## Adopted Levels, Gammas

History

| Type | Author | Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Jean Blachot | ENSDF | 1-Jul-2008 |

Q($\beta^-$)=1373 *17*; S(n)=7870 *12*; S(p)=12200 *12*; Q($\alpha$)=−5728 *13* 2012Wa38

Note: Current evaluation has used the following Q record.

Q($\beta^-$): Q($\beta^-$) to 16.8-s $^{108}$Rh= 1320 *100* from $\beta\gamma$-coin 1962Pi02; however, it is not known whether the 16.8-s or the 6-min $^{108}$Rh level is the ground state. From Q($\beta^-$)($^{108}$Rh) for these two activities, E(level)(6-min)=−60 *110* (2003Au03); thus, Q($\beta^-$($^{108}$Ru) could be 170 keV larger than the value given in 2003Au03 if the 6-min state in $^{108}$Rh were the g.s.

Q($\beta^-$)=1.35×10$^3$ *5*; S(n)=7.82×10$^3$ *17*; S(p)=1.186×10$^4$ *19*; Q($\alpha$)=−5.77×10$^3$ *13* 2003Au03

### $^{108}$Ru Levels

For collective-model predictions on E(levels), B(E2), and Q, see 1978Se05, 1980Su01.

Cross Reference (XREF) Flags

A $^{108}$Tc $\beta^-$ decay
B $^{252}$Cf SF decay
C $^{176}$Yb($^{28}$Si,X$\gamma$)

| E(level) | J$^\pi$ † | T$_{1/2}$ | XREF | Comments |
|---|---|---|---|---|
| 0.0‡ | 0$^+$ | 4.55 min *5* | ABC | %$\beta^-$=100<br>T$_{1/2}$: from 1978Fr16 (165$\gamma$ decay curve). Others: 4.5 min *2* (1962Pi02), 4.4 min *2* (1969WiZX), 4.6 min *1* (1976KaYO). |
| 242.23‡ *4* | 2$^+$ | 0.36 ns *3* | ABC | T$_{1/2}$: weighted average of 0.345 ns *30* in SF decay and 0.41 ns *7* in $\beta^-$ decay. Other: 0.41 *7* (1995Sc24) $\beta\gamma$(t). |
| 665.10‡ *7* | 4$^+$ | 13.4 ps *10* | ABC | T$_{1/2}$: from 1986Ma22. Recoil-distance Doppler shift measurements. The value is an average for the 4$^+$ states in $^{108}$Ru and $^{110}$Ru since E$\gamma$(4$^+$ to 2$^+$)=423 in both nuclides, and these transitions were not resolved. Other: <0.08 ns (1995Sc24) $\beta\gamma$(t).<br>J$^\pi$: $\gamma$ to 2$^+$. Probable member of g.s. rotational band. |
| 707.83# *4* | 2$^{(+)}$ | 0.10 ns *7* | ABC | T$_{1/2}$: from 1995Sc24, $\beta\gamma$(t).<br>J$^\pi$: $\gamma'$s to 0$^+$,2$^+$. $\gamma\gamma(\theta)$ gives J=2. Possible $\gamma$-vibrational bandhead. |
| 974.84# *7* | (3$^+$) | | ABC | J$^\pi$: D+Q to 2$^+$. Possible member of $\gamma$-vibrational band. |
| 975.95 *15* | (0$^+$) | | A | J$^\pi$: $\gamma\gamma(\theta)$ in $^{108}$Tc $\beta^-$ decay on the 732.6 and 733.9 doublet consistent only with J(975)=0 if J(974)=3. |
| 1182.97# *11* | (4$^+$) | | ABC | |
| 1218.81 *21* | | | A | |
| 1240.59‡ *17* | 6$^+$ | | BC | |
| 1249.17 *8* | (2$^+$) | 0.41 ns *27* | A | T$_{1/2}$: from 1995Sc24, $\beta\gamma$(t).<br>J$^\pi$: $\gamma\gamma(\theta)$ and $\gamma'$s to 0$^+$ and (4$^+$). |
| 1486.14 *13* | | | A | |
| 1496.14# *15* | (5$^+$) | | BC | |
| 1643.87[a] *8* | (4$^+$) | | AB | |
| 1741.28 *21* | | | A | |
| 1761.90# *16* | (6$^+$) | | BC | |
| 1825.75[a] *7* | (5$^+$) | | AB | J$^\pi$: From $^{252}$Cf SF Decay , not the same level given in $\beta$- decay feeding The 242 Level (2$^+$) by D+Q. |
| 1942.2‡ *3* | 8$^+$ | | BC | |
| 1973.27 *16* | | | A | |
| 2002.57 *9* | | | A | |
| 2110.6& *6* | (5$^-$) | | BC | |

Continued on next page (footnotes at end of table)

## Adopted Levels, Gammas (continued)

### $^{108}$Ru Levels (continued)

| E(level) | J$^{\pi}$[†] | XREF | Comments |
|---|---|---|---|
| 2124.95 *9* | 1,2,3 | A | J$^{\pi}$: $\gamma\gamma(\theta)$ gives 1,2,3. |
| 2132.68[#] *25* | (7$^+$) | BC | |
| 2273.0[@] *6* | (6$^-$) | BC | |
| 2352.26 *17* | | A | |
| 2419.7[#] *3* | (8$^+$) | B | |
| 2472.6[@] *7* | (7$^-$) | BC | |
| 2716.1[@] *8* | (8$^-$) | B | |
| 2730.99 *13* | | A | |
| 2740.5[‡] *3* | 10$^+$ | BC | |
| 2843.9[#] *7* | (9$^+$) | B | |
| 2862.56 *18* | | A | |
| 2925.11 *22* | | A | |
| 2984.7[&] *7* | (9$^-$) | B | |
| 3097.63 *14* | | A | |
| 3149.7[#] *4* | (10$^+$) | B | |
| 3294.2[@] *9* | (10$^-$) | B | |
| 3528.6[‡] *4* | 12$^+$ | BC | |
| 3556.2[&] *10* | (11$^-$) | B | |
| 3569.4[#] *8* | (11$^+$) | B | |
| 3981.7[@] *10* | (12$^-$) | B | |
| 4193.6[&] *11* | (13$^-$) | B | |
| 4290.8[‡] *5* | 14$^+$ | B | |
| 4309.8[#] *9* | (13$^+$) | B | |
| 4774.4[@] *10* | (14$^-$) | B | |
| 4947.3[&] *11* | (15$^-$) | B | |
| 5154.4[‡] *6* | 16$^+$ | B | |

[†] From syst and band assignment, unless otherwise noted.
[‡] Band(A): g.s. band. E(level)(4$^+$)/E(level)(2$^+$)=2.76 ($^{110}$Ru), 2.75 ($^{108}$Ru), 2.64 ($^{106}$Ru), 2.48 ($^{104}$Ru).
[#] Band(B): possible $\gamma$-vibrational band. Ratio of inertial parameters for $\gamma$-vibration/g.s. bands=1.10 ($^{108}$Ru), 1.11 ($^{106}$Ru).
[@] Band(C): $\nu$5/2[402]#$\nu$5/2[532], $\alpha$=0.
[&] Band(c): $\nu$5/2[402]#$\nu$5/2[532], $\alpha$=1.
[a] Band(D): two-phonon $\gamma$-vibrational band.

### $\gamma(^{108}Ru)$

| E$_i$(level) | J$_i^{\pi}$ | E$_{\gamma}$[†] | I$_{\gamma}$[‡] | E$_f$ | J$_f^{\pi}$ | Mult. | $\delta$ | $\alpha$[§] | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 242.23 | 2$^+$ | 242.25 *5* | 100 | 0.0 | 0$^+$ | [E2] | | 0.056 | $\alpha$=0.056<br>B(E2)(W.u.)=62 *6* |
| 665.10 | 4$^+$ | 422.9 *1* | 100 | 242.23 | 2$^+$ | [E2] | | | B(E2)(W.u.)=102 *8* |
| 707.83 | 2$^{(+)}$ | 465.6 *1* | 100 *9* | 242.23 | 2$^+$ | | | | |
| | | 707.81 *5* | 80 *6* | 0.0 | 0$^+$ | [E2] | | | B(E2)(W.u.)=0.5 *4* |
| 974.84 | (3$^+$) | 267.1 *2* | 10.8 *17* | 707.83 | 2$^{(+)}$ | | | | |
| | | 309.7 *2* | 6.3 *8* | 665.10 | 4$^+$ | | | | |
| | | 732.6 *1* | 100 *8* | 242.23 | 2$^+$ | D+Q | −3.0 *+7−14* | | |
| 975.95 | (0$^+$) | 733.9 *2* | 100 | 242.23 | 2$^+$ | | | | |
| 1182.97 | (4$^+$) | 475.4 *2* | 100 *24* | 707.83 | 2$^{(+)}$ | | | | |

Continued on next page (footnotes at end of table)

## Adopted Levels, Gammas (continued)

### γ($^{108}$Ru) (continued)

| $E_i$(level) | $J_i^\pi$ | $E_\gamma$ † | $I_\gamma$ ‡ | $E_f$ | $J_f^\pi$ | Mult. | δ | Comments |
|---|---|---|---|---|---|---|---|---|
| 1182.97 | (4+) | 518.0 *2* | 63 *16* | 665.10 | 4+ | | | |
| | | 940.5 *2* | 23 *10* | 242.23 | 2+ | | | $I_\gamma$: reported only in SF decay. |
| 1218.81 | | 553.7 *2* | 100 | 665.10 | 4+ | | | $E_\gamma$: this transition is not seen in (SF), So the 6+ assigned to the 1218 level in $^{108}$Tc decay is questionable. |
| 1240.59 | 6+ | 575.5 *2* | 100 | 665.10 | 4+ | | | |
| 1249.17 | (2+) | 273.4 *2* | 11 *3* | 975.95 | (0+) | | | |
| | | 541.3 *2* | 14.8 *19* | 707.83 | 2(+) | | | |
| | | 584.0 *1* | 28 *9* | 665.10 | 4+ | [E2] | | B(E2)(W.u.)=0.08 *7* |
| | | 1007.1 *2* | 100 *15* | 242.23 | 2+ | D+Q | 0.9 *+7−5* | |
| | | 1249.0 *5* | 67 *11* | 0.0 | 0+ | [E2] | | B(E2)(W.u.)=0.005 *3* |
| 1486.14 | | 511.0 *2* | 100 *20* | 974.84 | (3+) | | | |
| | | 821.0 *2* | 77 *18* | 665.10 | 4+ | | | |
| 1496.14 | (5+) | 521.1 *2* | 100 | 974.84 | (3+) | | | |
| | | 831.2 *2* | 50 | 665.10 | 4+ | | | |
| 1643.87 | (4+) | 394.6 *2* | 36 *10* | 1249.17 | (2+) | | | |
| | | 669.1 *1* | 100 *13* | 974.84 | (3+) | | | |
| | | 935.9 *2* | 41 *10* | 707.83 | 2(+) | | | |
| | | 1401.6 *2* | 73 *13* | 242.23 | 2+ | | | |
| 1741.28 | | 492.1 *2* | 100 | 1249.17 | (2+) | | | |
| 1761.90 | (6+) | 521.3 *2* | 17 | 1240.59 | 6+ | | | |
| | | 578.8 *2* | 100 | 1182.97 | (4+) | | | |
| | | 1097.1 *3* | 14 | 665.10 | 4+ | | | |
| 1825.75 | (5+) | 181.9 *2* | 9.2 *17* | 1643.87 | (4+) | | | |
| | | 576.6 *1* | 18 *4* | 1249.17 | (2+) | | | |
| | | 851.0 *2* | 33 *3* | 974.84 | (3+) | | | |
| | | 1118.0 *2* | 48 *6* | 707.83 | 2(+) | | | |
| | | 1583.5 *1* | 100 *8* | 242.23 | 2+ | | | Mult.: Could be different transition in β-decay and $^{252}$Cf SF. |
| 1942.2 | 8+ | 701.6 *2* | 100 | 1240.59 | 6+ | | | |
| 1973.27 | | 790.6 *2* | 39 *11* | 1182.97 | (4+) | | | |
| | | 1308.0 *3* | 61 *17* | 665.10 | 4+ | | | |
| | | 1730.5 *3* | 100 *28* | 242.23 | 2+ | | | |
| 2002.57 | | 358.7 *2* | 11 *3* | 1643.87 | (4+) | | | |
| | | 1027.4 *2* | 24 *5* | 974.84 | (3+) | | | |
| | | 1760.4 *1* | 100 *7* | 242.23 | 2+ | | | |
| 2110.6 | (5−) | 870.0 | <1.96 | 1240.59 | 6+ | | | |
| | | 1445.5 | 100 *10* | 665.10 | 4+ | | | |
| 2124.95 | 1,2,3 | 1150.4 *2* | 14 *3* | 974.84 | (3+) | | | |
| | | 1417.0 *1* | 100 *8* | 707.83 | 2(+) | D+Q | | δ: δ=−1.6 to +3.6. |
| | | 1882.8 *2* | 18 *3* | 242.23 | 2+ | D+Q | −0.7 *+6−11* | |
| 2132.68 | (7+) | 636.5 *2* | 100 | 1496.14 | (5+) | | | |
| 2273.0 | (6−) | 162.5 | 100 *11* | 2110.6 | (5−) | | | |
| | | 1032.0 | 63 *7* | 1240.59 | 6+ | | | |
| | | 1608.0 | 30 *7* | 665.10 | 4+ | | | |
| 2352.26 | | 1687.2 *2* | 22 *5* | 665.10 | 4+ | | | |
| | | 2352.1 *3* | 100 *36* | 0.0 | 0+ | | | |
| 2419.7 | (8+) | 657.8 *2* | 100 | 1761.90 | (6+) | | | |
| 2472.6 | (7−) | 199.5 | 100 *12* | 2273.0 | (6−) | | | |
| | | 362.0 | 31 *8* | 2110.6 | (5−) | | | |
| 2716.1 | (8−) | 243.50 | 100 *10* | 2472.6 | (7−) | | | |
| | | 443.0 | 55 *15* | 2273.0 | (6−) | | | |
| 2730.99 | | 1244.5 *2* | 90 *21* | 1486.14 | | | | |
| | | 1756.2 *2* | 46 *11* | 974.84 | (3+) | | | |

Continued on next page (footnotes at end of table)

## Adopted Levels, Gammas (continued)

### γ($^{108}$Ru) (continued)

| $E_i$(level) | $J_i^\pi$ | $E_\gamma$ † | $I_\gamma$ ‡ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|
| 2730.99 | | 2023.4 *2* | 100 *25* | 707.83 | $2^{(+)}$ |
| 2740.5 | $10^+$ | 798.3 *2* | 100 | 1942.2 | $8^+$ |
| 2843.9 | $(9^+)$ | 710.4 | 100 *15* | 2132.68 | $(7^+)$ |
| | | 902.5 | 4 *4* | 1942.2 | $8^+$ |
| 2862.56 | | 1887.7 *2* | 60 *16* | 974.84 | $(3^+)$ |
| | | 2620.3 *3* | 100 *27* | 242.23 | $2^+$ |
| 2925.11 | | 1950.4 *3* | 34 *9* | 974.84 | $(3^+)$ |
| | | 2217.1 *3* | 100 *28* | 707.83 | $2^{(+)}$ |
| 2984.7 | $(9^-)$ | 268.6 | 100 *18* | 2716.1 | $(8^-)$ |
| | | 512.1 | 45 *9* | 2472.6 | $(7^-)$ |
| | | 1042.7 | 55 *9* | 1942.2 | $8^+$ |
| 3097.63 | | 972.6 *2* | 38 *10* | 2124.95 | 1,2,3 |
| | | 1272.1 *2* | 100 *25* | 1825.75 | $(5^+)$ |
| | | 2389.4 *3* | 90 *25* | 707.83 | $2^{(+)}$ |
| 3149.7 | $(10^+)$ | 730.0 *3* | 100 | 2419.7 | $(8^+)$ |
| 3294.2 | $(10^-)$ | 309.5 | 100 *20* | 2984.7 | $(9^-)$ |
| | | 578.1 | 70 *20* | 2716.1 | $(8^-)$ |
| 3528.6 | $12^+$ | 788.1 *3* | 100 | 2740.5 | $10^+$ |
| 3556.2 | $(11^-)$ | 262.0 | 20 *10* | 3294.2 | $(10^-)$ |
| | | 571.5 | 100 *20* | 2984.7 | $(9^-)$ |
| 3569.4 | $(11^+)$ | 725.5 | 67 *22* | 2843.9 | $(9^+)$ |
| | | 828.9 | 100 *22* | 2740.5 | $10^+$ |
| 3981.7 | $(12^-)$ | 687.5 *3* | 100 | 3294.2 | $(10^-)$ |
| 4193.6 | $(13^-)$ | 637.4 *3* | 100 | 3556.2 | $(11^-)$ |
| 4290.8 | $14^+$ | 762.2 *3* | 100 | 3528.6 | $12^+$ |
| 4309.8 | $(13^+)$ | 740.4 *3* | 100 | 3569.4 | $(11^+)$ |
| 4774.4 | $(14^-)$ | 792.7 *3* | 100 | 3981.7 | $(12^-)$ |
| 4947.3 | $(15^-)$ | 753.7 *3* | 100 | 4193.6 | $(13^-)$ |
| 5154.4 | $16^+$ | 863.6 *3* | 100 | 4290.8 | $14^+$ |

† From $^{108}$Tc $\beta^-$ decay when available.

‡ Photon branching ratio from each level. Data with uncertainties are from $^{108}$Tc $\beta^-$ decay. Other data are from SF decay where uncertainties range from 5% to 50%.

§ 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.

## Adopted Levels, Gammas

### Level Scheme

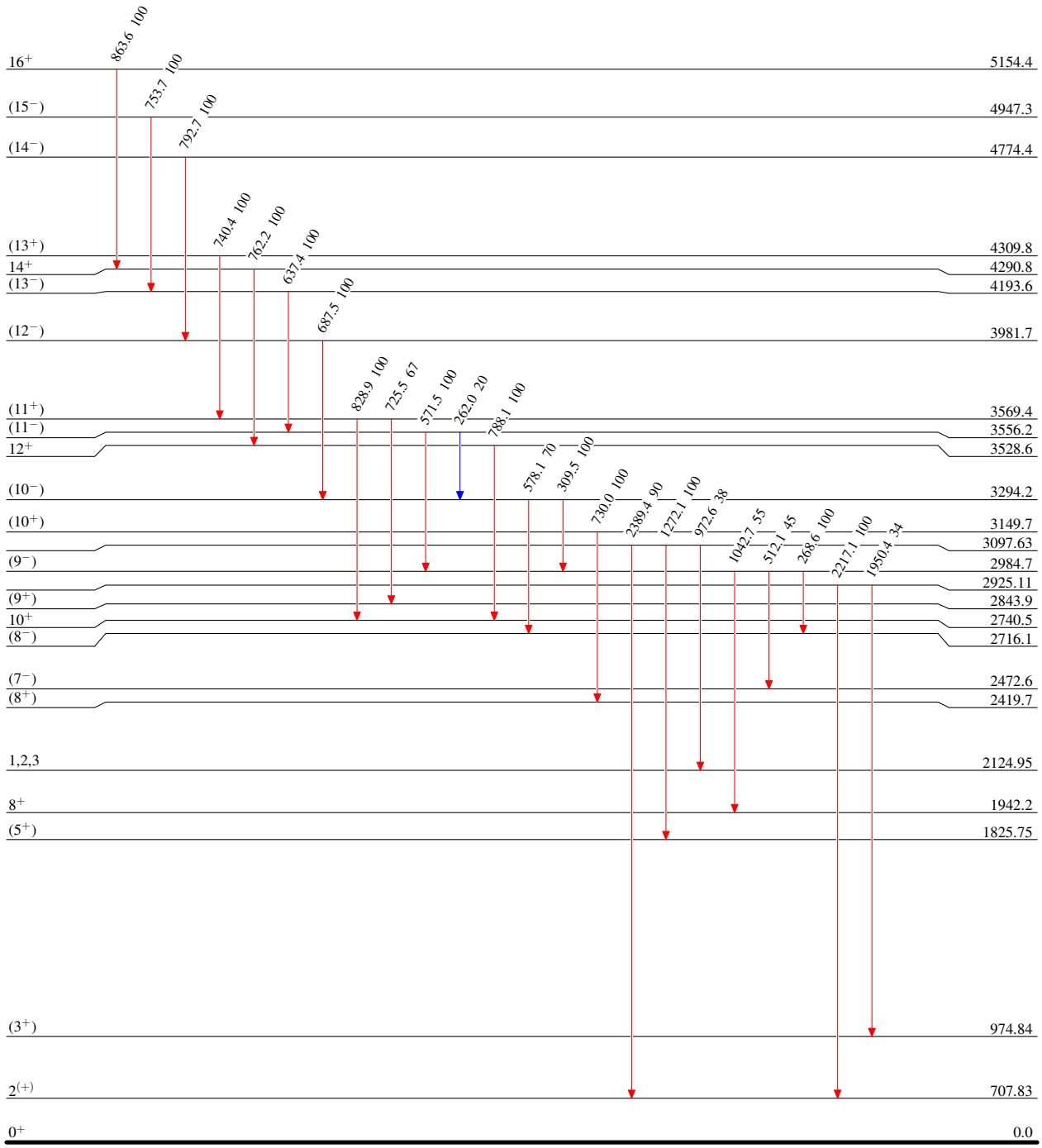
Intensities: Type not specified

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

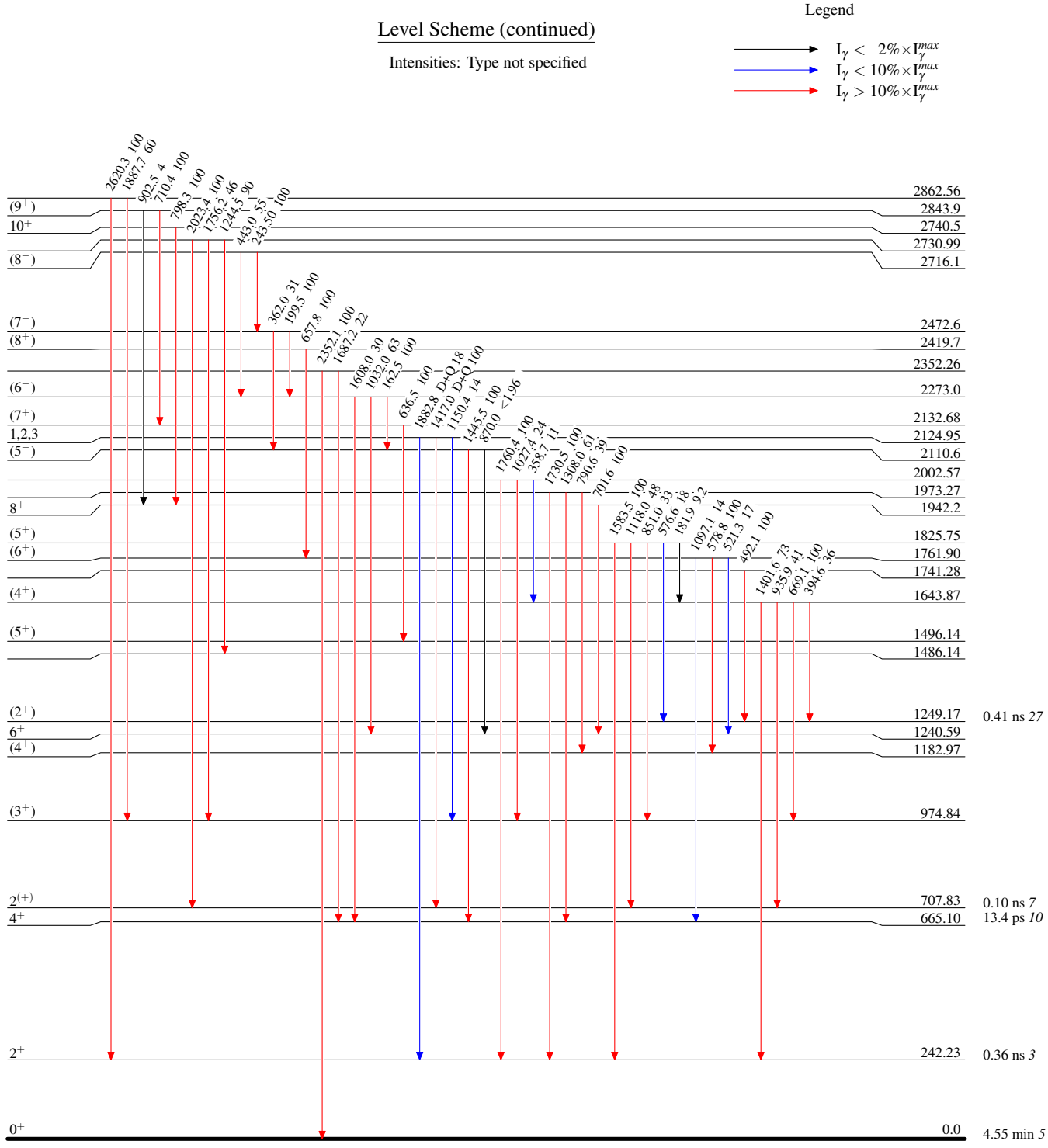



$^{108}_{44}Ru_{64}$

## Adopted Levels, Gammas

### Level Scheme (continued)

Intensities: Type not specified

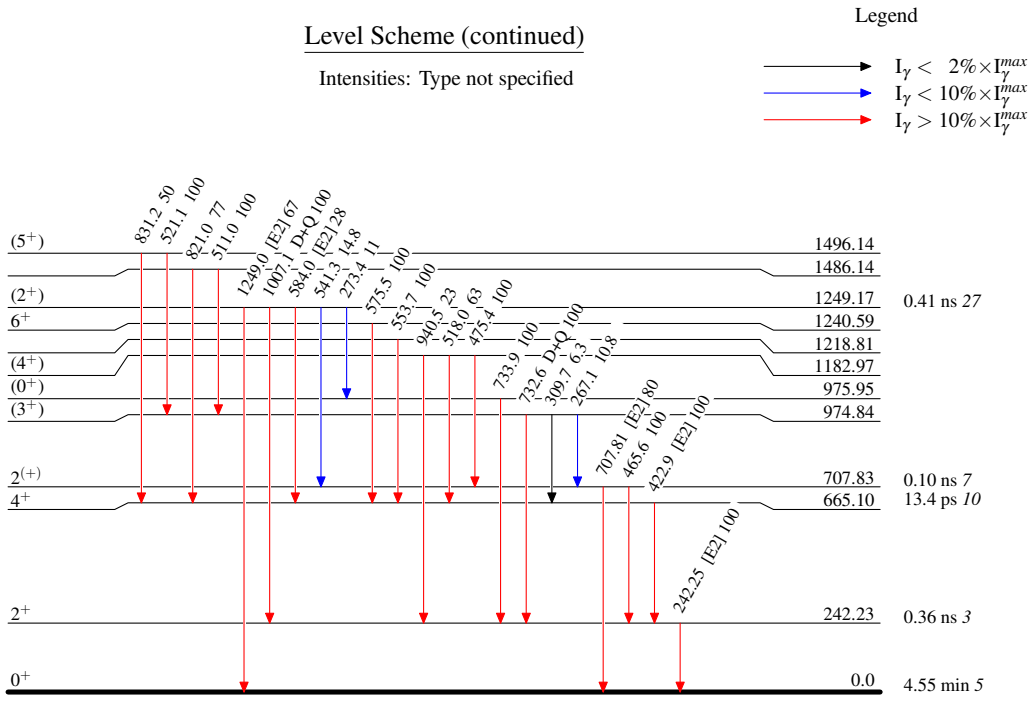



$^{108}_{44}Ru_{64}$

## Adopted Levels, Gammas

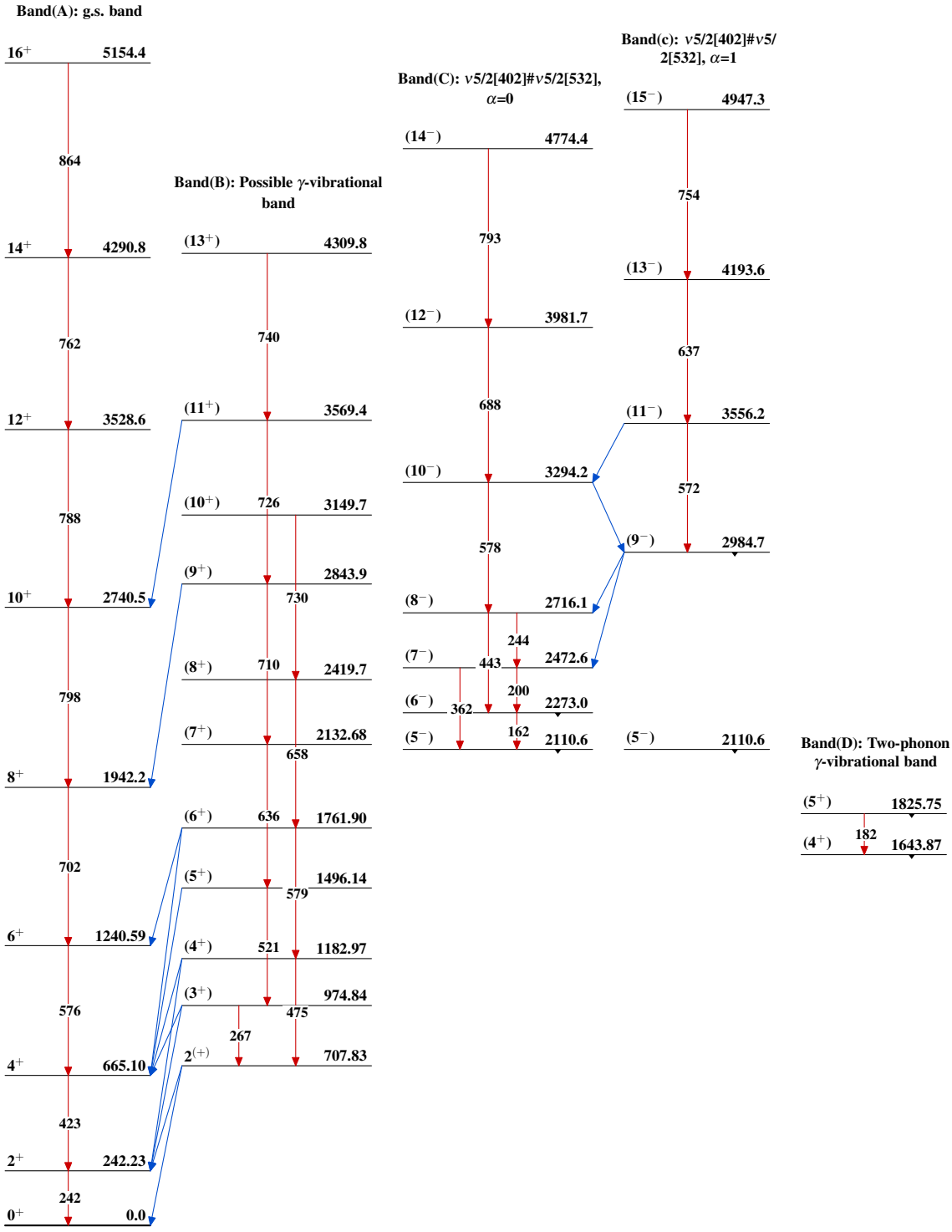
### Level Scheme (continued)

Intensities: Type not specified




$^{108}_{44}Ru_{64}$

## Adopted Levels, Gammas




$^{108}_{44}Ru_{64}$