## $^{80}$Y $\varepsilon$ decay (30.1 s) 1999Do01,1981Li12,1982De36

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

Parent: $^{80}$Y: E=0.0; $J^\pi=(4^-)$; $T_{1/2}$=30.1 s *5*; Q($\varepsilon$)=9.09×10$^3$ *18*; %$\varepsilon$+%$\beta^+$ decay=100.0

$^{80}$Y-Q($\varepsilon$): from 2003Au03. The $\beta\gamma$ measurement of 2003Ba18 gives≥8929 *83*.

1999Do01 (also 2000Do10): $^{80}$Y source produced by $^{24}$Mg($^{58}$Ni,pn) at 190 MeV and separated by Argonne fragment mass analyzer (FMA). Measured E$\gamma$, I$\gamma$, $\gamma\gamma$, $\beta\gamma$, time-$\gamma$ and $\beta$-gated time-$\gamma$ using three Compton-suppressed HPGe detectors, a low-energy photon (LEPS) spectrometer. Positrons emitted in the decay of $^{80}$Y were detected with thin plastic scintillators placed in front of Ge detectors.

1981Li12: source produced by $^{58}$Ni($^{24}$Mg,pn) E=85 MeV, $^{58}$Ni($^{25}$Mg,p2n) E=95 MeV and $^{58}$Ni($^{28}$Si,pn$\alpha$) E=110 MeV. Measured $T_{1/2}$($^{80}$Y), $\gamma$, $\gamma\gamma$, $\gamma$X, $\beta$, $\beta\gamma$.

1982De36: source produced by $^{54}$Fe($^{32}$S,pn$\alpha$) and mass separation. Measured $\gamma$, $\gamma\gamma$, $\gamma\gamma$(t), $\beta$, $\beta\gamma$, $T_{1/2}$($^{80}$Y).

Others:

2003Ba18: Source produced by $^{58}$Ni($^{28}$Si,np$\alpha$); measured Q value by $\beta\gamma$ coin.

1996Sh27: Source produced by $^{54}$Fe($^{28}$Si,pn) E=88 MeV. Measured Q value by $\beta\gamma$ coin.

1987Li14, 1987Lo10, 1987LeZT: yield of $^{80}$Y in heavy-ion reactions.

All data are from 1999Do01, unless otherwise stated.

### $^{80}$Sr Levels

| E(level)† | $J^\pi$‡ | $T_{1/2}$ | Comments |
|---|---|---|---|
| 0.0 | $0^+$ | | |
| 385.89 *8* | $2^+$ | 30 ps *10* | $T_{1/2}$: from $\gamma\gamma$(t) (1982De36). |
| 980.70 *10* | $4^+$ | | |
| 1142.13 *8* | $(2^+)$ | | Additional information 1. |
| 1571.05 *10* | $(3^+)$ | | Additional information 2. |
| 1653.59 *12* | $(2^+)$ | | Additional information 3. |
| 1763.80 *23* | $6^+$ | | |
| 1832.55 *10* | $(4^+)$ | | |
| 2296.27 *16* | $(5^+)$ | | |
| 2301.15 *13* | $(3,4^+)$ | | $J^\pi$: $(3^-,4^+)$ (1999Do01). |
| 2418.87 *12* | $(3,4^+)$ | | $J^\pi$: $(3^-,4^+)$ (1999Do01). |
| 2492.54? *13* | (0,1,2) | | $J^\pi$: $(1,2)^-$ (1999Do01). E(level): population uncertain in the decay of 30.5-s activity. |
| 2836.5 *3* | (4) | | $J^\pi$: $(5^-)$ (1999Do01). |
| 2958.26 *19* | $(3,4,5^+)$ | | $J^\pi$: $(4^-)$ (1999Do01). |
| 3058.07 *17* | $(3,4,5^+)$ | | $J^\pi$: $(4^-)$ (1999Do01). |
| 3094.6 *4* | | | |
| 3163.0 *3* | | | |
| 3283.96 *19* | $(3^+,4,5)$ | | $J^\pi$: $(4^-)$ (1999Do01). |
| 3311.6 *4* | | | |
| 3377.1 *3* | | | |
| 3697.6 *3* | (3,4,5) | | $J^\pi$: $(4,5)^-$ (1999Do01). |

† From least-squares fit to E$\gamma$'s.

‡ From 'Adopted Levels'. The assignments by 1999Do01, based on rather weak arguments, are different in some cases; these are listed under comments. In other cases the evaluator has added parentheses since strong arguments are lacking.

## $^{80}$Y ε decay (30.1 s) 1999Do01,1981Li12,1982De36 (continued)

### ε,β+ radiations

| E(decay) | E(level) | Iβ+ ‡ | Iε‡ | Log ft† | I(ε+β+)†‡ | Comments |
|---|---|---|---|---|---|---|
| (5.39×10³ *18*) | 3697.6 | 3.6 | 0.08 | 6.0 | 3.7 | av Eβ=2009 *87*; εK=0.0184 *24*; εL=0.0021 *3*; εM+=0.00047 *6* |
| (5.71×10³ *18*) | 3377.1 | 0.9 | 0.02 | 6.8 | 0.9 | av Eβ=2164 *87*; εK=0.0150 *18*; εL=0.00174 *21*; εM+=0.00038 *5* |
| (5.78×10³ *18*) | 3311.6 | 0.6 | 0.01 | 7.0 | 0.6 | av Eβ=2196 *87*; εK=0.0144 *17*; εL=0.00168 *20*; εM+=0.00037 *5* |
| (5.81×10³ *18*) | 3283.96 | 2.6 | 0.04 | 6.4 | 2.6 | av Eβ=2209 *87*; εK=0.0141 *17*; εL=0.00165 *20*; εM+=0.00036 *5*<br>E(end-point)=4543 *548* from β(1451γ) coin (2003Ba18). |
| (5.93×10³ *18*) | 3163.0 | 0.7 | 0.01 | 7.0 | 0.7 | av Eβ=2267 *88*; εK=0.0131 *16*; εL=0.00153 *18*; εM+=0.00033 *4* |
| (6.00×10³ *18*) | 3094.6 | 0.5 | 0.01 | 7.2 | 0.5 | av Eβ=2301 *88*; εK=0.0126 *15*; εL=0.00147 *17*; εM+=0.00032 *4* |
| (6.03×10³ *18*) | 3058.07 | 1.8 | 0.02 | 6.6 | 1.8 | av Eβ=2318 *88*; εK=0.0123 *14*; εL=0.00144 *17*; εM+=0.00031 *4* |
| (6.13×10³ *18*) | 2958.26 | 1.4 | 0.02 | 6.8 | 1.4 | av Eβ=2367 *88*; εK=0.0117 *13*; εL=0.00136 *15*; εM+=0.00030 *4*<br>E(end-point)=4543 *532* from β(1387γ) coin (2003Ba18). |
| (6.25×10³ *18*) | 2836.5 | 1.5 | 0.02 | 6.8 | 1.5 | av Eβ=2426 *88*; εK=0.0109 *12*; εL=0.00127 *14*; εM+=0.00028 *3* |
| (6.67×10³ *18*) | 2418.87 | 4.3 | 0.04 | 6.5 | 4.3 | av Eβ=2628 *88*; εK=0.0087 *9*; εL=0.00101 *10*; εM+=0.000221 *22*<br>E(end-point)=4593 *796* from β(1438γ) coin (2003Ba18). |
| (6.79×10³ *18*) | 2301.15 | 1.7 | 0.02 | 6.9 | 1.7 | av Eβ=2686 *88*; εK=0.0082 *8*; εL=0.00095 *10*; εM+=0.000208 *21* |
| (6.79×10³ *18*) | 2296.27 | 3.1 | 0.03 | 6.7 | 3.1 | av Eβ=2688 *88*; εK=0.0082 *8*; εL=0.00095 *10*; εM+=0.000207 *21* |
| (7.26×10³ *18*) | 1832.55 | 6.8 | 0.05 | 6.5 | 6.9 | av Eβ=2914 *88*; εK=0.0065 *6*; εL=0.00076 *7*; εM+=0.000165 *15*<br>E(end-point)=4560 *323* from β(852γ) coin (2003Ba18).<br>E(end-point)=4593 *879* from β(1447γ) coin (2003Ba18). |
| (7.33×10³# *18*) | 1763.80 | <5.4 | <0.08 | >8.6[1u] | <5.5 | av Eβ=2939 *87*; εK=0.0133 *13*; εL=0.00156 *15*; εM+=0.00034 *4*<br>E(end-point)=4664 *459* from β(783γ) coin (2003Ba18).<br>No evidence of direct feeding from βγ measurement of 2003Ba18. |
| (7.44×10³ *18*) | 1653.59 | 1.7 | 0.03 | 9.1[1u] | 1.7 | av Eβ=2992 *87*; εK=0.0126 *12*; εL=0.00148 *14*; εM+=0.00032 *3* |
| (7.52×10³ *18*) | 1571.05 | 5.2 | 0.03 | 6.7 | 5.2 | av Eβ=3042 *88*; εK=0.0058 *5*; εL=0.00067 *6*; εM+=0.000147 *13*<br>E(end-point)=4643 *120* from β(1185γ) coin (2003Ba18). |
| (7.95×10³ *18*) | 1142.13 | 5.0 | 0.06 | 8.9[1u] | 5.1 | av Eβ=3239 *87*; εK=0.0100 *9*; εL=0.00117 *10*; εM+=0.000254 *22* |
| (8.11×10³# *18*) | 980.70 | <31 | <0.2 | >6.1 | <31 | av Eβ=3331 *89*; εK=0.0045 *4*; εL=0.00052 *4*; εM+=0.000114 *9*<br>E(decay): from (595γ)(4945β), deduced values: 5.97×10³ *18* (1981Li12) and 6.10×10³ *67* (1982De36); but both these values most likely correspond to a β transition from a level above 3 MeV as discussed by 2003Ba18.<br>E(end-point)=4617 *136* from β(595γ) coin (2003Ba18).<br>No evidence of direct feeding from βγ coin measurement of 2003Ba18. |
| (8.70×10³# *18*) | 385.89 | <22 | <0.2 | >8.5[1u] | <22 | av Eβ=3606 *88*; εK=0.0073 *6*; εL=0.00085 *7*; |

Continued on next page (footnotes at end of table)

## $^{80}$Y ε decay (30.1 s) 1999Do01,1981Li12,1982De36 (continued)

### ε,β+ radiations (continued)

| E(decay) | E(level) | Comments |
|---|---|---|
| | | εM+=0.000185 *14* |
| | | E(decay): from (386γ)(5505β), deduced values: 6.53×10$^3$ *26* (1982De36) and 6.58×10$^3$ *31* (1981Li12); but both these values most likely correspond to a β transition from a level above 3 MeV as discussed by 2003Ba18. |

† All feedings should be treated as upper limits and associated log *ft* values as lower limits since there could be many higher levels, unobserved as yet, in the energy gap of about 5.5 MeV between Q value and the highest known level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

### γ($^{80}$Sr)

Iγ normalization: I(γ+ce)(γ's to g.s.)=100.

| $E_\gamma$ † | $I_\gamma$ †# | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult. | α@ | Comments |
|---|---|---|---|---|---|---|---|---|
| 325.7 *2* | 0.8 *2* | 3283.96 | (3$^+$,4,5) | 2958.26 | (3,4,5$^+$) | | | |
| 385.9 *1* | 80 *20* | 385.89 | 2$^+$ | 0.0 | 0$^+$ | [E2] | 0.0084 | $I_\gamma$: total intensity from the decay of g.s. and isomer=100.0 16; some fraction (about 20 units) may belong to the decay of of 4.8-s isomer. From the present decay scheme at least 60 units must be from the decay of the 30.5-s activity. |
| 413.6& *2* | 0.3 *2* | 3697.6 | (3,4,5) | 3283.96 | (3$^+$,4,5) | | | |
| 428.9 *1* | 1.8 *2* | 1571.05 | (3$^+$) | 1142.13 | (2$^+$) | | | |
| 463.4 *3* | 0.3 *1* | 2296.27 | (5$^+$) | 1832.55 | (4$^+$) | | | |
| 534.3& *2* | 0.2 *1* | 3697.6 | (3,4,5) | 3163.0 | | | | |
| 586.4& *3* | 0.3 *2* | 2418.87 | (3,4$^+$) | 1832.55 | (4$^+$) | | | |
| 590.2 *5* | 0.4 *2* | 1571.05 | (3$^+$) | 980.70 | 4$^+$ | | | |
| 594.8 *1* | 41.6 *8* | 980.70 | 4$^+$ | 385.89 | 2$^+$ | [E2] | 0.0022 | $I_\gamma$: ≈ 1 unit of intensity may belong to the decay of 4.8-s isomer. |
| 647.7 *2* | 0.7 *1* | 2301.15 | (3,4$^+$) | 1653.59 | (2$^+$) | | | |
| 673.1 *2* | 0.9 *2* | 1653.59 | (2$^+$) | 980.70 | 4$^+$ | | | |
| 690.3 *2* | 3.1 *2* | 1832.55 | (4$^+$) | 1142.13 | (2$^+$) | | | |
| 725.4 *2* | 1.9 *2* | 2296.27 | (5$^+$) | 1571.05 | (3$^+$) | | | |
| 756.2 *1* | 8.2 *3* | 1142.13 | (2$^+$) | 385.89 | 2$^+$ | | | $I_\gamma$: ≈ 2 unit of intensity may belong to the decay of 4.8-s isomer. |
| 765.3& *2* | 0.8 *1* | 2418.87 | (3,4$^+$) | 1653.59 | (2$^+$) | | | |
| 783.1 *2* | 4.6 *2* | 1763.80 | 6$^+$ | 980.70 | 4$^+$ | | | |
| x801 | | | | | | | | $E_\gamma$: from text in 1999Do01. |
| 847.7 *2* | 1.0 *1* | 2418.87 | (3,4$^+$) | 1571.05 | (3$^+$) | | | |
| 851.8 *1* | 3.9 *3* | 1832.55 | (4$^+$) | 980.70 | 4$^+$ | | | |
| 861.2 *3* | 0.6 *2* | 3697.6 | (3,4,5) | 2836.5 | (4) | | | |
| 987.4& *2* | 0.6 *1* | 3283.96 | (3$^+$,4,5) | 2296.27 | (5$^+$) | | | |
| 1142.1 *1* | 4.3 *2* | 1142.13 | (2$^+$) | 0.0 | 0$^+$ | | | $I_\gamma$: ≈ 1 unit of intensity may belong to the decay of 4.8-s isomer. |
| 1185.2 *1* | 9.7 *3* | 1571.05 | (3$^+$) | 385.89 | 2$^+$ | | | |
| 1225.5 *2* | 0.5 *2* | 3058.07 | (3,4,5$^+$) | 1832.55 | (4$^+$) | | | |
| 1267.6 *2* | 1.7 *2* | 1653.59 | (2$^+$) | 385.89 | 2$^+$ | | | |
| 1276.6 *3* | 1.6 *3* | 2418.87 | (3,4$^+$) | 1142.13 | (2$^+$) | | | $E_\gamma$: 1277.5 *3* (Iγ=3) (1981Li12) placed from a |

Continued on next page (footnotes at end of table)

## $^{80}$Y ε decay (30.1 s) 1999Do01,1981Li12,1982De36 (continued)

### γ($^{80}$Sr) (continued)

| $E_\gamma$ [†] | $I_\gamma$ [†#] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Comments |
|---|---|---|---|---|---|---|
| | | | | | | 1663 level corresponds to 1276.6γ+1278.7γ doublet from 1999Do01. |
| 1278.7 *3* | 1.6 *3* | 3697.6 | (3,4,5) | 2418.87 | (3,4$^+$) | |
| 1315.5 *2* | 1.0 *2* | 2296.27 | (5$^+$) | 980.70 | 4$^+$ | |
| 1320.4 *1* | 1.1 *1* | 2301.15 | (3,4$^+$) | 980.70 | 4$^+$ | |
| 1350.4 *1* | | 2492.54? | (0,1,2) | 1142.13 | (2$^+$) | $I_\gamma$: 1.2 *1* is most likely from the decay of 4.8-s isomer. |
| 1387.2 *2* | 2.0 *1* | 2958.26 | (3,4,5$^+$) | 1571.05 | (3$^+$) | |
| 1396.3[&] *3* | 0.4 *1* | 3697.6 | (3,4,5) | 2301.15 | (3,4$^+$) | $E_\gamma$: this γ corresponds to 1394.6 *3* (Iγ=1) (1981Li12) placed from a 1780 level. |
| 1438.2 *1* | 1.5 *1* | 2418.87 | (3,4$^+$) | 980.70 | 4$^+$ | |
| 1446.7 *1* | 1.4 *2* | 1832.55 | (4$^+$) | 385.89 | 2$^+$ | |
| 1451.4 *2* | 1.1 *1* | 3283.96 | (3$^+$,4,5) | 1832.55 | (4$^+$) | |
| 1487.0 *2* | 1.0 *1* | 3058.07 | (3,4,5$^+$) | 1571.05 | (3$^+$) | |
| 1523.5 *3* | 0.4 *1* | 3094.6 | | 1571.05 | (3$^+$) | |
| 1544.7[&] *3* | 0.4 *2* | 3377.1 | | 1832.55 | (4$^+$) | |
| 1591.9 *3* | 0.8 *1* | 3163.0 | | 1571.05 | (3$^+$) | |
| [x]1630.8[‡] | | | | | | |
| 1653.6 *2* | 0.7 *2* | 1653.59 | (2$^+$) | 0.0 | 0$^+$ | |
| 1658.0 *3* | 0.5 *1* | 3311.6 | | 1653.59 | (2$^+$) | |
| [x]1677.4[‡] | | | | | | |
| 1806.0 *3* | 0.4 *2* | 3377.1 | | 1571.05 | (3$^+$) | |
| [x]1846.7[‡] | | | | | | |
| 1855.8 *3* | 1.9 *1* | 2836.5 | (4) | 980.70 | 4$^+$ | |

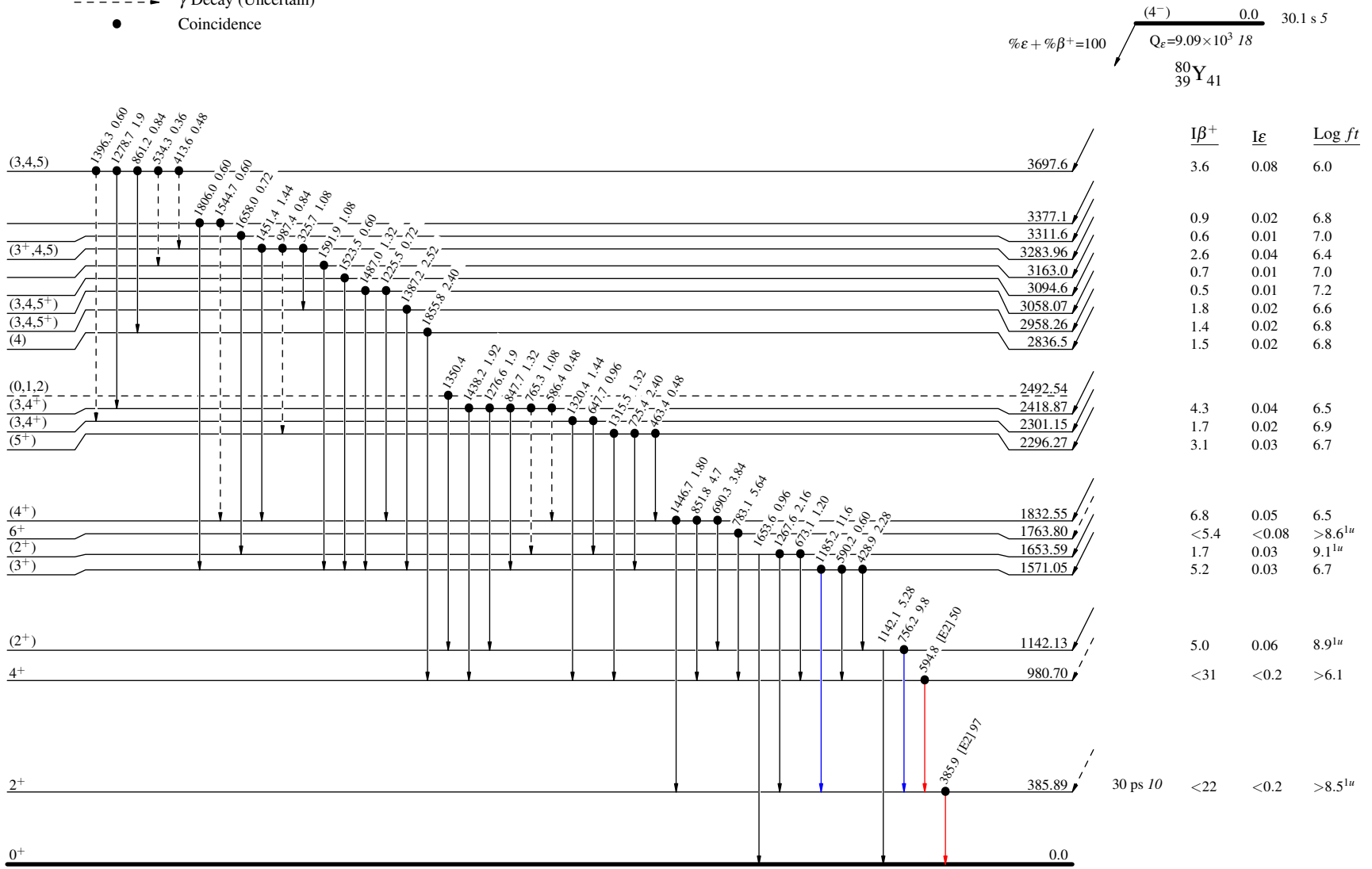
[†] From 1999Do01. Values for 9 gamma rays from 1981Li12 and 7 gamma rays from 1982De36 are in general agreement.
[‡] From text and figure 2 of 1999Do01; intensity is estimated (by the evaluator) as <1 from figure 2 of 1999Do01.
[#] For absolute intensity per 100 decays, multiply by 1.2.
[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[&] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

## $^{80}$Y ε decay (30.1 s)  1999Do01,1981Li12,1982De36

### Decay Scheme

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

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence




$^{80}_{38}Sr_{42}$





$^{80}_{38}Sr_{42}$-5