

$^{96}\text{Ru}(\text{}^3\text{He,pn}\gamma), (\text{d,n}\gamma)$  1983Va24

| Type            | Author  | History Citation    | Literature Cutoff Date |
|-----------------|---------|---------------------|------------------------|
| Full Evaluation | N. Nica | NDS 111, 525 (2010) | 19-Nov-2009            |

$E(\text{}^3\text{He})=20$  MeV,  $E(\text{d})=9$  MeV. Measured  $E_\gamma$ ,  $I_\gamma$ ,  $\gamma\gamma$ ,  $\gamma(\theta)$ ;Ge(Li) detectors with resolution of 2.2 keV.

$^{97}\text{Rh}$  Levels

| E(level) | $J^\pi$ <sup>†</sup>                  | E(level) | $J^\pi$ <sup>†</sup>                                    | E(level) | $J^\pi$ <sup>†</sup>                    | E(level) | $J^\pi$ <sup>†</sup>              |
|----------|---------------------------------------|----------|---|----------|---|----------|-----------------------------------|
| 0.0      | 9/2 <sup>+</sup>                      | 1415.5   | (3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> ) | 1928.2   | (13/2 <sup>-</sup> )                    | 2186.5   | (11/2 <sup>-</sup> ) <sup>‡</sup> |
| 258.8    | 1/2 <sup>-</sup>                      | 1463.6   | (13/2 <sup>+</sup> ,15/2 <sup>+</sup> )                 | 1962.3   | (19/2 <sup>+</sup> )                    | 2225.3   | (15/2 <sup>+</sup> ) <sup>#</sup> |
| 265.3    | 7/2 <sup>+</sup>                      | 1470.6   | (7/2 <sup>-</sup> )                                     | 1984.1   | (13/2 <sup>+</sup> ,15/2 <sup>+</sup> ) | 2271.1   |                                   |
| 475.1    | 5/2 <sup>+</sup>                      | 1528.6   | (3/2 <sup>+</sup> ,5/2 <sup>+</sup> ,7/2 <sup>+</sup> ) | 1994.1   |   | 2295.2   |                                   |
| 850.1    | (5/2 <sup>-</sup> )                   | 1541.7   | (7/2 <sup>+</sup> ,9/2 <sup>+</sup> )                   | 2062.0   |   | 2297.7   |                                   |
| 857.5    | 13/2 <sup>+</sup>                     | 1553.2   | (17/2 <sup>+</sup> )                                    | 2068.0   |   | 2353.6   | (17/2 <sup>-</sup> )              |
| 863.4    | (9/2 <sup>+</sup> )                   | 1619.1   | (5/2 <sup>+</sup> ,7/2 <sup>+</sup> )                   | 2097.5   |   | 2372.7   |                                   |
| 1057.8   | (5/2 <sup>+</sup> )                   | 1635.0   |   | 2103.6   |   | 2903.5   |                                   |
| 1199.1   | (5/2 <sup>+</sup> ,7/2 <sup>+</sup> ) | 1759.0   | (7/2 <sup>+</sup> )                                     | 2113.1   |   |          |                                   |
| 1242.6   | 11/2 <sup>+</sup>                     | 1775.5   | (13/2 <sup>+</sup> ,15/2 <sup>+</sup> )                 | 2126.8   |   |          |                                   |
| 1375.6   | (9/2 <sup>-</sup> )                   | 1906.4   |   | 2147.5   |   |          |                                   |

<sup>†</sup> Assignments proposed by the authors, based on  $\gamma\gamma$ ,  $\gamma(\theta)$   $I_\gamma$  results and can differ from values assigned in the Adopted Levels, Gammas dataset.

<sup>‡</sup> Adopted  $J^\pi=(3/2,5/2,7/2)$ .

<sup>#</sup> Adopted  $J^\pi=(17/2^-)$ .

<sup>96</sup>Ru(<sup>3</sup>He,pn $\gamma$ ), (d,n $\gamma$ ) 1983Va24 (continued)

$\gamma(^{97}\text{Rh})$

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$   | $E_f$  | $J_f^\pi$   | Mult. # | Comments                        |
|--------------|--------------|---------------------|---|--------|---|---------|---------------------------------|
| 209.3 5      | 1.6 2        | 475.1               | 5/2 <sup>+</sup>  | 265.3  | 7/2 <sup>+</sup>  |         |                                 |
| 230.1 & b 5  | 0.5 2        | 1759.0              | (7/2 <sup>+</sup> )                                       | 1528.6 | (3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) |         |                                 |
| 258.8 & 5    | 2.5 2        | 258.8               | 1/2 <sup>-</sup>  | 0.0    | 9/2 <sup>+</sup>  |         |                                 |
| 265.3 5      | 100 5        | 265.3               | 7/2 <sup>+</sup>  | 0.0    | 9/2 <sup>+</sup>  | (M1+E2) | Mult.: $\delta < 0.2$ .         |
| 311.4 5      | <1           | 1775.5              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 1463.6 | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  |         |                                 |
| 354.4 5      | 0.8 2        | 2113.1              |   | 1759.0 | (7/2 <sup>+</sup> )                                       |         |                                 |
| 409.1 & 5    | 11.0 6       | 1962.3              | (19/2 <sup>+</sup> )                                      | 1553.2 | (17/2 <sup>+</sup> )                                      | D(+Q)   |                                 |
| 425.4 @ & 5  | <1           | 2353.6              | (17/2 <sup>-</sup> )                                      | 1928.2 | (13/2 <sup>-</sup> )                                      |         |                                 |
| 475.2 5      | 52 3         | 475.1               | 5/2 <sup>+</sup>  | 0.0    | 9/2 <sup>+</sup>  |         |                                 |
| 519 @ &      |              | 1984.1              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 1463.6 | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  |         |                                 |
| 525.3 5      | 26 1         | 1375.6              | (9/2 <sup>-</sup> )                                       | 850.1  | (5/2 <sup>-</sup> )                                       | (E2)    |                                 |
| 532.6 5      | 1.6 2        | 1775.5              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 1242.6 | 11/2 <sup>+</sup>   |         |                                 |
| 552.8 5      | 10.0 5       | 1928.2              | (13/2 <sup>-</sup> )                                      | 1375.6 | (9/2 <sup>-</sup> )                                       | (E2)    |                                 |
| 571 @ &      | $\approx 1$  | 2113.1              |   | 1541.7 | (7/2 <sup>+</sup> , 9/2 <sup>+</sup> )                    |         |                                 |
| 582.7 5      | 3.0 3        | 1057.8              | (5/2 <sup>+</sup> )                                       | 475.1  | 5/2 <sup>+</sup>  |         |                                 |
| 591.1 5      | 58 3         | 850.1               | (5/2 <sup>-</sup> )                                       | 258.8  | 1/2 <sup>-</sup>  | (E2)    |                                 |
| 597.7 5      | <1.3         | 863.4               | (9/2 <sup>+</sup> )                                       | 265.3  | 7/2 <sup>+</sup>  |         |                                 |
| 599.7 @ 5    | <2.7         | 1463.6              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 863.4  | (9/2 <sup>+</sup> )                                       |         |                                 |
| 605.9 5      | 30 2         | 1463.6              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 857.5  | 13/2 <sup>+</sup>   |         |                                 |
| 620.5 5      | 9.4 5        | 1470.6              | (7/2 <sup>-</sup> )                                       | 850.1  | (5/2 <sup>-</sup> )                                       | D(+Q)   |                                 |
| 640 &        | 2.2 2        | 2103.6              |   | 1463.6 | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  |         |                                 |
| 658.5 5      | 0.5 2        | 2186.5              | (11/2 <sup>-</sup> )                                      | 1528.6 | (3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) |         |                                 |
| 672.0 & 5    | 1.8 2        | 2225.3              | (15/2 <sup>+</sup> )                                      | 1553.2 | (17/2 <sup>+</sup> )                                      |         |                                 |
| 678.5 & 5    | 2.6 3        | 1541.7              | (7/2 <sup>+</sup> , 9/2 <sup>+</sup> )                    | 863.4  | (9/2 <sup>+</sup> )                                       |         |                                 |
| 685.7 @ 5    | 5.0 3        | 1928.2              | (13/2 <sup>-</sup> )                                      | 1242.6 | 11/2 <sup>+</sup>   |         |                                 |
| 695.4 5      | 27.0 14      | 1553.2              | (17/2 <sup>+</sup> )                                      | 857.5  | 13/2 <sup>+</sup>   | (E2)    |                                 |
| 721.9 & 5    | <4.4         | 2097.5              |   | 1375.6 | (9/2 <sup>-</sup> )                                       |         |                                 |
| 741.9 5      | 4.1 4        | 1984.1              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 1242.6 | 11/2 <sup>+</sup>   |         |                                 |
| 761.8 & 5    | 9.0 5        | 2225.3              | (15/2 <sup>+</sup> )                                      | 1463.6 | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | D(+Q)   |                                 |
| 792.7 5      | 13 1         | 1057.8              | (5/2 <sup>+</sup> )                                       | 265.3  | 7/2 <sup>+</sup>  | D(+Q)   |                                 |
| 857.5 5      | 79 4         | 857.5               | 13/2 <sup>+</sup>   | 0.0    | 9/2 <sup>+</sup>  | (E2)    |                                 |
| 863.1 5      | 31 2         | 863.4               | (9/2 <sup>+</sup> )                                       | 0.0    | 9/2 <sup>+</sup>  | D(+Q)   | Mult.: $\Delta J=0$ transition. |
| 895.2 5      | 2.1 2        | 1759.0              | (7/2 <sup>+</sup> )                                       | 863.4  | (9/2 <sup>+</sup> )                                       |         |                                 |
| 904.7 & 5    | 3.1 3        | 2147.5              |   | 1242.6 | 11/2 <sup>+</sup>   |         |                                 |
| 912.6 b 5    | <3.9         | 1775.5              | (13/2 <sup>+</sup> , 15/2 <sup>+</sup> )                  | 863.4  | (9/2 <sup>+</sup> )                                       |         |                                 |
| 922.1 & 5    | 1.1 1        | 2297.7              |   | 1375.6 | (9/2 <sup>-</sup> )                                       |         |                                 |
| 933.7 5      | 7.3 4        | 1199.1              | (5/2 <sup>+</sup> , 7/2 <sup>+</sup> )                    | 265.3  | 7/2 <sup>+</sup>  |         |                                 |
| 940.3 5      | 7.1 4        | 1415.5              | (3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) | 475.1  | 5/2 <sup>+</sup>  |         |                                 |
| 977.5 5      | 3.8 4        | 1242.6              | 11/2 <sup>+</sup>   | 265.3  | 7/2 <sup>+</sup>  |         |                                 |

<sup>96</sup>Ru(<sup>3</sup>He,pn $\gamma$ ), (d,n $\gamma$ ) 1983Va24 (continued) $\gamma(^{97}\text{Rh})$  (continued)

| $E_\gamma$ † | $I_\gamma$ ‡      | $E_i(\text{level})$ | $J_i^\pi$      | $E_f$  | $J_f^\pi$   | Mult. # | $\delta$                               |                       |
|--------------|-------------------|---------------------|----------------|--------|---|---------|--|-----------------------|
| 1053.6       | 5                 | <7                  |                | 1528.6 | (3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 1055.4       | 5                 | <2                  |                | 2113.1 |   | 1057.8  | (5/2 <sup>+</sup> )                    |                       |
| 1058.5       | 5                 | 2.4                 | 2              | 1057.8 | (5/2 <sup>+</sup> )                                       | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 1070.4       | 5                 | 4.1                 | 4              | 1928.2 | (13/2 <sup>-</sup> )                                      | 857.5   | 13/2 <sup>+</sup>                      |                       |
| 1109.9       | 5                 | 3.3                 | 3              | 1375.6 | (9/2 <sup>-</sup> )                                       | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1150.3       | & 5               | 2.1                 | 2              | 1415.5 | (3/2 <sup>+</sup> , 5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1159.9       | 5                 | 2.0                 | 2              | 1635.0 |   | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 1199.2       | 5                 | 4.5                 | 5              | 1199.1 | (5/2 <sup>+</sup> , 7/2 <sup>+</sup> )                    | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 1237.8       | 5                 | 2.9                 | 3              | 2295.2 |   | 1057.8  | (5/2 <sup>+</sup> )                    |                       |
| 1242.7       | 5                 | 23                  | 1              | 1242.6 | 11/2 <sup>+</sup>   | 0.0     | 9/2 <sup>+</sup>                       | (M1+E2) $\approx 0.3$ |
| 1276.5       | <sup>a</sup> 5    | 1.7                 | <sup>a</sup> 2 | 1541.7 | (7/2 <sup>+</sup> , 9/2 <sup>+</sup> )                    | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1276.5       | <sup>a</sup> 5    | 1.7                 | <sup>a</sup> 2 | 2126.8 |   | 850.1   | (5/2 <sup>-</sup> )                    |                       |
| 1285.0       | & 5               | 1.1                 | 1              | 2903.5 |   | 1619.1  | (5/2 <sup>+</sup> , 7/2 <sup>+</sup> ) |                       |
| 1328.4       | & 5               | 1.9                 | 2              | 2186.5 | (11/2 <sup>-</sup> )                                      | 857.5   | 13/2 <sup>+</sup>                      |                       |
| 1354.1       | 5                 | 5.1                 | 3              | 1619.1 | (5/2 <sup>+</sup> , 7/2 <sup>+</sup> )                    | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1376.4       | 5                 | 2.8                 | 3              | 1375.6 | (9/2 <sup>-</sup> )                                       | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 1421.0       | 5                 | 0.9                 | 2              | 2271.1 |   | 850.1   | (5/2 <sup>-</sup> )                    |                       |
| 1494.2       | 5                 | 3.9                 | 4              | 1759.0 | (7/2 <sup>+</sup> )                                       | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1515.1       | & <sup>b</sup> 5  | 3.7                 | 4              | 2372.7 |   | 857.5   | 13/2 <sup>+</sup>                      |                       |
| 1519.8       | & 5               | 1.1                 | 1              | 1994.1 |   | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 1541.4       | 5                 | 0.4                 | 2              | 1541.7 | (7/2 <sup>+</sup> , 9/2 <sup>+</sup> )                    | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 1592.9       | 5                 | 1.8                 | 2              | 2068.0 |   | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 1638.7       | 5                 | <3.1                |                | 2113.1 |   | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 1641.1       | 5                 | <3.1                |                | 1906.4 |   | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1759.5       | 5                 | <4.5                |                | 1759.0 | (7/2 <sup>+</sup> )                                       | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 1796.7       | @& <sup>b</sup> 5 |                     |                | 2062.0 |   | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1846.8       | & 5               | 0.7                 | 2              | 2113.1 |   | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 1993.3       | 5                 | <1                  |                | 1994.1 |   | 0.0     | 9/2 <sup>+</sup>                       |                       |
| 2029.5       | & 5               | 3.1                 | 3              | 2295.2 |   | 265.3   | 7/2 <sup>+</sup>                       |                       |
| 2428.4       | 5                 | 1.0                 | 1              | 2903.5 |   | 475.1   | 5/2 <sup>+</sup>                       |                       |
| 2903.3       | & 5               | 0.4                 | 2              | 2903.5 |   | 0.0     | 9/2 <sup>+</sup>                       |                       |

† Gammas observed in both (<sup>3</sup>He,pn $\gamma$ ) and (d,n $\gamma$ ) reaction, unless otherwise indicated. Since <sup>97</sup>Pd cannot be formed in <sup>96</sup>Ru+d reaction, the gammas observed in that reaction cannot be the result of <sup>97</sup>Pd decay.

‡ From (<sup>3</sup>He,pn) reaction.

# Based on  $\gamma(\theta)$ ,  $\Delta J=2$ , Q and  $\Delta J=1$ , D+Q transitions are assumed to be  $\Delta J=2$ , (E2) and  $\Delta J=1$ , (M1+E2), respectively.

@ Observed in coincidences only.

$^{96}\text{Ru}({}^3\text{He,pn}\gamma), (\text{d,n}\gamma)$  1983Va24 (continued)

$\gamma({}^{97}\text{Rh})$  (continued)

& Seen only in  $^{96}\text{Ru}({}^3\text{He,pn}\gamma)$  reaction.

<sup>a</sup> Multiply placed with undivided intensity.

<sup>b</sup> Placement of transition in the level scheme is uncertain.

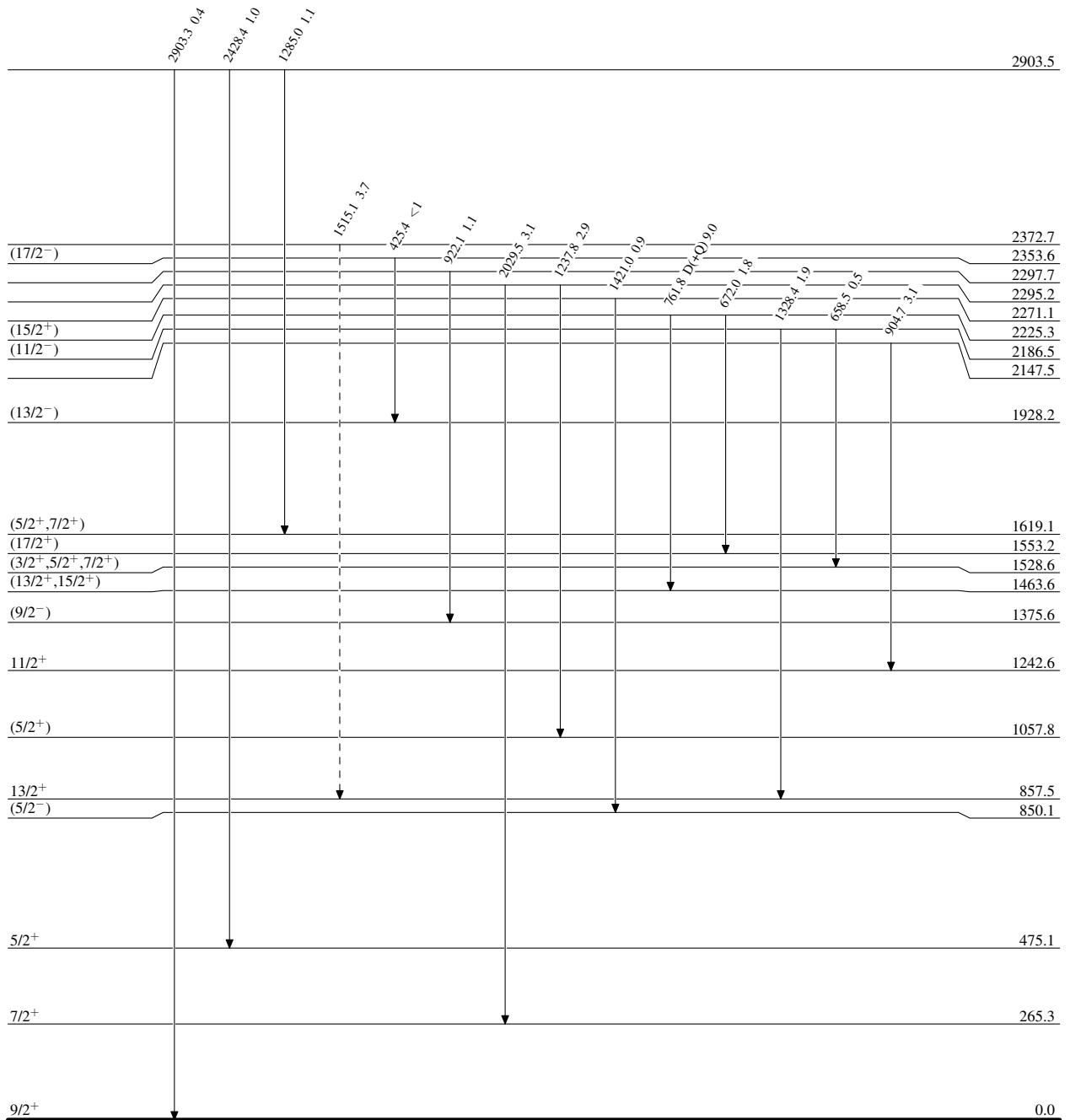
$^{96}\text{Ru}(\text{}^3\text{He,pn}\gamma), (\text{d,n}\gamma)$  1983Va24

Legend

Level Scheme

Intensities: Relative  $I_\gamma$

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - →  $\gamma$  Decay (Uncertain)



$^{97}_{45}\text{Rh}_{52}$

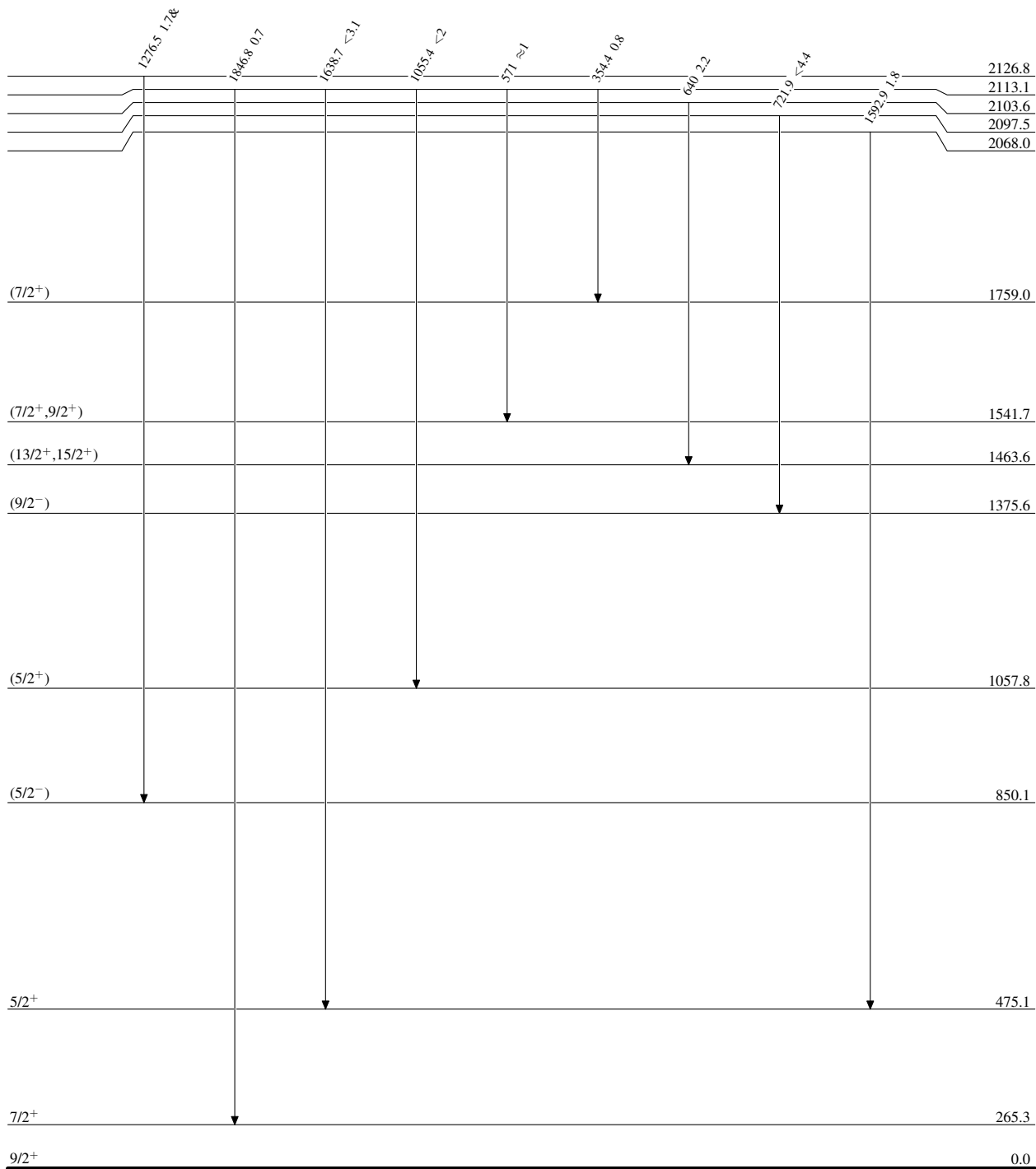
<sup>96</sup>Ru(<sup>3</sup>He,pn $\gamma$ ), (d,n $\gamma$ ) 1983Va24

Level Scheme (continued)

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

- I $\gamma$  < 2% × I $\gamma^{max}$
- I $\gamma$  < 10% × I $\gamma^{max}$
- I $\gamma$  > 10% × I $\gamma^{max}$



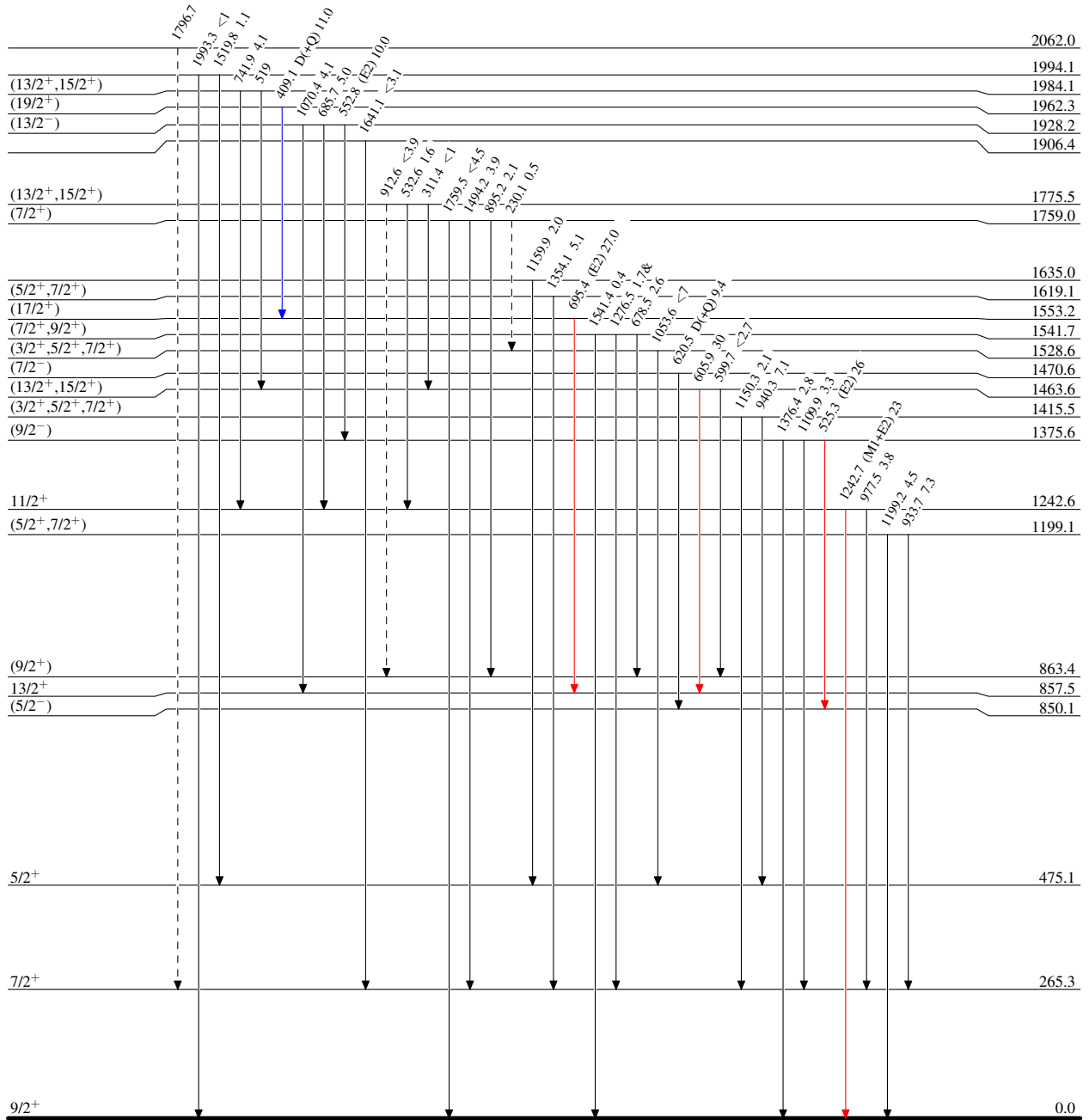
<sup>96</sup>Ru(<sup>3</sup>He,pn $\gamma$ ), (d,n $\gamma$ ) 1983Va24

Level Scheme (continued)

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

- I $\gamma$  < 2%  $\times$  I $\gamma^{max}$
- I $\gamma$  < 10%  $\times$  I $\gamma^{max}$
- I $\gamma$  > 10%  $\times$  I $\gamma^{max}$
- - - - -  $\gamma$  Decay (Uncertain)



<sup>97</sup>Rh<sub>52</sub>

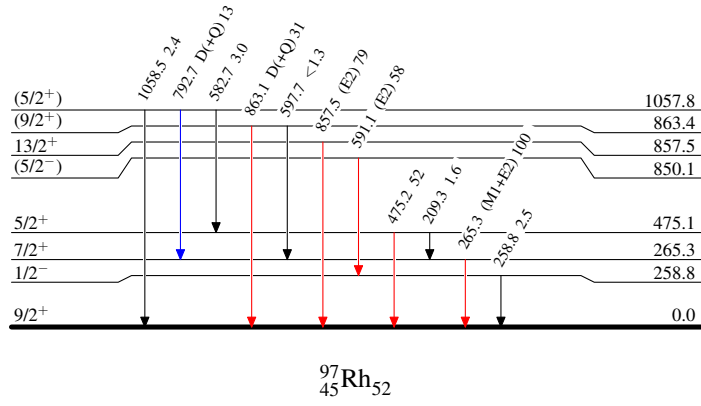
<sup>96</sup>Ru(<sup>3</sup>He,pn $\gamma$ ), (d,n $\gamma$ ) 1983Va24

Level Scheme (continued)

Intensities: Relative I $\gamma$   
& Multiply placed: undivided intensity given

Legend

- $\rightarrow$  I $\gamma$  < 2%  $\times$  I $\gamma^{max}$
- $\rightarrow$  I $\gamma$  < 10%  $\times$  I $\gamma^{max}$
- $\rightarrow$  I $\gamma$  > 10%  $\times$  I $\gamma^{max}$



<sup>97</sup>Rh<sub>52</sub>