | | | | |
| [x]498.04 *20* | 4.7 *6* | | | | | | | | |
| 554.37 *5* | 2.21 *10* | 1536.37 | | 982.07 | (9/2$^+$) | | | | |
| [x]558.50 *6* | 1.61 *10* | | | | | | | | |
| 580.03 *4* | 6.8 *4* | 991.36 | | 411.42 | | | | | |
| [x]595.99 *6* | 4.5 *3* | | | | | | | | |
| [x]609.38 *20* | 2.3 *4* | | | | | | | | |
| 621.56 *5* | 1.83 *8* | 2104.43 | | 1482.94 | | | | | |
| [x]738.72 *5* | 2.64 *11* | | | | | | | | |
| 789.76 *5* | 5.3 *3* | 1887.63 | | 1097.835 | | | | | |
| 807.33 *8* | 11.7 *10* | 1833.89 | | 1026.54 | | | | | |
| 896.37 *10* | 1.81 *15* | 1887.63 | | 991.36 | | | | | |
| 953.53 *4* | 71 *2* | 982.07 | (9/2$^+$) | 28.59 | (5/2$^+$) | | | | |
| 962.70 *4* | 24 *1* | 991.36 | | 28.59 | (5/2$^+$) | | | | |
| 991.5 *3* | 5.3 *9* | 991.36 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 997.93 *4* | 71 *2* | 1026.54 | | 28.59 | (5/2$^+$) | | | | |
| 1012.25 *4* | 15.9 *4* | 2038.82 | | 1026.54 | | | | | |
| 1026.46 *4* | 30 *1* | 1026.54 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 1036.13 *7* | 3.9 *2* | 2062.76 | | 1026.54 | | | | | |
| 1064.0 *10* | 2 *1* | 4381.70 | | 3318.4 | | | | | |
| 1069.24 *7* | 3.6 *2* | 1097.835 | | 28.59 | (5/2$^+$) | | | | |
| 1080.61 *8* | 3.2 *2* | 2062.76 | | 982.07 | (9/2$^+$) | | | | |
| 1097.82 *3* | 100 *3* | 1097.835 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 1122.08 *10* | 4.8 *4* | 2104.43 | | 982.07 | (9/2$^+$) | | | | |
| 1190.11 *8* | 4.4 *3* | 2216.64 | | 1026.54 | | | | | |
| 1351.31 *5* | 35 *2* | 1379.90 | | 28.59 | (5/2$^+$) | | | | |
| 1355.54 *20* | 4.3 *4* | 2735.45 | | 1379.90 | | | | | |
| 1379.80 *4* | 22.1 *15* | 1379.90 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 1391.64 *7* | 7.3 *4* | 2373.72 | | 982.07 | (9/2$^+$) | | | | |
| 1399.77 *13* | 4.1 *4* | 2426.32 | | 1026.54 | | | | | |
| 1454.22 *7* | 17.9 *10* | 1482.94 | | 28.59 | (5/2$^+$) | | | | |
| 1483.00 *4* | 32 *2* | 1482.94 | | 0.0 | 3/2$^{(+)}$ | | | | |
| 1487.25[‡] *20* | 7.9 *4* | 2468.2 | | 982.07 | (9/2$^+$) | | | | |
| 1507.70 *4* | 41 *2* | 1536.37 | | 28.59 | (5/2$^+$) | | | | |
| [x]1529.79 *17* | 4.5 *6* | | | | | | | | |
| [x]1533.62 *20* | 3.7 *4* | | | | | | | | |

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## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17 (continued)

### $\gamma(^{89}Kr)$ (continued)

| $E_\gamma$ | $I_\gamma$[&] | $E_i$(level) | $E_f$ | $J_f^\pi$ | Comments |
|---|---|---|---|---|---|
| 1606.93 *10* | 5.8 *3* | 3753.91 | 2146.99 | | |
| 1693.71 *12* | 2.6 *3* | 3992.16 | 2298.48 | | |
| 1697.00[b] *17* | 1.86[b] *3* | 4165.89 | 2468.2 | | |
| 1697.00[b#c] *17* | 1.86[b] *3* | 4673.1 | 2976.50 | | For deducing Iβ, intensity of this γ was used as 0.94 *94*. |
| 1741.34 *12* | 3.4 *3* | 4114.72 | 2373.72 | | |
| [x]1763.80 *15* | 2.5 *3* | | | | |
| 1782 | ≈6 | 3318.4 | 1536.37 | | |
| 1858.73 *5* | 17.8 *6* | 4232.48 | 2373.72 | | |
| 1865.98[†] *6* | 13.5 *5* | 1894.59 | 28.59 | $(5/2^+)$ | |
| 1915.23[‡] *8* | 6.1 *3* | 4381.70 | 2468.2 | | |
| 1919.96 *12* | 3.4 *3* | 3753.91 | 1833.89 | | |
| 1928.44 *13* | 5.3 *3* | 1957.19 | 28.59 | $(5/2^+)$ | |
| 1957.22 *15* | 4.6 *4* | 1957.19 | 0.0 | $3/2^{(+)}$ | |
| [x]1966.51 *12* | 6.7 *5* | | | | |
| 1994.40 *10* | 11.4 *5* | 2976.50 | 982.07 | $(9/2^+)$ | |
| 2006.72 *13* | 8.3 *5* | 4114.72 | 2108.15 | | |
| 2034.49 *13* | 6.0 *4* | 2062.76 | 28.59 | $(5/2^+)$ | |
| 2075.61 *13* | 4.3 *4* | 4114.72 | 2038.82 | | |
| 2108.16 *6* | 23.8 *15* | 2108.15 | 0.0 | $3/2^{(+)}$ | |
| 2118.40 *6* | 32 *2* | 2146.99 | 28.59 | $(5/2^+)$ | |
| 2165.04 *12* | 6.0 *5* | 4381.70 | 2216.64 | | |
| [x]2179.69 *10* | 5.0 *5* | | | | |
| 2208.59 *12* | 5.6 *5* | 4165.89 | 1957.19 | | |
| 2216.60 *12* | 11.2 *10* | 2216.64 | 0.0 | $3/2^{(+)}$ | |
| 2228.42 *20* | 3.1 *3* | 4185.66 | 1957.19 | | |
| 2234.81 *15* | 4.0 *4* | 4381.70 | 2146.99 | | |
| 2298.47[†] *8* | 14.0 *10* | 2298.48 | 0.0 | $3/2^{(+)}$ | |
| 2318.79 *13* | 4.3 *4* | 4381.70 | 2062.76 | | |
| [x]2336.18 *15* | 4.6 *4* | | | | |
| 2345.33 *10* | 12.2 *10* | 2373.72 | 28.59 | $(5/2^+)$ | |
| 2503.16[@c] *15* | 5.7 *5* | 4610.7 | 2108.15 | | For deducing Iβ, intensity of this γ was used as 3.1 *31*. |
| 2578.03 *16* | 13.7 *15* | 4114.72 | 1536.37 | | |
| [x]2733.97 *15* | 6.3 *6* | | | | |
| 2785.8 *2* | 3.6 *5* | 4165.89 | 1379.90 | | |
| [x]2815.3 *2* | 3.7 *5* | | | | |
| 2894.20 *15* | 17.2 *13* | 3992.16 | 1097.835 | | |
| 3001.60 *13* | 7.5 *6* | 4381.70 | 1379.90 | | |
| 3017.0 *7* | 3 *1* | 4114.72 | 1097.835 | | |
| 3132.30 *15* | 4.7 *4* | 4114.72 | 982.07 | $(9/2^+)$ | |
| [x]3139.5 *2* | 6.2 *6* | | | | |
| 3174.6 *2* | 7.5 *5* | 4165.89 | 991.36 | | |
| [x]3187.48 *15* | 7.8 *6* | | | | |
| 3289.8 *3* | 6.1 *8* | 3318.4 | 28.59 | $(5/2^+)$ | |
| [x]3326.4 *2* | 10.9 *10* | | | | |
| 3400.0 *8* | 3 *1* | 4381.70 | 982.07 | $(9/2^+)$ | |
| 3489.1 *2* | 5.7 *6* | 4515.97 | 1026.54 | | |
| [x]3495.1 *3* | 3.4 *5* | | | | |
| [x]3531.5 *2* | 9.5 *7* | | | | |
| [x]3588.0 *3* | 5.4 *5* | | | | |
| 3837.3 *3* | 7.7 *8* | 4248.8 | 411.42 | | |
| 3877.0 *8* | 3 *1* | 4288.86 | 411.42 | | |
| 4086.3 *3* | 30 *3* | 4114.72 | 28.59 | $(5/2^+)$ | |
| 4166.3 *3* | 64 *5* | 4165.89 | 0.0 | $3/2^{(+)}$ | |
| 4185.6[†] *3* | 10.3 *10* | 4185.66 | 0.0 | $3/2^{(+)}$ | |

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## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17 (continued)

### $\gamma(^{89}Kr)$ (continued)

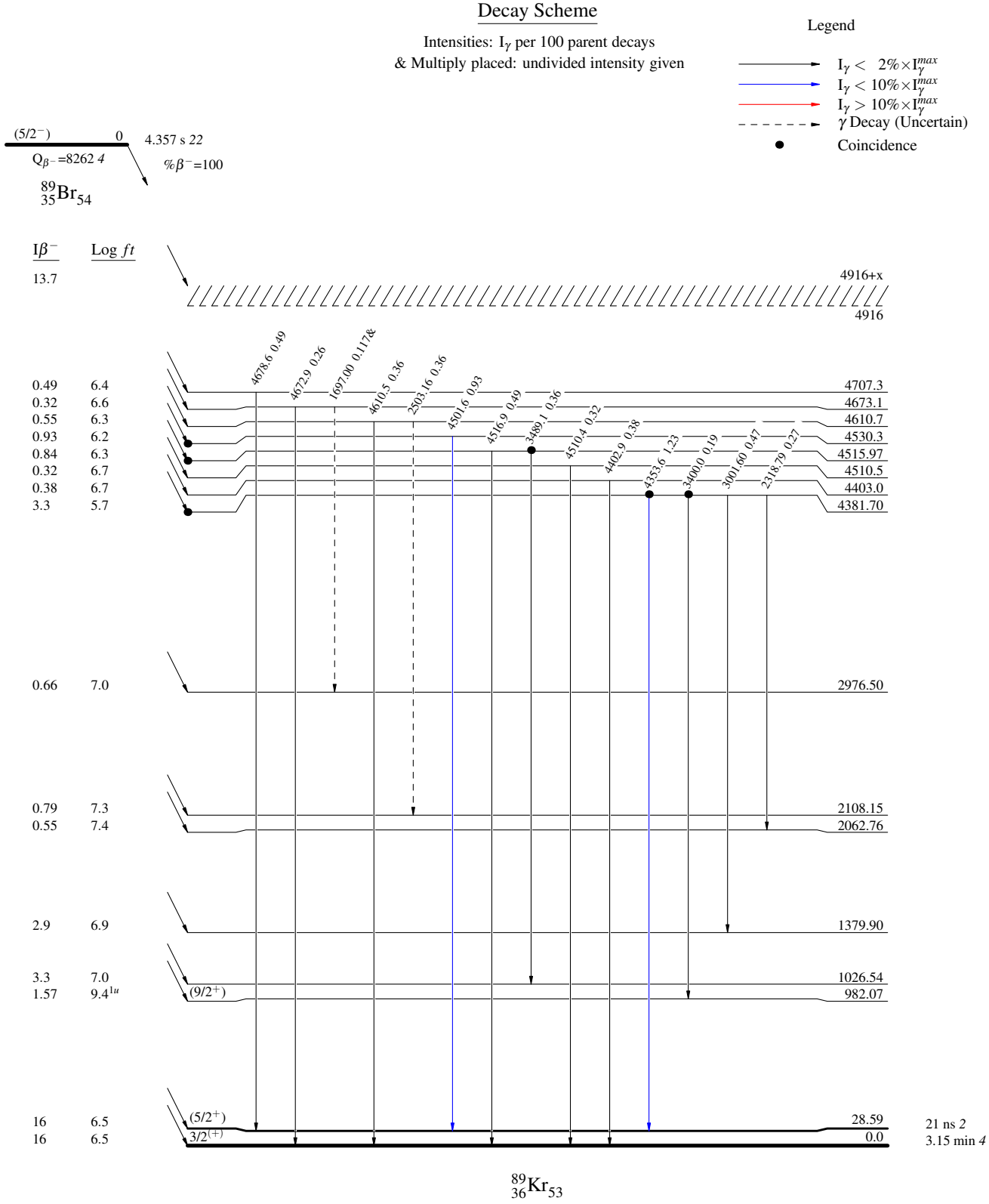
| $E_\gamma$ | $I_\gamma$[&] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | $E_\gamma$ | $I_\gamma$[&] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4209.9 *3* | 5.5 *5* | 4238.45 | | 28.59 | $(5/2^+)$ | 4402.9[†] *4* | 6.1 *6* | 4403.0 | | 0.0 | $3/2^{(+)}$ |
| 4232.5[†] *4* | 4.3 *5* | 4232.48 | | 0.0 | $3/2^{(+)}$ | 4501.6[†] *3* | 14.7 *14* | 4530.3 | | 28.59 | $(5/2^+)$ |
| 4238.2 *3* | 7.2 *7* | 4238.45 | | 0.0 | $3/2^{(+)}$ | 4510.4[†] *4* | 5.1 *6* | 4510.5 | | 0.0 | $3/2^{(+)}$ |
| 4260.5 *4* | 6.5 *7* | 4288.86 | | 28.59 | $(5/2^+)$ | 4516.9[†] *4* | 7.7 *8* | 4515.97 | | 0.0 | $3/2^{(+)}$ |
| 4288.6 *3* | 8.3 *8* | 4288.86 | | 0.0 | $3/2^{(+)}$ | 4610.5[†] *4* | 5.7 *6* | 4610.7 | | 0.0 | $3/2^{(+)}$ |
| 4319.0[†] *3* | 15.0 *14* | 4319.1 | | 0.0 | $3/2^{(+)}$ | 4672.9[†] *4* | 4.2 *5* | 4673.1 | | 0.0 | $3/2^{(+)}$ |
| 4353.6 *3* | 19.6 *17* | 4381.70 | | 28.59 | $(5/2^+)$ | 4678.6[†] *4* | 7.7 *7* | 4707.3 | | 28.59 | $(5/2^+)$ |

[†] Transition feeds the g.s. or the 28.6 level.
[‡] Energy may be too high by ≈2.5 keV, see comment for 2468 level.
[#] Alternative placement (evaluator).
[@] Placement from level-energy difference (evaluator), unplaced in 1981Ho17.
[&] For absolute intensity per 100 decays, multiply by 0.063 *5*.
[a] 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.
[b] Multiply placed with undivided intensity.
[c] Placement of transition in the level scheme is uncertain.
[x] $\gamma$ ray not placed in level scheme.

## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17

### Decay Scheme

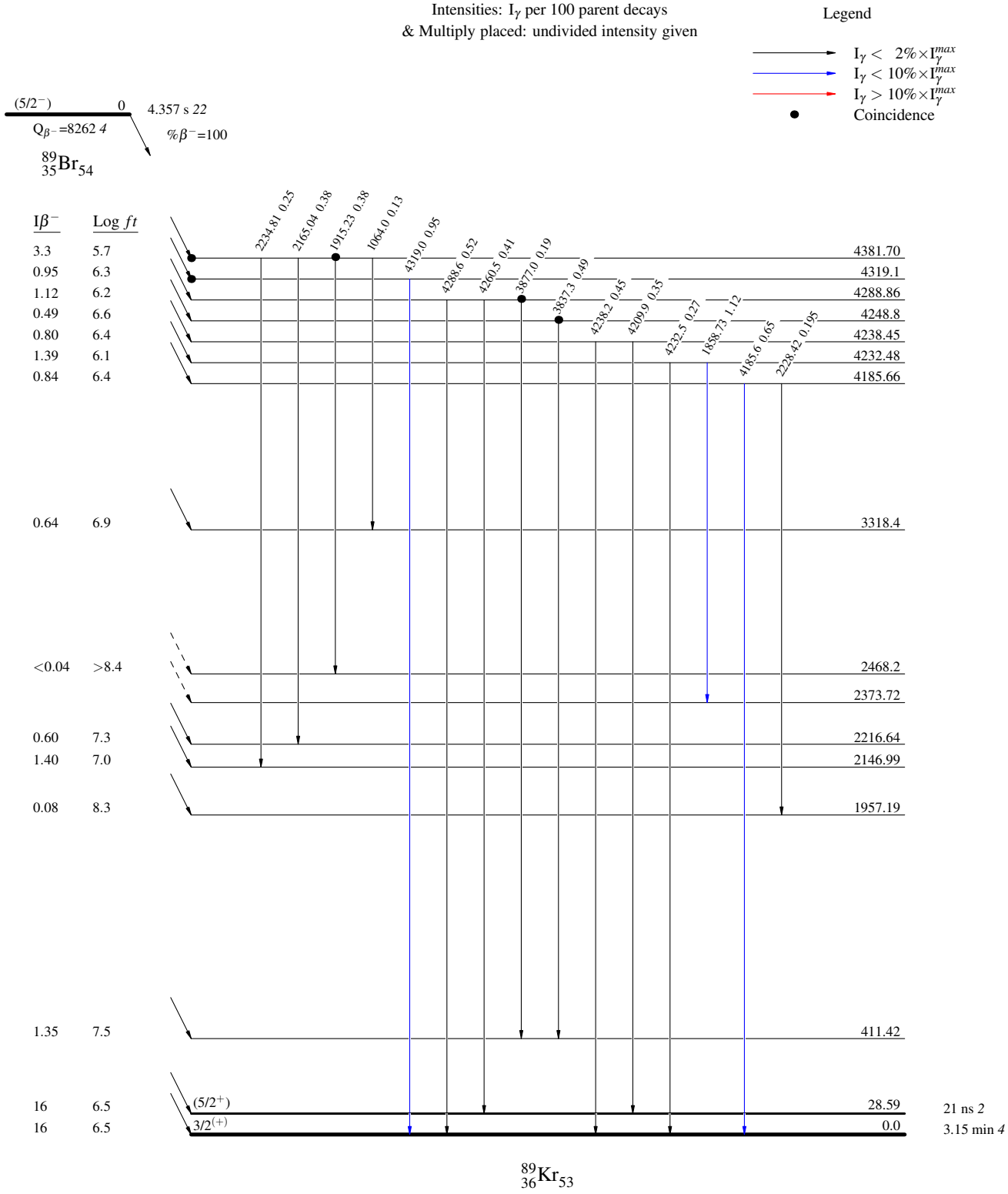
Intensities: $I_\gamma$ per 100 parent decays
& Multiply placed: undivided intensity given



## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17

### Decay Scheme (continued)

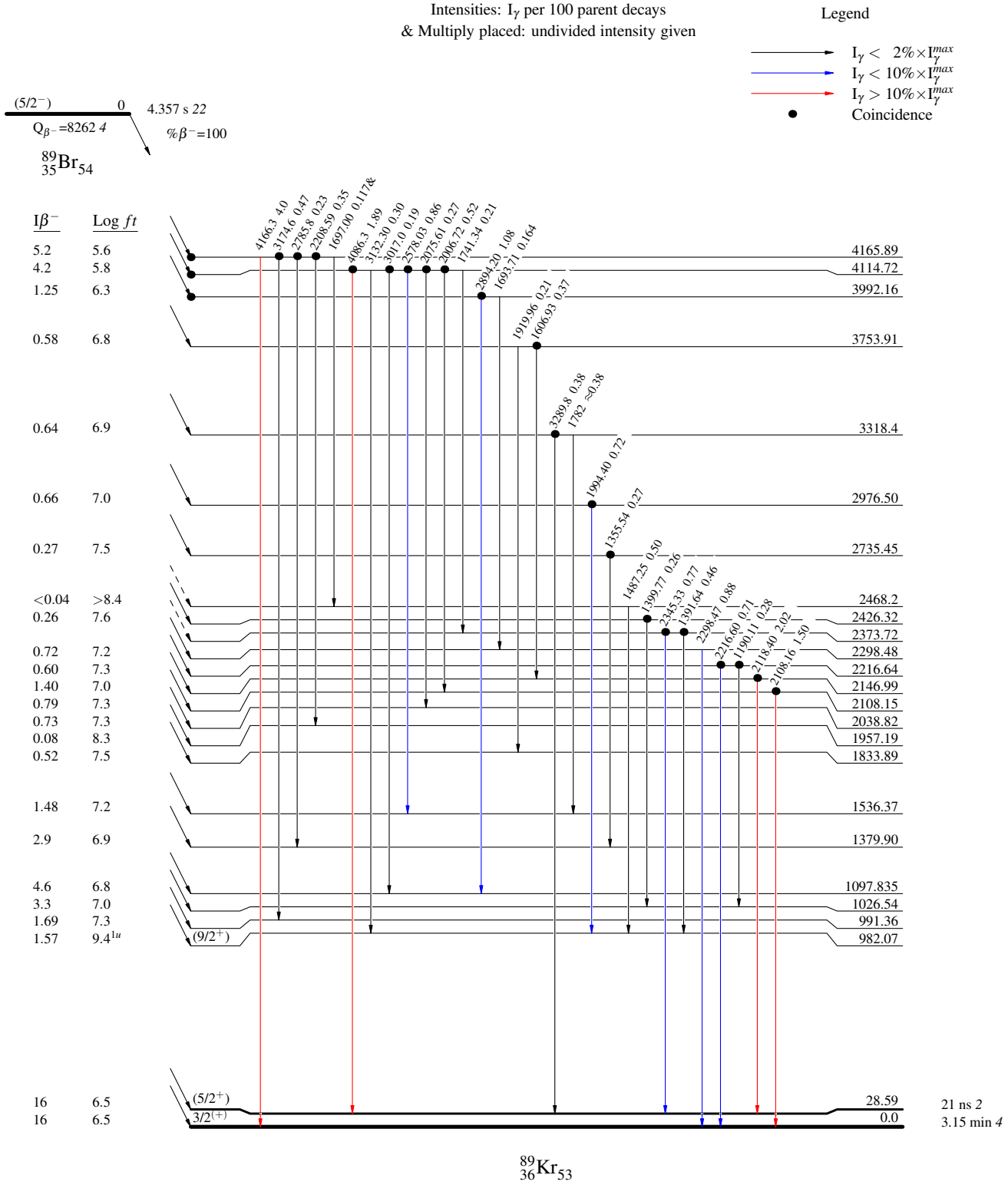
Intensities: $I_\gamma$ per 100 parent decays
& Multiply placed: undivided intensity given



## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17

### Decay Scheme (continued)

Intensities: $I_\gamma$ per 100 parent decays
& Multiply placed: undivided intensity given



## $^{89}$Br $\beta^-$ decay (4.357 s) 1981Ho17

### Decay Scheme (continued)

Intensities: $I_\gamma$ per 100 parent decays
& Multiply placed: undivided intensity given