# $^{80}$Ga $\beta^-$ decay (1.676 s) 1981Ho24

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Balraj Singh | NDS 105, 223 (2005) | 22-Jun-2005 |

Parent: $^{80}$Ga: E=0; $J^\pi$=(3); $T_{1/2}$=1.676 s *14*; Q($\beta^-$)=10.38×10$^3$ *12*; %$\beta^-$ decay=100.0

$^{80}$Ga-E,$J^\pi$: Population of ($6^+$) and ($8^+$) states is unlikely if J=(3) for $^{80}$Ga g.s.; there might Be a high-spin isomer (possibly J=7) In $^{80}$Ga which May account for the population of ($6^+$) and ($8^+$) states.

$^{80}$Ga-$T_{1/2}$: From $^{80}$Ga Adopted Levels.

1981Ho24: $^{80}$Ga obtained from mass separation of fission fragments. Measured $\gamma$, $\gamma\gamma$. Some details are given by 1980HoZN.

Other measurements:

$\beta\gamma\gamma$(t): 2005MaZW.

$\beta^-$, $\beta\gamma$ data: 1986Ek01, 1981Al20.

Absolute intensity data: 1981Ho07.

$T_{1/2}$($^{80}$Ga): 1993Ru01, 1991Kr15, 1976Ru01, 1982FoZZ, 1981Gi17, 1974Gr29.

$\beta^-$ strength function: 1975Al11.

Additional information 1.

$\beta^-$n: 1993Ru01, 1991Kr15, 1987Wi13, 1986Wa17, 1981Ru07, 1980Lu04, 1977Ru09.

## $^{80}$Ge Levels

| E(level)[†] | $J^\pi$[‡] | $T_{1/2}$ | Comments |
|---|---|---|---|
| 0.0 | $0^+$ | | |
| 659.15 *4* | $2^+$ | | |
| 1573.56 *4* | ($2^+$) | | |
| 1742.59 *5* | ($4^+$) | | |
| 1972.16 *5* | | | |
| 2265.77 *5* | | | |
| 2851.93 *5* | | | |
| 2978.35 *7* | ($6^+$) | | |
| 3036.95 *6* | | | |
| 3423.00 *6* | | | |
| 3423.66 *6* | | | |
| 3445.11 *8* | ($8^+$) | 2.95 ns *6* | $T_{1/2}$: $\beta\gamma\gamma$(t) (2005MaZW). |
| 3498.33 *14* | | | |
| 3515.41 *6* | | | |
| 3685.89 *6* | | | |
| 3913.73 *11* | | | |
| 3982.64 *8* | | | |
| 3987.89 *6* | | | |
| 4025.85 *8* | | | |
| 4323.84 *5* | | | |
| 4413.15 *7* | | | |
| 4532.58 *7* | | | |
| 4851.13 *9* | | | |
| 4992.70 *7* | | | |
| 5232.74 *9* | | | |
| 5338.18 *14* | | | |
| 5451.26 *17* | | | |
| 5568.01 *12* | | | |
| 5573.20 *7* | | | |
| 5800.48 *8* | | | |
| 6047.14 *21* | | | |
| 6155.32 *21* | | | |

[†] From least-squares fit to Eγ′s.

[‡] From 'Adopted Levels'.

## $^{80}$Ga $\beta^-$ decay (1.676 s) 1981Ho24 (continued)

### $\beta^-$ radiations

| E(decay) | E(level) | I$\beta^-$[†‡] | Log *ft*[†] | Comments |
|---|---|---|---|---|
| (4.22×10$^3$ *12*) | 6155.32 | 0.56 *7* | 6.2 | av E$\beta$=1.68×10$^3$ *15* |
| (4.33×10$^3$ *12*) | 6047.14 | 1.09 *13* | 6.0 | av E$\beta$=1.74×10$^3$ *15* |
| 4.34×10$^3$ *78* | 5800.48 | 1.96 *21* | 5.8 | av E$\beta$=1.86×10$^3$ *15*<br>E(decay): from (2115$\gamma$)($\beta$) (1981Al20). Other: 3820 *580* (from (2948$\gamma$)($\beta$) (1981Al20)). |
| 5.08×10$^3$ *51* | 5573.20 | 1.81 *20* | 5.9 | av E$\beta$=1.96×10$^3$ *15*<br>E(decay): from (1041$\gamma$)($\beta$) (1986Ek01). |
| (4.81×10$^3$ *12*) | 5568.01 | 0.75 *9* | 5.9 | av E$\beta$=1.97×10$^3$ *15* |
| (4.93×10$^3$ *12*) | 5451.26 | 0.67 *8* | 6.3 | av E$\beta$=2.02×10$^3$ *15* |
| (5.04×10$^3$ *12*) | 5338.18 | 0.88 *10* | 6.4 | av E$\beta$=2.08×10$^3$ *15* |
| (5.15×10$^3$ *12*) | 5232.74 | 0.61 *7* | 6.6 | av E$\beta$=2.13×10$^3$ *15* |
| 5.70×10$^3$ *35* | 4992.70 | 3.1 *4* | 5.9 | av E$\beta$=2.25×10$^3$ *15*<br>E(decay): from (1307$\gamma$)($\beta$) (1986Ek01). |
| 5.56×10$^3$ *64* | 4851.13 | 1.52 *17* | 6.3 | av E$\beta$=2.31×10$^3$ *15*<br>E(decay): from (3108$\gamma$)($\beta$) (1986Ek01). Other: 5460 *860* (1981Al20). |
| 5.78×10$^3$ *20* | 4532.58 | 2.9 *4* | 6.1 | av E$\beta$=2.47×10$^3$ *15*<br>E(decay): from (1681$\gamma$)($\beta$) (1986Ek01). |
| (5.97×10$^3$ *12*) | 4413.15 | 0.51 *8* | 6.9 | av E$\beta$=2.53×10$^3$ *15* |
| 6.01×10$^3$ *40* | 4323.84 | 5.6 *6* | 5.9 | av E$\beta$=2.57×10$^3$ *15*<br>E(decay): from (3664$\gamma$)($\beta$) (1986Ek01). Others: 5820 *420* (from (3664$\gamma$)($\beta$) (1981Al20)), 5570 *760* (from (2581$\gamma$)($\beta$) (1981Al20)). |
| (6.35×10$^3$ *12*) | 4025.85 | 1.22 *16* | 6.7 | av E$\beta$=2.71×10$^3$ *15* |
| (6.39×10$^3$ *12*) | 3987.89 | 1.45 *22* | 6.6 | av E$\beta$=2.73×10$^3$ *15* |
| (6.40×10$^3$ *12*) | 3982.64 | 0.91 *10* | 6.8 | av E$\beta$=2.74×10$^3$ *15* |
| (6.47×10$^3$ *12*) | 3913.73 | 0.46 *6* | 7.1 | av E$\beta$=2.77×10$^3$ *15* |
| (6.69×10$^3$ *12*) | 3685.89 | 1.8 *3* | 6.6 | av E$\beta$=2.88×10$^3$ *15* |
| (6.86×10$^3$ *12*) | 3515.41 | 0.92 *14* | 6.9 | av E$\beta$=2.96×10$^3$ *15* |
| (6.88×10$^3$ *12*) | 3498.33 | 0.97 *13* | 6.9 | av E$\beta$=2.97×10$^3$ *15* |
| (6.93×10$^3$ *12*) | 3445.11 | 1.05 *12* | 6.9 | av E$\beta$=3.00×10$^3$ *15* |
| (6.96×10$^3$ *12*) | 3423.66 | 0.74 *11* | 7.1 | av E$\beta$=3.01×10$^3$ *15* |
| 6.91×10$^3$ *19* | 3423.00 | 4.5 *5* | 6.3 | av E$\beta$=3.01×10$^3$ *15*<br>E(decay): from (571$\gamma$)($\beta$) (1986Ek01). |
| (7.34×10$^3$ *12*) | 3036.95 | 1.59 *18* | 6.8 | av E$\beta$=3.20×10$^3$ *15* |
| (7.40×10$^3$ *12*) | 2978.35 | 2.0 *4* | 6.8 | av E$\beta$=3.22×10$^3$ *15* |
| (7.53×10$^3$ *12*) | 2851.93 | 3.0 *9* | 6.6 | av E$\beta$=3.29×10$^3$ *15* |
| (8.11×10$^3$ *12*) | 2265.77 | 4.5 *7* | 6.6 | av E$\beta$=3.57×10$^3$ *15* |
| (8.41×10$^3$ *12*) | 1972.16 | 5.5 *7* | 6.6 | av E$\beta$=3.71×10$^3$ *15* |
| (8.64×10$^3$ *12*) | 1742.59 | 9.5 *20* | 6.4 | av E$\beta$=3.82×10$^3$ *15* |
| (8.81×10$^3$ *12*) | 1573.56 | 5.3 *6* | 6.7 | av E$\beta$=3.91×10$^3$ *15* |
| (9.72×10$^3$ *12*) | 659.15 | 13 *4* | 6.5 | av E$\beta$=4.35×10$^3$ *15* |
| (1.038×10$^4$[#] *12*) | 0.0 | 18 *9* | 6.5 | av E$\beta$=4.67×10$^3$ *15*<br>log *ft*=6.5 is inconsistent with J($^{80}$Ga g.s.)=3. The apparent feeding to g.s. may be due to incomplete features of the decay scheme. |

[†] All values should Be considered As approximate since there is about 4 MeV gap between the Q($\beta^-$)=10.4 MeV and the last known populated level At 6155. There might Be additional unobserved transitions which could affect direct feedings quoted here. Apparent population of high-spin states of (6$^+$) and (8$^+$) also suggests that either the decay scheme is incomplete or there is another isomer contributing to this decay.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

## $^{80}$Ga $\beta^-$ decay (1.676 s) 1981Ho24 (continued)

### $\gamma(^{80}Ge)$

I$\gamma$ normalization: from I$\gamma$(659$\gamma$)(absolute)/I(delayed neutrons)(absolute)=99 *6* (1981Ho07) and %$\beta^-$n ($^{80}$Ga)=0.86 *7* (1993Ru01,1986Wa17, 1980Lu04). I$\gamma$ normalization=0.960 *2* for zero $\beta^-$ feeding to g.s. and present level scheme.

| $E_\gamma$ † | $I_\gamma$ †@ | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|
| 399.5 *5* | 0.5 *1* | 1972.16 | | 1573.56 | $(2^+)$ |
| 466.76 *4* | 1.36 *5* | 3445.11 | $(8^+)$ | 2978.35 | $(6^+)$ |
| 519.98 *12* | 1.25 *11* | 3498.33 | | 2978.35 | $(6^+)$ |
| 523.18 *4* | 12.9 *4* | 2265.77 | | 1742.59 | $(4^+)$ |
| 571.06 *4* | 5.8 *2* | 3423.00 | | 2851.93 | |
| 586.16 *3* | 6.6 *4* | 2851.93 | | 2265.77 | |
| 659.14 *4* | 100 *3* | 659.15 | $2^+$ | 0.0 | $0^+$ |
| 692.22 *5* | 0.58 *3* | 2265.77 | | 1573.56 | $(2^+)$ |
| 707.63 *14* | 0.30 *3* | 3685.89 | | 2978.35 | $(6^+)$ |
| 771.16 *5* | 0.47 *2* | 3036.95 | | 2265.77 | |
| 808.45 *4* | 0.73 *4* | 4323.84 | | 3515.41 | |
| 834.04 *5* | 5.6 *3* | 3685.89 | | 2851.93 | |
| 914.47 *5* | 5.3 *2* | 1573.56 | $(2^+)$ | 659.15 | $2^+$ |
| 989.51 *4* | 1.13 *5* | 4413.15 | | 3423.66 | |
| 1004.79 *4* | 0.91 *4* | 4992.70 | | 3987.89 | |
| 1040.58 *4* | 1.71 *7* | 5573.20 | | 4532.58 | |
| 1047.5 *10* | 0.3 *1* | 4025.85 | | 2978.35 | $(6^+)$ |
| 1064.80 *6* | 0.89 *5* | 3036.95 | | 1972.16 | |
| 1083.47 *4* | 62 *2* | 1742.59 | $(4^+)$ | 659.15 | $2^+$ |
| 1109.36 *4* | 23.8 *8* | 2851.93 | | 1742.59 | $(4^+)$ |
| 1130.70 *6* | 1.17 *5* | 3982.64 | | 2851.93 | |
| 1135.96 *4* | 4.2 *2* | 3987.89 | | 2851.93 | |
| 1154.85 *9* | 0.77 *5* | 5568.01 | | 4413.15 | |
| 1158.01 *18* | 0.34 *3* | 3423.66 | | 2265.77 | |
| 1235.74 *6* | 6.2 *4* | 2978.35 | $(6^+)$ | 1742.59 | $(4^+)$ |
| 1244.84 *7* | 0.79 *4* | 5232.74 | | 3987.89 | |
| 1249.76 *8* | 0.29 *3* | 3515.41 | | 2265.77 | |
| 1294.37 *8* | 0.69 *5* | 3036.95 | | 1742.59 | $(4^+)$ |
| 1306.89 *6* | 2.26 *10* | 4992.70 | | 3685.89 | |
| 1313.00 *4* | 8.5 *3* | 1972.16 | | 659.15 | $2^+$ |
| 1471.93 *5* | 0.67 *4* | 4323.84 | | 2851.93 | |
| x1547.39 *19* | 0.37 *5* | | | | |
| 1561# | 0.3# | 4413.15 | | 2851.93 | |
| 1573.57 *5* | 4.4 *2* | 1573.56 | $(2^+)$ | 0.0 | $0^+$ |
| 1585.34 *5* | 0.63 *3* | 5573.20 | | 3987.89 | |
| 1680.58 *5* | 5.4 *2* | 4532.58 | | 2851.93 | |
| 1772.67 *14* | 1.63 *12* | 3515.41 | | 1742.59 | $(4^+)$ |
| 1850.10 *5* | 0.67 *4* | 3423.66 | | 1573.56 | $(2^+)$ |
| x1867.46 *10* | 0.31 *2* | | | | |
| 1882 | 0.2 | 5568.01 | | 3685.89 | |
| 1941.54 *9* | 0.59 *3* | 3913.73 | | 1972.16 | |
| 1999.20 *10* | 0.62 *4* | 4851.13 | | 2851.93 | |
| x2008.78 *9* | 0.52 *3* | | | | |
| x2016.53 *21* | 0.28 *2* | | | | |
| 2114.63 *7* | 1.14 *5* | 5800.48 | | 3685.89 | |
| 2140.54 *13* | 0.88 *6* | 4992.70 | | 2851.93 | |
| x2160.53 *21* | 0.48 *5* | | | | |
| 2283.22 *6* | 1.28 *6* | 4025.85 | | 1742.59 | $(4^+)$ |
| 2351.59 *10* | 0.39 *3* | 4323.84 | | 1972.16 | |
| x2396.54 *10* | 0.41 *3* | | | | |
| x2554.95 *12* | 0.24 *2* | | | | |

Continued on next page (footnotes at end of table)

## $^{80}$Ga $\beta^-$ decay (1.676 s) 1981Ho24 (continued)

### $\gamma(^{80}Ge)$ (continued)

| $E_\gamma$ † | $I_\gamma$ †@ | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | $E_\gamma$ † | $I_\gamma$ †@ | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2581.35 *10* | 1.12 *5* | 4323.84 | | 1742.59 | $(4^+)$ | 3664.37‡ *7* | 3.7 *2* | 4323.84 | | 659.15 | $2^+$ |
| 2599.28 *16* | 0.86 *5* | 5451.26 | | 2851.93 | | 3764.47 *18* | 0.48 *4* | 5338.18 | | 1573.56 | $(2^+)$ |
| x2637.94 *50* | 0.21 *4* | | | | | x3818.7 *3* | 0.58 *5* | | | | |
| x2665.18 *15* | 0.57 *5* | | | | | x3919.4 *4* | 0.30 *5* | | | | |
| 2750.35 *11* | 0.64 *4* | 4323.84 | | 1573.56 | $(2^+)$ | x3971.6 *3* | 0.42 *6* | | | | |
| 2764.45 *10* | 1.08 *6* | 3423.66 | | 659.15 | $2^+$ | x4238.6 *2* | 0.53 *4* | | | | |
| 2821.82 *20* | 0.41 *4* | 5800.48 | | 2978.35 | $(6^+)$ | 4412.6 *2* | 0.72 *5* | 6155.32 | | 1742.59 | $(4^+)$ |
| 2948.40 *10* | 0.98 *5* | 5800.48 | | 2851.93 | | x4443.4 *3* | 1.00 *8* | | | | |
| x3044.02 *10* | 0.49 *3* | | | | | 4678.94 *20* | 0.66 *4* | 5338.18 | | 659.15 | $2^+$ |
| x3090.57 *14* | 0.55 *4* | | | | | x4729.9 *3* | 0.42 *4* | | | | |
| 3108.44 *10* | 1.35 *7* | 4851.13 | | 1742.59 | $(4^+)$ | x5354.9 *2* | 0.25 *2* | | | | |
| x3335.6 *4* | 0.35 *6* | | | | | 5387.8 *2* | 1.41 *6* | 6047.14 | | 659.15 | $2^+$ |

† From 1981Ho24. The intensities are from 1980HoZN (a separate report by 1981Ho24).
‡ Poor fit in level scheme. A value of 3664.87 would fit better.
# From 1981Ho24. 1980HoZN give Eγ=1558.9 *4*, Iγ=0.60 *9*.
@ For absolute intensity per 100 decays, multiply by 0.78 *9*.
x γ ray not placed in level scheme.

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### Decay Scheme

Intensities: $I_\gamma$ per 100 parent decays

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- Coincidence

(3) 0 1.676 s *14*

$Q_{\beta^-}$=10.38×10$^3$ *12* %$\beta^-$=100

$^{80}_{31}Ga_{49}$

| Iβ⁻ | Log *ft* | | |
|---|---|---|---|
| 0.56 | 6.2 | 4412.6 0.56 5387.8 1.10 | 6155.32 |
| 1.09 | 6.0 | 2948.40 0.76 2821.82 1.32 2114.63 0.89 | 6047.14 |
| 1.96 | 5.8 | 1585.34 0.49 1040.58 1.33 | 5800.48 |
| 1.81 | 5.9 | 1882 0.156 1154.85 0.60 | 5573.20 |
| 0.75 | 5.9 | 2599.28 0.67 | 5568.01 |
| 0.67 | 6.3 | 4678.94 0.51 3764.47 0.37 | 5451.26 |
| 0.88 | 6.4 | 1244.84 0.62 | 5338.18 |
| 0.61 | 6.6 | 2140.54 0.69 1306.89 1.76 1004.79 0.71 | 5232.74 |
| 3.1 | 5.9 | 3108.44 1.05 1999.20 0.48 | 4992.70 |
| 1.52 | 6.3 | 1680.58 4.2 | 4851.13 |
| 2.9 | 6.1 | 1561 0.23 989.51 0.88 | 4532.58 |
| 0.51 | 6.9 | 3664.37 2.9 2750.35 0.50 2581.35 0.87 2351.59 0.30 1471.93 0.52 808.45 0.57 | 4413.15 |
| 5.6 | 5.9 | | 4323.84 |
| 1.45 | 6.6 | | 3987.89 |
| 1.8 | 6.6 | | 3685.89 |
| 0.92 | 6.9 | | 3515.41 |
| 0.74 | 7.1 | | 3423.66 |
| 2.0 | 6.8 | (6$^+$) | 2978.35 |
| 3.0 | 6.6 | | 2851.93 |
| 5.5 | 6.6 | | 1972.16 |
| 9.5 | 6.4 | (4$^+$) | 1742.59 |
| 5.3 | 6.7 | (2$^+$) | 1573.56 |
| 13 | 6.5 | 2$^+$ | 659.15 |
| | | 0$^+$ | 0.0 |

$^{80}_{32}Ge_{48}$

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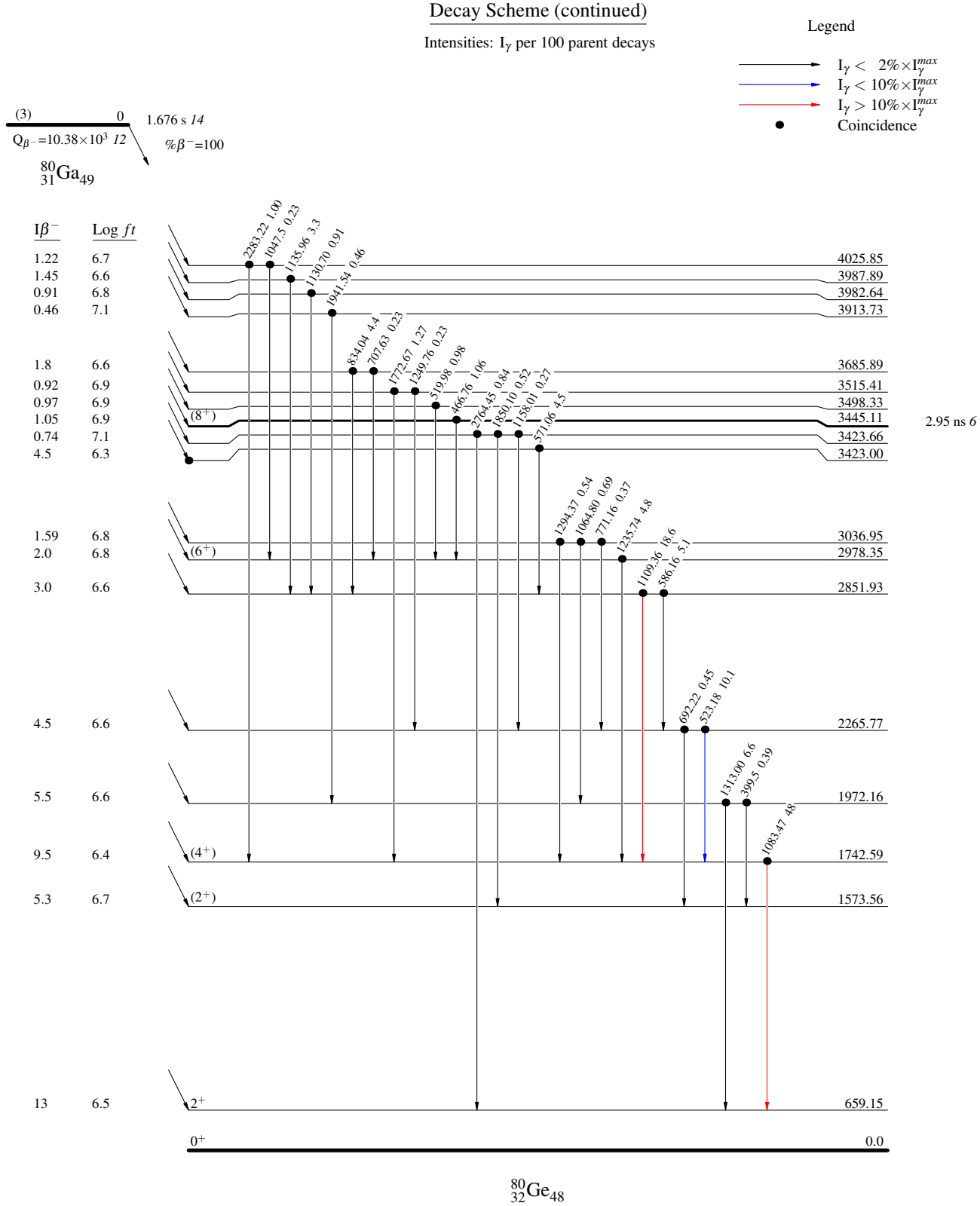
### Decay Scheme (continued)

Intensities: $I_\gamma$ per 100 parent decays



## $^{80}$Ga $\beta^-$ decay (1.676 s) 1981Ho24

### Decay Scheme (continued)

Intensities: $I_\gamma$ per 100 parent decays