

$^{150}\text{Nd}(^{19}\text{F}, 5n\gamma)$  1999Re05

| Type            | Author                                 | History | Citation          | Literature Cutoff Date |
|-----------------|----------------------------------------|---------|-------------------|------------------------|
| Full Evaluation | Balraj Singh and Jun Chen <sup>#</sup> |         | NDS 147, 1 (2018) | 30-Nov-2017            |

1999Re05 (also 1997Ba45): E( $^{19}\text{F}$ )=85 MeV. Measured  $E\gamma$ ,  $I\gamma$ ,  $\gamma\gamma$ -coin within a time window of 130 ns,  $\gamma\gamma(\theta)$ (DCO) using an array of 18 HPGe detectors. 1997Ba45 reported data for two bands:  $\pi 1/2[541]\nu 5/2[642]$  and  $\pi 2[411]\nu 5/2[642]$ . Deduced B(M1)/B(E2) ratios.

 $^{164}\text{Tm}$  Levels

| E(level) <sup>†</sup>                 | $J^\pi$           | $T_{1/2}$ <sup>‡</sup> | Comments                                                                                                                                                                                                                                                                                                         |
|---------------------------------------|-------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0                                   | 1 <sup>+</sup>    |                        | Configuration= $\pi 7/2[523]\otimes \nu 5/2[523]$ , $K^\pi=1^+$ .                                                                                                                                                                                                                                                |
| 0.0+x <sup>&amp;</sup>                | 6 <sup>-</sup>    | 5.1 min <i>I</i>       | Additional information 1.                                                                                                                                                                                                                                                                                        |
| 0.0+y <sup>p</sup>                    | (2 <sup>+</sup> ) |                        | E(level): x≈31 keV (1987Dr07).<br>Additional information 2.                                                                                                                                                                                                                                                      |
|                                       |                   |                        | E(level): from the level-scheme Fig. 2, energy is close to 38 keV. This level may be the same as 37.5 keV, (2) <sup>+</sup> in Adopted Levels, and 38 keV here, but 1999Re05 show it as a different level from the well-established 37.5-keV, (2) <sup>+</sup> level from $^{164}\text{Yb}$ $\varepsilon$ decay. |
| 37.573 <sup>13</sup>                  | 2 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 84.0+y <sup>p</sup> <sup>10</sup>     | (3 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 107.9 <sup>c</sup> <sup>17</sup>      | 3 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 110.1 <sup>b</sup> <sup>7</sup>       | 2 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 124.3+x <sup>#</sup> <sup>5</sup>     | 6 <sup>-</sup>    | 36 ns <i>5</i>         |                                                                                                                                                                                                                                                                                                                  |
| 140.7+x <sup>f</sup> <sup>6</sup>     | 6 <sup>+</sup>    | 5 ns <i>I</i>          |                                                                                                                                                                                                                                                                                                                  |
| 157.8+x <sup>a</sup> <sup>4</sup>     | 7 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 158.1 <sup>b</sup> <sup>13</sup>      | 4 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 168.3+x <sup>l</sup> <sup>9</sup>     | (6 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 172.9 <sup>c</sup> <sup>14</sup>      | 5 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 182.3+x <sup>@</sup> <sup>4</sup>     | 7 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 185.0+x <sup>g</sup> <sup>6</sup>     | 7 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 188.8+y <sup>p</sup> <sup>11</sup>    | (4 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 253.4 <sup>b</sup> <sup>14</sup>      | 6 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 257.4+x <sup>#</sup> <sup>4</sup>     | 8 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 264.1+x <sup>f</sup> <sup>6</sup>     | 8 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 270.7+y <sup>k</sup> <sup>11</sup>    | (5 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 301.5 <sup>c</sup> <sup>14</sup>      | 7 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 302.6+x <sup>m</sup> <sup>8</sup>     | (7 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 310.1+y <sup>p</sup> <sup>11</sup>    | (5 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 338.4+x <sup>&amp;</sup> <sup>4</sup> | 8 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 353.4+x <sup>@</sup> <sup>4</sup>     | 9 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 354.6+y <sup>j</sup> <sup>11</sup>    | (6 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 376.3+x <sup>g</sup> <sup>6</sup>     | 9 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 381.2 <sup>d</sup> <sup>14</sup>      | 6 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 410.2 <sup>b</sup> <sup>14</sup>      | 8 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 443.3+x <sup>l</sup> <sup>9</sup>     | (8 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 461.7+y <sup>k</sup> <sup>11</sup>    | (7 <sup>+</sup> ) |                        |                                                                                                                                                                                                                                                                                                                  |
| 463.1 <sup>e</sup> <sup>15</sup>      | 7 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 470.1+x <sup>#</sup> <sup>4</sup>     | 10 <sup>-</sup>   |                        |                                                                                                                                                                                                                                                                                                                  |
| 517.2+x <sup>f</sup> <sup>6</sup>     | 10 <sup>+</sup>   |                        |                                                                                                                                                                                                                                                                                                                  |
| 520.2 <sup>c</sup> <sup>14</sup>      | 9 <sup>+</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |
| 535.6+x <sup>a</sup> <sup>5</sup>     | 9 <sup>-</sup>    |                        |                                                                                                                                                                                                                                                                                                                  |

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$^{150}\text{Nd}(^{19}\text{F},\text{Sn}\gamma)$  **1999Re05 (continued)** $^{164}\text{Tm}$  Levels (continued)

| E(level) <sup>†</sup>       | J <sup>π</sup>     | E(level) <sup>†</sup>       | J <sup>π</sup>     | E(level) <sup>†</sup>        | J <sup>π</sup>     | E(level) <sup>†</sup>        | J <sup>π</sup>  |
|-----------------------------|--------------------|-----------------------------|--------------------|------------------------------|--------------------|------------------------------|-----------------|
| 542.3 <sup>h</sup> 14       | 8 <sup>-</sup>     | 1231.7 <sup>c</sup> 14      | 13 <sup>+</sup>    | 2287.9 <sup>c</sup> 15       | 17 <sup>+</sup>    | 3495.0+x <sup>g</sup> 9      | 21 <sup>+</sup> |
| 547.7 <sup>d</sup> 14       | 8 <sup>-</sup>     | 1301.2+y <sup>j</sup> 14    | (12 <sup>+</sup> ) | 2307.6 <sup>e</sup> 15       | 17 <sup>-</sup>    | 3519.4+x <sup>#</sup> 7      | 22 <sup>-</sup> |
| 587.9+y <sup>j</sup> 12     | (8 <sup>+</sup> )  | 1319.6 <sup>i</sup> 14      | 13 <sup>-</sup>    | 2316.0+y <sup>j</sup> 15     | (16 <sup>+</sup> ) | 3541.1+x <sup>a</sup> 12     | 21 <sup>-</sup> |
| 602.5+x <sup>m</sup> 9      | (9 <sup>+</sup> )  | 1325.5+x <sup>f</sup> 7     | 14 <sup>+</sup>    | 2352.5+x <sup>o</sup> 6      | 17 <sup>+</sup>    | 3548.4 <sup>e</sup> 16       | 21 <sup>-</sup> |
| 607.8+x <sup>@</sup> 5      | 11 <sup>-</sup>    | 1343.7 <sup>e</sup> 14      | 13 <sup>-</sup>    | 2369.3 <sup>i</sup> 15       | 17 <sup>-</sup>    | 3634.7 <sup>i</sup> 16       | 21 <sup>-</sup> |
| 656.9 <sup>b</sup> 14       | 10 <sup>+</sup>    | 1389.5+x <sup>@</sup> 5     | 15 <sup>-</sup>    | 2447.8+x <sup>a</sup> 9      | 17 <sup>-</sup>    | 3649.8 <sup>c</sup> 16       | 21 <sup>+</sup> |
| 657.3 <sup>i</sup> 14       | 9 <sup>-</sup>     | 1409.2+x <sup>m</sup> 11    | (13 <sup>+</sup> ) | 2459.6+x <sup>f</sup> 8      | 18 <sup>+</sup>    | 3674.2+x <sup>n</sup> 7      | 22 <sup>+</sup> |
| 684.7+x <sup>g</sup> 7      | 11 <sup>+</sup>    | 1438.3 <sup>b</sup> 14      | 14 <sup>+</sup>    | 2520.5+x <sup>@</sup> 6      | 19 <sup>-</sup>    | 3854.6+x <sup>f</sup> 10     | 22 <sup>+</sup> |
| 685.2 <sup>e</sup> 14       | 9 <sup>-</sup>     | 1455.2+x <sup>a</sup> 7     | 13 <sup>-</sup>    | 2566.9 <sup>b</sup> 15       | 18 <sup>+</sup>    | 3855.4+x <sup>&amp;</sup> 12 | 22 <sup>-</sup> |
| 736.9+y <sup>k</sup> 12     | (9 <sup>+</sup> )  | 1511.9 <sup>d</sup> 14      | 14 <sup>-</sup>    | 2580.9 <sup>d</sup> 15       | 18 <sup>-</sup>    | 3939.2+x <sup>@</sup> 7      | 23 <sup>-</sup> |
| 747.9+x <sup>&amp;</sup> 5  | 10 <sup>-</sup>    | 1525.0+y <sup>k</sup> 14    | (13 <sup>+</sup> ) | 2601.7+x <sup>n</sup> 6      | 18 <sup>+</sup>    | 3943.1 <sup>d</sup> 16       | 22 <sup>-</sup> |
| 769.9+x <sup>#</sup> 5      | 12 <sup>-</sup>    | 1541.0 <sup>h</sup> 14      | 14 <sup>-</sup>    | 2610.3+y <sup>k</sup> 16     | (17 <sup>+</sup> ) | 3945.2 <sup>b</sup> 16       | 22 <sup>+</sup> |
| 773.5+x <sup>l</sup> 9      | (10 <sup>+</sup> ) | 1583.3+x <sup>g</sup> 7     | 15 <sup>+</sup>    | 2682.4 <sup>h</sup> 15       | 18 <sup>-</sup>    | 3972.8+x <sup>o</sup> 8      | 23 <sup>+</sup> |
| 776.6 <sup>h</sup> 14       | 10 <sup>-</sup>    | 1636.4+x <sup>#</sup> 6     | 16 <sup>-</sup>    | 2704.9+x <sup>&amp;</sup> 10 | 18 <sup>-</sup>    | 4085.2 <sup>h</sup> 17       | 22 <sup>-</sup> |
| 785.7 <sup>d</sup> 14       | 10 <sup>-</sup>    | 1642.9+x <sup>l</sup> 11    | (14 <sup>+</sup> ) | 2793.1+x <sup>g</sup> 8      | 19 <sup>+</sup>    | 4176.6+x <sup>a</sup> 13     | 23 <sup>-</sup> |
| 830.3 <sup>c</sup> 14       | 11 <sup>+</sup>    | 1702.6+x <sup>&amp;</sup> 7 | 14 <sup>-</sup>    | 2823.8+x <sup>#</sup> 6      | 20 <sup>-</sup>    | 4249.7+x <sup>g</sup> 11     | 23 <sup>+</sup> |
| 875.5+x <sup>f</sup> 7      | 12 <sup>+</sup>    | 1720.1 <sup>c</sup> 14      | 15 <sup>+</sup>    | 2856.2+x <sup>o</sup> 6      | 19 <sup>+</sup>    | 4262.0 <sup>e</sup> 17       | 23 <sup>-</sup> |
| 903.0+y <sup>j</sup> 13     | (10 <sup>+</sup> ) | 1774.5+y <sup>j</sup> 15    | (14 <sup>+</sup> ) | 2895.9 <sup>e</sup> 16       | 19 <sup>-</sup>    | 4272.5+x <sup>#</sup> 8      | 24 <sup>-</sup> |
| 937.1 <sup>i</sup> 14       | 11 <sup>-</sup>    | 1787.8 <sup>e</sup> 14      | 15 <sup>-</sup>    | 2911.4+y <sup>j</sup> 16     | (18 <sup>+</sup> ) | 4290.7+x <sup>n</sup> 8      | 24 <sup>+</sup> |
| 952.7+x <sup>@</sup> 5      | 13 <sup>-</sup>    | 1802.2 <sup>i</sup> 15      | 15 <sup>-</sup>    | 2926.8 <sup>c</sup> 15       | 19 <sup>+</sup>    | 4377.2 <sup>c</sup> 16       | 23 <sup>+</sup> |
| 964.0+x <sup>m</sup> 9      | (11 <sup>+</sup> ) | 1856.1+x <sup>f</sup> 7     | 16 <sup>+</sup>    | 2970.1+x <sup>a</sup> 11     | 19 <sup>-</sup>    | 4525.4+x <sup>&amp;</sup> 13 | 24 <sup>-</sup> |
| 974.4+x <sup>a</sup> 6      | 11 <sup>-</sup>    | 1914.4+x <sup>@</sup> 6     | 17 <sup>-</sup>    | 3002.5 <sup>i</sup> 15       | 19 <sup>-</sup>    | 4598.7 <sup>b</sup> 17       | 24 <sup>+</sup> |
| 975.2 <sup>e</sup> 14       | 11 <sup>-</sup>    | 1951.4+x <sup>a</sup> 8     | 15 <sup>-</sup>    | 3115.8+x <sup>n</sup> 6      | 20 <sup>+</sup>    | 4620.0+x <sup>o</sup> 9      | 25 <sup>+</sup> |
| 1000.5 <sup>b</sup> 14      | 12 <sup>+</sup>    | 1963.9 <sup>b</sup> 14      | 16 <sup>+</sup>    | 3129.6+x <sup>f</sup> 8      | 20 <sup>+</sup>    | 4633.2+x <sup>f</sup> 11     | 24 <sup>+</sup> |
| 1090.8+x <sup>g</sup> 7     | 13 <sup>+</sup>    | 2005.3 <sup>d</sup> 14      | 16 <sup>-</sup>    | 3198.7+x <sup>@</sup> 7      | 21 <sup>-</sup>    | 4650.5 <sup>d</sup> 17       | 24 <sup>-</sup> |
| 1091.2+y <sup>k</sup> 13    | (11 <sup>+</sup> ) | 2031.4+y <sup>k</sup> 15    | (15 <sup>+</sup> ) | 3229.8 <sup>d</sup> 16       | 20 <sup>-</sup>    | 4732.0+x <sup>@</sup> 9      | 25 <sup>-</sup> |
| 1104.9 <sup>d</sup> 14      | 12 <sup>-</sup>    | 2070.4 <sup>h</sup> 15      | 16 <sup>-</sup>    | 3231.7 <sup>b</sup> 15       | 20 <sup>+</sup>    | 5016.3 <sup>e</sup> 18       | 25 <sup>-</sup> |
| 1107.8 <sup>h</sup> 14      | 12 <sup>-</sup>    | 2102.6+x <sup>n</sup> 6     | 16 <sup>+</sup>    | 3250.4+x <sup>&amp;</sup> 11 | 20 <sup>-</sup>    | 5020.8+x <sup>g</sup> 12     | 25 <sup>+</sup> |
| 1159.9+x <sup>#</sup> 5     | 14 <sup>-</sup>    | 2153.2+x <sup>g</sup> 8     | 17 <sup>+</sup>    | 3264.1+y <sup>k</sup> 16     | (19 <sup>+</sup> ) | 5068.1+x <sup>#</sup> 10     | 26 <sup>-</sup> |
| 1170.1+x <sup>l</sup> 10    | (12 <sup>+</sup> ) | 2193.7+x <sup>#</sup> 6     | 18 <sup>-</sup>    | 3349.9 <sup>h</sup> 16       | 20 <sup>-</sup>    | 5575.4+x <sup>@</sup> 10     | 27 <sup>-</sup> |
| 1211.1+x <sup>&amp;</sup> 6 | 12 <sup>-</sup>    | 2199.0+x <sup>&amp;</sup> 9 | 16 <sup>-</sup>    | 3388.4+x <sup>o</sup> 7      | 21 <sup>+</sup>    | 5888.5+x <sup>#</sup> 11     | 28 <sup>-</sup> |

<sup>†</sup> From least squares fit to E<sub>γ</sub> data.<sup>‡</sup> From Adopted Levels.<sup>#</sup> Band(A):  $K^\pi=6^-, \pi 7/2[523] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=0.9.<sup>@</sup> Band(a):  $K^\pi=6^-, \pi 7/2[523] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=0.9.<sup>&</sup> Band(B):  $K^\pi=6^-, \pi 7/2[404] \otimes \nu 5/2[523], \alpha=0$ . B(M1)/B(E2)=0.5.<sup>a</sup> Band(b):  $K^\pi=6^-, \pi 7/2[404] \otimes \nu 5/2[523], \alpha=1$ . B(M1)/B(E2)=0.5.<sup>b</sup> Band(C):  $K^\pi=2^+, \pi 1/2[411] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=0.1.<sup>c</sup> Band(c):  $K^\pi=2^+, \pi 1/2[411] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=0.1.<sup>d</sup> Band(D):  $K^\pi=2^-, \pi 1/2[541] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=0.3.<sup>e</sup> Band(d):  $K^\pi=2^-, \pi 1/2[541] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=0.3.<sup>f</sup> Band(E):  $K^\pi=6^+, \pi 7/2[404] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=0.2.<sup>g</sup> Band(e):  $K^\pi=6^+, \pi 7/2[404] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=0.2.<sup>h</sup> Band(F):  $K^\pi=1^-, \pi 7/2[523] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=1.3.

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$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  **1999Re05 (continued)** $^{164}\text{Tm}$  Levels (continued)

- <sup>i</sup> Band(f):  $K^\pi=1^-, \pi 7/2[523] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=1.3.  
<sup>j</sup> Band(G):  $K^\pi=1^+, \pi 7/2[404] \otimes \nu 5/2[642], \alpha=0$ . B(M1)/B(E2)=0.1.  
<sup>k</sup> Band(g):  $K^\pi=1^+, \pi 7/2[404] \otimes \nu 5/2[642], \alpha=1$ . B(M1)/B(E2)=0.1.  
<sup>l</sup> Band(H):  $K^\pi=5^+, \pi 7/2[523] \otimes \nu 3/2[521], \alpha=0$ . B(M1)/B(E2)=0.9.  
<sup>m</sup> Band(h):  $K^\pi=5^+, \pi 7/2[523] \otimes \nu 3/2[521], \alpha=1$ . B(M1)/B(E2)=0.9.  
<sup>n</sup> Band(I):  $K^\pi=6^+, 3\text{-qp band}, \alpha=0$ . Configuration= $\pi 7/2[523] \otimes \nu 5/2[523](i_{13/2})^2$ . B(M1)/B(E2)=1.2 after  $i_{13/2}$  crossing.  
<sup>o</sup> Band(i):  $K^\pi=6^+, 3\text{-qp band}, \alpha=1$ . Configuration= $\pi 7/2[523] \otimes \nu 5/2[523](i_{13/2})^2$ . B(M1)/B(E2)=1.2 (after  $i_{13/2}$  crossing).  
<sup>p</sup> Band(J): Band based on ( $2^+$ ).

 $\gamma(^{164}\text{Tm})$ 

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$ | $E_f$   | $J_f^\pi$ | Mult. #              | Comments                                                |
|--------------|--------------|---------------------|-----------|---------|-----------|----------------------|---------------------------------------------------------|
| 37.573 13    |              | 37.573              | $2^+$     | 0.0     | $1^+$     |                      | $E_\gamma$ : from Adopted Gammas. 1999Re05 list 38 keV. |
| 44 1         |              | 185.0+x             | $7^+$     | 140.7+x | $6^+$     |                      |                                                         |
| 48 1         |              | 158.1               | $4^+$     | 110.1   | $2^+$     |                      |                                                         |
| 48 1         |              | 301.5               | $7^+$     | 253.4   | $6^+$     |                      |                                                         |
| 58 1         |              | 182.3+x             | $7^-$     | 124.3+x | $6^-$     |                      |                                                         |
| 65 1         |              | 172.9               | $5^+$     | 107.9   | $3^+$     | (E2) <sup>a</sup>    | DCO=0.94 14                                             |
| 75.5 5       | 30           | 257.4+x             | $8^-$     | 182.3+x | $7^-$     | D                    | DCO=0.69 15                                             |
| 79.2 3       | 65           | 264.1+x             | $8^+$     | 185.0+x | $7^+$     | (M1+E2) <sup>b</sup> | DCO=0.82 9                                              |
| 79.3 7       |              | 542.3               | $8^-$     | 463.1   | $7^-$     |                      |                                                         |
| 80.2 7       | 1            | 253.4               | $6^+$     | 172.9   | $5^+$     | D                    | DCO=0.63 13                                             |
| 83.9 5       | 2            | 354.6+y             | ( $6^+$ ) | 270.7+y | ( $5^+$ ) |                      |                                                         |
| 84 1         |              | 84.0+y              | ( $3^+$ ) | 0.0+y   | ( $2^+$ ) |                      |                                                         |
| 95.3 5       | 8            | 253.4               | $6^+$     | 158.1   | $4^+$     |                      |                                                         |
| 95.9 3       | 131          | 353.4+x             | $9^-$     | 257.4+x | $8^-$     | (M1+E2) <sup>b</sup> | DCO=0.78 4                                              |
| 99.7 5       | 17           | 257.4+x             | $8^-$     | 157.8+x | $7^-$     |                      |                                                         |
| 99.7 5       | 3            | 785.7               | $10^-$    | 685.2   | $9^-$     |                      |                                                         |
| 104.8 5      | 13           | 188.8+y             | ( $4^+$ ) | 84.0+y  | ( $3^+$ ) |                      |                                                         |
| 107.1 5      | 2            | 461.7+y             | ( $7^+$ ) | 354.6+y | ( $6^+$ ) |                      |                                                         |
| 109.0 5      | 7            | 410.2               | $8^+$     | 301.5   | $7^+$     |                      |                                                         |
| 110.0 7      |              | 657.3               | $9^-$     | 547.7   | $8^-$     |                      |                                                         |
| 110.1 7      |              | 110.1               | $2^+$     | 0.0     | $1^+$     |                      |                                                         |
| 110.4 5      | 15           | 520.2               | $9^+$     | 410.2   | $8^+$     | D                    | DCO=0.66 10                                             |
| 112.3 3      | 96           | 376.3+x             | $9^+$     | 264.1+x | $8^+$     | (M1+E2) <sup>b</sup> | DCO=0.90 1                                              |
| 115.2 7      |              | 657.3               | $9^-$     | 542.3   | $8^-$     | (M1+E2) <sup>b</sup> | DCO=0.81 5                                              |
| 116.8 3      | 279          | 470.1+x             | $10^-$    | 353.4+x | $9^-$     | (M1+E2) <sup>b</sup> | DCO=0.78 4                                              |
| 117.6 5      | 10           | 302.6+x             | ( $7^+$ ) | 185.0+x | $7^+$     |                      |                                                         |
| 119.3 3      | 60           | 776.6               | $10^-$    | 657.3   | $9^-$     | (M1+E2) <sup>b</sup> | DCO=0.80 3                                              |
| 121.4 5      | 6            | 310.1+y             | ( $5^+$ ) | 188.8+y | ( $4^+$ ) |                      |                                                         |
| 123.5 5      | 5            | 264.1+x             | $8^+$     | 140.7+x | $6^+$     |                      |                                                         |
| 124.2 7      |              | 124.3+x             | $6^-$     | 0.0+x   | $6^-$     |                      |                                                         |
| 125.9 5      | 3            | 587.9+y             | ( $8^+$ ) | 461.7+y | ( $7^+$ ) |                      |                                                         |
| 128.6 3      | 116          | 301.5               | $7^+$     | 172.9   | $5^+$     | (E2) <sup>a</sup>    | DCO=0.87 8                                              |
| 128.6 7      |              | 381.2               | $6^-$     | 253.4   | $6^+$     |                      |                                                         |
| 129.7 5      | 18           | 1104.9              | $12^-$    | 975.2   | $11^-$    |                      |                                                         |
| 133.1 5      | 19           | 257.4+x             | $8^-$     | 124.3+x | $6^-$     |                      |                                                         |
| 134.5 5      | 5            | 302.6+x             | ( $7^+$ ) | 168.3+x | ( $6^+$ ) |                      |                                                         |
| 138.5 3      | 338          | 607.8+x             | $11^-$    | 470.1+x | $10^-$    | (M1+E2) <sup>b</sup> | DCO=0.83 4                                              |
| 140.5 7      |              | 140.7+x             | $6^+$     | 0.0+x   | $6^-$     |                      |                                                         |
| 140.9 7      |              | 443.3+x             | ( $8^+$ ) | 302.6+x | ( $7^+$ ) |                      |                                                         |
| 141.0 3      | 53           | 517.2+x             | $10^+$    | 376.3+x | $9^+$     |                      |                                                         |
| 148.8 5      | 3            | 736.9+y             | ( $9^+$ ) | 587.9+y | ( $8^+$ ) |                      |                                                         |

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(^{19}\text{F}, 5n\gamma)$  **1999Re05 (continued)** $\gamma(^{164}\text{Tm})$  (continued)

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$          | $E_f$    | $J_f^\pi$          | Mult. #               | Comments    |
|--------------|--------------|---------------------|--------------------|----------|--------------------|-----------------------|-------------|
| 151.7 5      | 9            | 461.7+y             | (7 <sup>+</sup> )  | 310.1+y  | (5 <sup>+</sup> )  |                       |             |
| 156.6 3      | 150          | 410.2               | 8 <sup>+</sup>     | 253.4    | 6 <sup>+</sup>     |                       |             |
| 158.2 7      |              | 157.8+x             | 7 <sup>-</sup>     | 0.0+x    | 6 <sup>-</sup>     |                       |             |
| 159.0 5      | 33           | 602.5+x             | (9 <sup>+</sup> )  | 443.3+x  | (8 <sup>+</sup> )  |                       |             |
| 160.6 3      | 109          | 937.1               | 11 <sup>-</sup>    | 776.6    | 10 <sup>-</sup>    | (M1+E2) <sup>b</sup>  | DCO=0.76 3  |
| 161.2 7      |              | 542.3               | 8 <sup>-</sup>     | 381.2    | 6 <sup>-</sup>     |                       |             |
| 162.7 3      | 312          | 769.9+x             | 12 <sup>-</sup>    | 607.8+x  | 11 <sup>-</sup>    | (M1+E2) <sup>b</sup>  | DCO=0.80 4  |
| 165.8 5      | 11           | 354.6+y             | (6 <sup>+</sup> )  | 188.8+y  | (4 <sup>+</sup> )  |                       |             |
| 166.9 5      | 2            | 547.7               | 8 <sup>-</sup>     | 381.2    | 6 <sup>-</sup>     |                       |             |
| 167.5 3      | 68           | 684.7+x             | 11 <sup>+</sup>    | 517.2+x  | 10 <sup>+</sup>    | (M1+E2) <sup>b</sup>  | DCO=0.91 3  |
| 167.7 3      | 55           | 1104.9              | 12 <sup>-</sup>    | 937.1    | 11 <sup>-</sup>    |                       |             |
| 170.7 5      | 21           | 353.4+x             | 9 <sup>-</sup>     | 182.3+x  | 7 <sup>-</sup>     | (E2) <sup>a</sup>     | DCO=0.97 12 |
| 170.7 3      | 75           | 1107.8              | 12 <sup>-</sup>    | 937.1    | 11 <sup>-</sup>    | (M1+E2) <sup>b</sup>  | DCO=0.78 4  |
| 170.9 5      | 26           | 773.5+x             | (10 <sup>+</sup> ) | 602.5+x  | (9 <sup>+</sup> )  |                       |             |
| 173.1 5      | 19           | 830.3               | 11 <sup>+</sup>    | 657.3    | 9 <sup>-</sup>     |                       |             |
| 180.6 5      | 26           | 338.4+x             | 8 <sup>-</sup>     | 157.8+x  | 7 <sup>-</sup>     |                       |             |
| 182.2 7      |              | 182.3+x             | 7 <sup>-</sup>     | 0.0+x    | 6 <sup>-</sup>     | D                     | DCO=0.60 15 |
| 183.1 3      | 230          | 952.7+x             | 13 <sup>-</sup>    | 769.9+x  | 12 <sup>-</sup>    | (M1+E2) <sup>b</sup>  | DCO=0.75 4  |
| 185.2 7      |              | 185.0+x             | 7 <sup>+</sup>     | 0.0+x    | 6 <sup>-</sup>     | D                     | DCO=0.70 7  |
| 186.7 5      | 9            | 270.7+y             | (5 <sup>+</sup> )  | 84.0+y   | (3 <sup>+</sup> )  |                       |             |
| 189.1 5      | 19           | 975.2               | 11 <sup>-</sup>    | 785.7    | 10 <sup>-</sup>    |                       |             |
| 190.5 5      | 24           | 964.0+x             | (11 <sup>+</sup> ) | 773.5+x  | (10 <sup>+</sup> ) |                       |             |
| 190.6 3      | 56           | 875.5+x             | 12 <sup>+</sup>    | 684.7+x  | 11 <sup>+</sup>    | (M1+E2) <sup>@b</sup> | DCO=0.96 4  |
| 191.0 5      | 44           | 376.3+x             | 9 <sup>+</sup>     | 185.0+x  | 7 <sup>+</sup>     | &                     | DCO=0.78 4  |
| 191.1 5      | 10           | 461.7+y             | (7 <sup>+</sup> )  | 270.7+y  | (5 <sup>+</sup> )  |                       |             |
| 197.6 5      | 17           | 535.6+x             | 9 <sup>-</sup>     | 338.4+x  | 8 <sup>-</sup>     |                       |             |
| 206.2 5      | 23           | 1170.1+x            | (12 <sup>+</sup> ) | 964.0+x  | (11 <sup>+</sup> ) |                       |             |
| 207.4 3      | 219          | 1159.9+x            | 14 <sup>-</sup>    | 952.7+x  | 13 <sup>-</sup>    | D+Q                   | DCO=0.82 5  |
| 209.8 7      |              | 463.1               | 7 <sup>-</sup>     | 253.4    | 6 <sup>+</sup>     |                       |             |
| 211.8 3      | 81           | 1319.6              | 13 <sup>-</sup>    | 1107.8   | 12 <sup>-</sup>    |                       |             |
| 212.6 5      | 13           | 747.9+x             | 10 <sup>-</sup>    | 535.6+x  | 9 <sup>-</sup>     |                       |             |
| 212.9 3      | 64           | 470.1+x             | 10 <sup>-</sup>    | 257.4+x  | 8 <sup>-</sup>     | Q                     | DCO=0.94 10 |
| 214.9 5      | 38           | 1090.8+x            | 13 <sup>+</sup>    | 875.5+x  | 12 <sup>+</sup>    | D+Q                   | DCO=0.87 4  |
| 218.7 3      | 150          | 520.2               | 9 <sup>+</sup>     | 301.5    | 7 <sup>+</sup>     | Q                     | DCO=0.90 4  |
| 221.3 5      | 42           | 1541.0              | 14 <sup>-</sup>    | 1319.6   | 13 <sup>-</sup>    | D+Q                   | DCO=0.77 4  |
| 226.0 5      | 7            | 310.1+y             | (5 <sup>+</sup> )  | 84.0+y   | (3 <sup>+</sup> )  |                       |             |
| 226.8 5      | 10           | 974.4+x             | 11 <sup>-</sup>    | 747.9+x  | 10 <sup>-</sup>    |                       |             |
| 229.8 3      | 173          | 1389.5+x            | 15 <sup>-</sup>    | 1159.9+x | 14 <sup>-</sup>    | D+Q                   | DCO=0.80 5  |
| 230.6 5      | 18           | 1231.7              | 13 <sup>+</sup>    | 1000.5   | 12 <sup>+</sup>    | D                     | DCO=0.62 7  |
| 233.3 5      | 19           | 587.9+y             | (8 <sup>+</sup> )  | 354.6+y  | (6 <sup>+</sup> )  |                       |             |
| 234.2 5      | 23           | 776.6               | 10 <sup>-</sup>    | 542.3    | 8 <sup>-</sup>     |                       |             |
| 234.7 5      | 36           | 1325.5+x            | 14 <sup>+</sup>    | 1090.8+x | 13 <sup>+</sup>    | D+Q                   | DCO=0.86 5  |
| 236.6 5      | 11           | 1211.1+x            | 12 <sup>-</sup>    | 974.4+x  | 11 <sup>-</sup>    |                       |             |
| 237.8 5      | 11           | 785.7               | 10 <sup>-</sup>    | 547.7    | 8 <sup>-</sup>     |                       |             |
| 238.1 5      | 28           | 1343.7              | 13 <sup>-</sup>    | 1104.9   | 12 <sup>-</sup>    |                       |             |
| 243.8 5      | 14           | 1455.2+x            | 13 <sup>-</sup>    | 1211.1+x | 12 <sup>-</sup>    |                       |             |
| 245.9 5      | 12           | 547.7               | 8 <sup>-</sup>     | 301.5    | 7 <sup>+</sup>     |                       |             |
| 246.6 3      | 261          | 656.9               | 10 <sup>+</sup>    | 410.2    | 8 <sup>+</sup>     | Q                     | DCO=1.12 4  |
| 247.1 3      | 170          | 1636.4+x            | 16 <sup>-</sup>    | 1389.5+x | 15 <sup>-</sup>    | D+Q                   | DCO=0.81 6  |
| 247.6 5      | 18           | 1702.6+x            | 14 <sup>-</sup>    | 1455.2+x | 13 <sup>-</sup>    |                       |             |
| 248.8 5      | 15           | 1951.4+x            | 15 <sup>-</sup>    | 1702.6+x | 14 <sup>-</sup>    |                       |             |
| 249.1 5      | 31           | 2601.7+x            | 18 <sup>+</sup>    | 2352.5+x | 17 <sup>+</sup>    |                       |             |
| 249.7 5      | 13           | 2352.5+x            | 17 <sup>+</sup>    | 2102.6+x | 16 <sup>+</sup>    |                       |             |
| 253.1 3      | 99           | 517.2+x             | 10 <sup>+</sup>    | 264.1+x  | 8 <sup>+</sup>     | &                     | DCO=0.78 4  |

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  **1999Re05 (continued)** $\gamma(^{164}\text{Tm})$  (continued)

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$          | $E_f$    | $J_f^\pi$         | Mult. # | Comments    |
|--------------|--------------|---------------------|--------------------|----------|-------------------|---------|-------------|
| 254.1 3      | 121          | 607.8+x             | 11 <sup>-</sup>    | 353.4+x  | 9 <sup>-</sup>    | Q       | DCO=0.99 7  |
| 254.8 5      | 37           | 2856.2+x            | 19 <sup>+</sup>    | 2601.7+x | 18 <sup>+</sup>   |         |             |
| 257.3 5      | 16           | 257.4+x             | 8 <sup>-</sup>     | 0.0+x    | 6 <sup>-</sup>    |         |             |
| 257.7 5      | 27           | 1583.3+x            | 15 <sup>+</sup>    | 1325.5+x | 14 <sup>+</sup>   | D+Q @   | DCO=0.96 8  |
| 259.9 5      | 28           | 3115.8+x            | 20 <sup>+</sup>    | 2856.2+x | 19 <sup>+</sup>   |         |             |
| 261.0 3      | 53           | 1802.2              | 15 <sup>-</sup>    | 1541.0   | 14 <sup>-</sup>   | D+Q     | DCO=0.79 4  |
| 265.6 5      | 20           | 785.7               | 10 <sup>-</sup>    | 520.2    | 9 <sup>+</sup>    | D       | DCO=0.63 9  |
| 268.1 5      | 34           | 2070.4              | 16 <sup>-</sup>    | 1802.2   | 15 <sup>-</sup>   | D+Q     | DCO=0.83 5  |
| 272.6 5      | 21           | 1856.1+x            | 16 <sup>+</sup>    | 1583.3+x | 15 <sup>+</sup>   | D+Q @   | DCO=0.97 12 |
| 272.8 5      | 18           | 3388.4+x            | 21 <sup>+</sup>    | 3115.8+x | 20 <sup>+</sup>   |         |             |
| 274.5 5      | 14           | 1104.9              | 12 <sup>-</sup>    | 830.3    | 11 <sup>+</sup>   | D       | DCO=0.60 12 |
| 274.7 5      | 11           | 685.2               | 9 <sup>-</sup>     | 410.2    | 8 <sup>+</sup>    |         |             |
| 274.8 5      | 14           | 443.3+x             | (8 <sup>+</sup> )  | 168.3+x  | (6 <sup>+</sup> ) |         |             |
| 275.4 5      | 19           | 736.9+y             | (9 <sup>+</sup> )  | 461.7+y  | (7 <sup>+</sup> ) |         |             |
| 275.6 5      | 33           | 1787.8              | 15 <sup>-</sup>    | 1511.9   | 14 <sup>-</sup>   |         |             |
| 278.1 3      | 105          | 1914.4+x            | 17 <sup>-</sup>    | 1636.4+x | 16 <sup>-</sup>   | D+Q     | DCO=0.80 9  |
| 279.5 3      | 76           | 2193.7+x            | 18 <sup>-</sup>    | 1914.4+x | 17 <sup>-</sup>   | D+Q     | DCO=0.80 9  |
| 279.7 5      | 11           | 1511.9              | 14 <sup>-</sup>    | 1231.7   | 13 <sup>+</sup>   | D       | DCO=0.62 9  |
| 280.1 5      | 29           | 937.1               | 11 <sup>-</sup>    | 657.3    | 9 <sup>-</sup>    | Q       | DCO=1.03 8  |
| 281.7 5      | 10           | 1720.1              | 15 <sup>+</sup>    | 1438.3   | 14 <sup>+</sup>   |         |             |
| 285.9 5      | 31           | 3674.2+x            | 22 <sup>+</sup>    | 3388.4+x | 21 <sup>+</sup>   |         |             |
| 290.3 5      | 15           | 975.2               | 11 <sup>-</sup>    | 685.2    | 9 <sup>-</sup>    |         |             |
| 297.7 5      | 15           | 2153.2+x            | 17 <sup>+</sup>    | 1856.1+x | 16 <sup>+</sup>   |         |             |
| 298.7 5      | 36           | 2369.3              | 17 <sup>-</sup>    | 2070.4   | 16 <sup>-</sup>   | D+Q     | DCO=0.89 10 |
| 298.9 7      |              | 3972.8+x            | 23 <sup>+</sup>    | 3674.2+x | 22 <sup>+</sup>   |         |             |
| 299.4 3      | 113          | 769.9+x             | 12 <sup>-</sup>    | 470.1+x  | 10 <sup>-</sup>   | Q       | DCO=1.05 7  |
| 299.9 5      | 29           | 602.5+x             | (9 <sup>+</sup> )  | 302.6+x  | (7 <sup>+</sup> ) |         |             |
| 302.7 5      | 9            | 2307.6              | 17 <sup>-</sup>    | 2005.3   | 16 <sup>-</sup>   |         |             |
| 303.0 5      | 38           | 2823.8+x            | 20 <sup>-</sup>    | 2520.5+x | 19 <sup>-</sup>   |         |             |
| 307.4 5      | 10           | 2459.6+x            | 18 <sup>+</sup>    | 2153.2+x | 17 <sup>+</sup>   |         |             |
| 308.3 3      | 136          | 684.7+x             | 11 <sup>+</sup>    | 376.3+x  | 9 <sup>+</sup>    | Q       | DCO=1.05 4  |
| 310.3 3      | 162          | 830.3               | 11 <sup>+</sup>    | 520.2    | 9 <sup>+</sup>    | Q       | DCO=0.97 5  |
| 312.6 5      | 39           | 2682.4              | 18 <sup>-</sup>    | 2369.3   | 17 <sup>-</sup>   | D+Q     | DCO=0.78 12 |
| 315.1 5      | 20           | 903.0+y             | (10 <sup>+</sup> ) | 587.9+y  | (8 <sup>+</sup> ) |         |             |
| 318.0 5      | 14           | 4290.7+x            | 24 <sup>+</sup>    | 3972.8+x | 23 <sup>+</sup>   |         |             |
| 318.2 5      | 24           | 975.2               | 11 <sup>-</sup>    | 656.9    | 10 <sup>+</sup>   |         |             |
| 319.4 5      | 48           | 1104.9              | 12 <sup>-</sup>    | 785.7    | 10 <sup>-</sup>   |         |             |
| 319.7 5      | 16           | 3002.5              | 19 <sup>-</sup>    | 2682.4   | 18 <sup>-</sup>   | D       | DCO=0.52 25 |
| 320.5 5      | 19           | 3519.4+x            | 22 <sup>-</sup>    | 3198.7+x | 21 <sup>-</sup>   |         |             |
| 321.6 5      | 23           | 1107.8              | 12 <sup>-</sup>    | 785.7    | 10 <sup>-</sup>   |         |             |
| 323.7 5      | 7            | 2287.9              | 17 <sup>+</sup>    | 1963.9   | 16 <sup>+</sup>   |         |             |
| 326.7 5      | 45           | 2520.5+x            | 19 <sup>-</sup>    | 2193.7+x | 18 <sup>-</sup>   | D+Q     | DCO=0.83 9  |
| 328.1 5      | 27           | 1104.9              | 12 <sup>-</sup>    | 776.6    | 10 <sup>-</sup>   |         |             |
| 330.2 5      | 17           | 773.5+x             | (10 <sup>+</sup> ) | 443.3+x  | (8 <sup>+</sup> ) |         |             |
| 331.2 5      | 23           | 1107.8              | 12 <sup>-</sup>    | 776.6    | 10 <sup>-</sup>   | Q       | DCO=1.14 8  |
| 333.7 5      | 6            | 2793.1+x            | 19 <sup>+</sup>    | 2459.6+x | 18 <sup>+</sup>   |         |             |
| 336.4 5      | 6            | 3129.6+x            | 20 <sup>+</sup>    | 2793.1+x | 19 <sup>+</sup>   |         |             |
| 338.3 5      | 25           | 338.4+x             | 8 <sup>-</sup>     | 0.0+x    | 6 <sup>-</sup>    |         |             |
| 343.4 3      | 252          | 1000.5              | 12 <sup>+</sup>    | 656.9    | 10 <sup>+</sup>   |         |             |
| 343.7 5      | 35           | 1343.7              | 13 <sup>-</sup>    | 1000.5   | 12 <sup>+</sup>   |         |             |
| 344.8 3      | 150          | 952.7+x             | 13 <sup>-</sup>    | 607.8+x  | 11 <sup>-</sup>   | Q       | DCO=1.05 7  |
| 349.7 5      | 13           | 1787.8              | 15 <sup>-</sup>    | 1438.3   | 14 <sup>+</sup>   | D       | DCO=0.60 14 |
| 354.3 5      | 22           | 1091.2+y            | (11 <sup>+</sup> ) | 736.9+y  | (9 <sup>+</sup> ) |         |             |
| 358.3 3      | 163          | 875.5+x             | 12 <sup>+</sup>    | 517.2+x  | 10 <sup>+</sup>   | Q       | DCO=1.05 4  |
| 361.6 5      | 12           | 964.0+x             | (11 <sup>+</sup> ) | 602.5+x  | (9 <sup>+</sup> ) |         |             |

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$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  **1999Re05** (continued) $\gamma(^{164}\text{Tm})$  (continued)

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$          | $E_f$    | $J_f^\pi$          | Mult. # | Comments    |
|--------------|--------------|---------------------|--------------------|----------|--------------------|---------|-------------|
| 368.4 5      | 33           | 1343.7              | 13 <sup>-</sup>    | 975.2    | 11 <sup>-</sup>    |         |             |
| 374.7 5      | 22           | 3198.7+x            | 21 <sup>-</sup>    | 2823.8+x | 20 <sup>-</sup>    | D       | DCO=0.70 10 |
| 377.8 5      | 20           | 535.6+x             | 9 <sup>-</sup>     | 157.8+x  | 7 <sup>-</sup>     |         |             |
| 383.0 5      | 33           | 1319.6              | 13 <sup>-</sup>    | 937.1    | 11 <sup>-</sup>    | Q       | DCO=1.02 6  |
| 389.9 3      | 165          | 1159.9+x            | 14 <sup>-</sup>    | 769.9+x  | 12 <sup>-</sup>    | Q       | DCO=1.03 7  |
| 396.6 5      | 22           | 1170.1+x            | (12 <sup>+</sup> ) | 773.5+x  | (10 <sup>+</sup> ) |         |             |
| 398.2 5      | 22           | 1301.2+y            | (12 <sup>+</sup> ) | 903.0+y  | (10 <sup>+</sup> ) |         |             |
| 401.6 3      | 142          | 1231.7              | 13 <sup>+</sup>    | 830.3    | 11 <sup>+</sup>    |         |             |
| 403.7 5      | 24           | 1511.9              | 14 <sup>-</sup>    | 1107.8   | 12 <sup>-</sup>    |         |             |
| 406.2 3      | 161          | 1090.8+x            | 13 <sup>+</sup>    | 684.7+x  | 11 <sup>+</sup>    | Q       | DCO=1.09 7  |
| 407.4 3      | 163          | 1511.9              | 14 <sup>-</sup>    | 1104.9   | 12 <sup>-</sup>    |         |             |
| 409.3 5      | 23           | 747.9+x             | 10 <sup>-</sup>    | 338.4+x  | 8 <sup>-</sup>     |         |             |
| 419.7 5      | 13           | 3939.2+x            | 23 <sup>-</sup>    | 3519.4+x | 22 <sup>-</sup>    |         |             |
| 433.3 5      | 39           | 1541.0              | 14 <sup>-</sup>    | 1107.8   | 12 <sup>-</sup>    | Q       | DCO=1.19 8  |
| 433.8 5      | 23           | 1525.0+y            | (13 <sup>+</sup> ) | 1091.2+y | (11 <sup>+</sup> ) |         |             |
| 435.6 5      | 29           | 1541.0              | 14 <sup>-</sup>    | 1104.9   | 12 <sup>-</sup>    |         |             |
| 436.6 3      | 246          | 1389.5+x            | 15 <sup>-</sup>    | 952.7+x  | 13 <sup>-</sup>    | Q       | DCO=1.09 9  |
| 437.8 3      | 209          | 1438.3              | 14 <sup>+</sup>    | 1000.5   | 12 <sup>+</sup>    | Q       | DCO=1.19 6  |
| 438.7 5      | 27           | 974.4+x             | 11 <sup>-</sup>    | 535.6+x  | 9 <sup>-</sup>     |         |             |
| 443.8 5      | 48           | 1787.8              | 15 <sup>-</sup>    | 1343.7   | 13 <sup>-</sup>    |         |             |
| 445.2 5      | 19           | 1409.2+x            | (13 <sup>+</sup> ) | 964.0+x  | (11 <sup>+</sup> ) |         |             |
| 450.1 3      | 144          | 1325.5+x            | 14 <sup>+</sup>    | 875.5+x  | 12 <sup>+</sup>    | Q       | DCO=1.10 7  |
| 462.8 5      | 28           | 1211.1+x            | 12 <sup>-</sup>    | 747.9+x  | 10 <sup>-</sup>    |         |             |
| 472.8 5      | 22           | 1642.9+x            | (14 <sup>+</sup> ) | 1170.1+x | (12 <sup>+</sup> ) |         |             |
| 473.3 5      | 22           | 1774.5+y            | (14 <sup>+</sup> ) | 1301.2+y | (12 <sup>+</sup> ) |         |             |
| 476.4 3      | 203          | 1636.4+x            | 16 <sup>-</sup>    | 1159.9+x | 14 <sup>-</sup>    | Q       | DCO=1.07 8  |
| 481.3 5      | 26           | 1455.2+x            | 13 <sup>-</sup>    | 974.4+x  | 11 <sup>-</sup>    |         |             |
| 483.1 5      | 41           | 1802.2              | 15 <sup>-</sup>    | 1319.6   | 13 <sup>-</sup>    |         | DCO=1.03 8  |
| 488.5 3      | 118          | 1720.1              | 15 <sup>+</sup>    | 1231.7   | 13 <sup>+</sup>    |         |             |
| 491.3 5      | 28           | 1702.6+x            | 14 <sup>-</sup>    | 1211.1+x | 12 <sup>-</sup>    |         |             |
| 492.4 3      | 150          | 1583.3+x            | 15 <sup>+</sup>    | 1090.8+x | 13 <sup>+</sup>    | Q       | DCO=1.05 8  |
| 493.6 3      | 145          | 2005.3              | 16 <sup>-</sup>    | 1511.9   | 14 <sup>-</sup>    |         |             |
| 496.3 5      | 14           | 1951.4+x            | 15 <sup>-</sup>    | 1455.2+x | 13 <sup>-</sup>    |         |             |
| 496.4 5      | 20           | 2199.0+x            | 16 <sup>-</sup>    | 1702.6+x | 14 <sup>-</sup>    |         |             |
| 496.4 5      | 12           | 2447.8+x            | 17 <sup>-</sup>    | 1951.4+x | 15 <sup>-</sup>    |         |             |
| 499.3 5      | 14           | 2601.7+x            | 18 <sup>+</sup>    | 2102.6+x | 16 <sup>+</sup>    |         |             |
| 503.8 5      | 23           | 2856.2+x            | 19 <sup>+</sup>    | 2352.5+x | 17 <sup>+</sup>    |         |             |
| 505.9 5      | 18           | 2704.9+x            | 18 <sup>-</sup>    | 2199.0+x | 16 <sup>-</sup>    |         |             |
| 506.4 5      | 22           | 2031.4+y            | (15 <sup>+</sup> ) | 1525.0+y | (13 <sup>+</sup> ) |         |             |
| 514.1 5      | 28           | 3115.8+x            | 20 <sup>+</sup>    | 2601.7+x | 18 <sup>+</sup>    |         |             |
| 519.3 5      | 43           | 2307.6              | 17 <sup>-</sup>    | 1787.8   | 15 <sup>-</sup>    |         |             |
| 522.3 5      | 17           | 2970.1+x            | 19 <sup>-</sup>    | 2447.8+x | 17 <sup>-</sup>    |         |             |
| 524.9 3      | 195          | 1914.4+x            | 17 <sup>-</sup>    | 1389.5+x | 15 <sup>-</sup>    | Q       | DCO=1.20 11 |
| 525.4 3      | 146          | 1963.9              | 16 <sup>+</sup>    | 1438.3   | 14 <sup>+</sup>    |         |             |
| 529.6 5      | 45           | 2070.4              | 16 <sup>-</sup>    | 1541.0   | 14 <sup>-</sup>    | Q       | DCO=1.07 12 |
| 530.7 3      | 118          | 1856.1+x            | 16 <sup>+</sup>    | 1325.5+x | 14 <sup>+</sup>    | Q       | DCO=1.06 9  |
| 532.5 5      | 27           | 3388.4+x            | 21 <sup>+</sup>    | 2856.2+x | 19 <sup>+</sup>    |         |             |
| 541.5 5      | 20           | 2316.0+y            | (16 <sup>+</sup> ) | 1774.5+y | (14 <sup>+</sup> ) |         |             |
| 545.5 5      | 10           | 3250.4+x            | 20 <sup>-</sup>    | 2704.9+x | 18 <sup>-</sup>    |         |             |
| 557.1 3      | 141          | 2193.7+x            | 18 <sup>-</sup>    | 1636.4+x | 16 <sup>-</sup>    | Q       | DCO=1.08 16 |
| 558.4 5      | 33           | 3674.2+x            | 22 <sup>+</sup>    | 3115.8+x | 20 <sup>+</sup>    |         |             |
| 564.2 5      | 12           | 3388.4+x            | 21 <sup>+</sup>    | 2823.8+x | 20 <sup>-</sup>    |         |             |
| 567.1 5      | 43           | 2369.3              | 17 <sup>-</sup>    | 1802.2   | 15 <sup>-</sup>    | Q       | DCO=1.13 17 |
| 568.0 3      | 98           | 2287.9              | 17 <sup>+</sup>    | 1720.1   | 15 <sup>+</sup>    |         |             |
| 569.9 3      | 111          | 2153.2+x            | 17 <sup>+</sup>    | 1583.3+x | 15 <sup>+</sup>    | Q       | DCO=1.08 9  |
| 571.0 5      | 7            | 3541.1+x            | 21 <sup>-</sup>    | 2970.1+x | 19 <sup>-</sup>    |         |             |

Continued on next page (footnotes at end of table)

| $^{150}\text{Nd}(^{19}\text{F}, 5\text{n}\gamma)$ <b>1999Re05 (continued)</b> |              |                     |                    |          |                    |             |
|-------------------------------------------------------------------------------|--------------|---------------------|--------------------|----------|--------------------|-------------|
| $\gamma(^{164}\text{Tm})$ (continued)                                         |              |                     |                    |          |                    |             |
| $E_\gamma$ †                                                                  | $I_\gamma$ ‡ | $E_i(\text{level})$ | $J_i^\pi$          | $E_f$    | $J_f^\pi$          | Mult. #     |
| Comments                                                                      |              |                     |                    |          |                    |             |
| 575.6 3                                                                       | 105          | 2580.9              | 18 <sup>-</sup>    | 2005.3   | 16 <sup>-</sup>    |             |
| 578.9 5                                                                       | 16           | 2610.3+y            | (17 <sup>+</sup> ) | 2031.4+y | (15 <sup>+</sup> ) |             |
| 584.3 5                                                                       | 31           | 3972.8+x            | 23 <sup>+</sup>    | 3388.4+x | 21 <sup>+</sup>    |             |
| 588.3 5                                                                       | 42           | 2895.9              | 19 <sup>-</sup>    | 2307.6   | 17 <sup>-</sup>    |             |
| 595.0 5                                                                       | 19           | 3115.8+x            | 20 <sup>+</sup>    | 2520.5+x | 19 <sup>-</sup>    | D           |
| 595.4 5                                                                       | 14           | 2911.4+y            | (18 <sup>+</sup> ) | 2316.0+y | (16 <sup>+</sup> ) | DCO=0.57 19 |
| 603.0 3                                                                       | 114          | 2566.9              | 18 <sup>+</sup>    | 1963.9   | 16 <sup>+</sup>    |             |
| 603.2 3                                                                       | 110          | 2459.6+x            | 18 <sup>+</sup>    | 1856.1+x | 16 <sup>+</sup>    | Q           |
| 605.0 5                                                                       | 6            | 3855.4+x            | 22 <sup>-</sup>    | 3250.4+x | 20 <sup>-</sup>    | DCO=1.07 10 |
| 605.9 3                                                                       | 129          | 2520.5+x            | 19 <sup>-</sup>    | 1914.4+x | 17 <sup>-</sup>    | Q           |
| 612.0 5                                                                       | 43           | 2682.4              | 18 <sup>-</sup>    | 2070.4   | 16 <sup>-</sup>    | Q           |
| 616.4 5                                                                       | 33           | 4290.7+x            | 24 <sup>+</sup>    | 3674.2+x | 22 <sup>+</sup>    | DCO=1.12 18 |
| 630.1 3                                                                       | 106          | 2823.8+x            | 20 <sup>-</sup>    | 2193.7+x | 18 <sup>-</sup>    | Q           |
| 632.2 5                                                                       | 19           | 3634.7              | 21 <sup>-</sup>    | 3002.5   | 19 <sup>-</sup>    | DCO=1.24 19 |
| 633.6 5                                                                       | 26           | 3002.5              | 19 <sup>-</sup>    | 2369.3   | 17 <sup>-</sup>    | Q           |
| 635.5 5                                                                       | 8            | 4176.6+x            | 23 <sup>-</sup>    | 3541.1+x | 21 <sup>-</sup>    | DCO=1.12 20 |
| 638.9 3                                                                       | 59           | 2926.8              | 19 <sup>+</sup>    | 2287.9   | 17 <sup>+</sup>    |             |
| 639.9 3                                                                       | 59           | 2793.1+x            | 19 <sup>+</sup>    | 2153.2+x | 17 <sup>+</sup>    | Q           |
| 647.2 5                                                                       | 24           | 4620.0+x            | 25 <sup>+</sup>    | 3972.8+x | 23 <sup>+</sup>    | DCO=0.99 10 |
| 648.9 5                                                                       | 64           | 3229.8              | 20 <sup>-</sup>    | 2580.9   | 18 <sup>-</sup>    |             |
| 652.5 5                                                                       | 34           | 3548.4              | 21 <sup>-</sup>    | 2895.9   | 19 <sup>-</sup>    |             |
| 653.5 5                                                                       | 5            | 4598.7              | 24 <sup>+</sup>    | 3945.2   | 22 <sup>+</sup>    |             |
| 653.8 5                                                                       | 3            | 3264.1+y            | (19 <sup>+</sup> ) | 2610.3+y | (17 <sup>+</sup> ) |             |
| 662.7 5                                                                       | 28           | 2856.2+x            | 19 <sup>+</sup>    | 2193.7+x | 18 <sup>-</sup>    | D           |
| 664.8 3                                                                       | 62           | 3231.7              | 20 <sup>+</sup>    | 2566.9   | 18 <sup>+</sup>    | DCO=0.68 17 |
| 667.5 5                                                                       | 26           | 3349.9              | 20 <sup>-</sup>    | 2682.4   | 18 <sup>-</sup>    |             |
| 670.0 5                                                                       | 46           | 3129.6+x            | 20 <sup>+</sup>    | 2459.6+x | 18 <sup>+</sup>    | Q           |
| 670.0 5                                                                       | 5            | 4525.4+x            | 24 <sup>-</sup>    | 3855.4+x | 22 <sup>-</sup>    | DCO=1.04 10 |
| 678.3 5                                                                       | 70           | 3198.7+x            | 21 <sup>-</sup>    | 2520.5+x | 19 <sup>-</sup>    |             |
| 687.4 5                                                                       | 34           | 2601.7+x            | 18 <sup>+</sup>    | 1914.4+x | 17 <sup>-</sup>    | D           |
| 695.6 3                                                                       | 61           | 3519.4+x            | 22 <sup>-</sup>    | 2823.8+x | 20 <sup>-</sup>    | Q           |
| 701.9 5                                                                       | 32           | 3495.0+x            | 21 <sup>+</sup>    | 2793.1+x | 19 <sup>+</sup>    | Q           |
| 707.4 5                                                                       | 11           | 4650.5              | 24 <sup>-</sup>    | 3943.1   | 22 <sup>-</sup>    | DCO=1.14 13 |
| 713.2 5                                                                       | 39           | 2102.6+x            | 16 <sup>+</sup>    | 1389.5+x | 15 <sup>-</sup>    | D           |
| 713.3 5                                                                       | 29           | 3943.1              | 22 <sup>-</sup>    | 3229.8   | 20 <sup>-</sup>    | DCO=0.61 21 |
| 713.5 5                                                                       | 16           | 3945.2              | 22 <sup>+</sup>    | 3231.7   | 20 <sup>+</sup>    |             |
| 713.6 5                                                                       | 13           | 4262.0              | 23 <sup>-</sup>    | 3548.4   | 21 <sup>-</sup>    |             |
| 716.4 5                                                                       | 32           | 2352.5+x            | 17 <sup>+</sup>    | 1636.4+x | 16 <sup>-</sup>    | D           |
| 723.0 5                                                                       | 16           | 3649.8              | 21 <sup>+</sup>    | 2926.8   | 19 <sup>+</sup>    | DCO=0.60 22 |
| 725.0 5                                                                       | 24           | 3854.6+x            | 22 <sup>+</sup>    | 3129.6+x | 20 <sup>+</sup>    |             |
| 727.4 5                                                                       | 5            | 4377.2              | 23 <sup>+</sup>    | 3649.8   | 21 <sup>+</sup>    |             |
| 735.3 5                                                                       | 9            | 4085.2              | 22 <sup>-</sup>    | 3349.9   | 20 <sup>-</sup>    |             |
| 740.6 5                                                                       | 29           | 3939.2+x            | 23 <sup>-</sup>    | 3198.7+x | 21 <sup>-</sup>    | Q           |
| 753.1 5                                                                       | 29           | 4272.5+x            | 24 <sup>-</sup>    | 3519.4+x | 22 <sup>-</sup>    | DCO=1.20 21 |
| 754.3 5                                                                       | 5            | 5016.3              | 25 <sup>-</sup>    | 4262.0   | 23 <sup>-</sup>    |             |
| 754.7 5                                                                       | 15           | 4249.7+x            | 23 <sup>+</sup>    | 3495.0+x | 21 <sup>+</sup>    |             |
| 771.1 5                                                                       | 5            | 5020.8+x            | 25 <sup>+</sup>    | 4249.7+x | 23 <sup>+</sup>    |             |
| 778.6 5                                                                       | 8            | 4633.2+x            | 24 <sup>+</sup>    | 3854.6+x | 22 <sup>+</sup>    |             |
| 792.8 5                                                                       | 18           | 4732.0+x            | 25 <sup>-</sup>    | 3939.2+x | 23 <sup>-</sup>    |             |
| 795.6 5                                                                       | 12           | 5068.1+x            | 26 <sup>-</sup>    | 4272.5+x | 24 <sup>-</sup>    |             |
| 820.4 5                                                                       | 5            | 5888.5+x            | 28 <sup>-</sup>    | 5068.1+x | 26 <sup>-</sup>    |             |
| 843.4 5                                                                       | 8            | 5575.4+x            | 27 <sup>-</sup>    | 4732.0+x | 25 <sup>-</sup>    |             |

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 $^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  **1999Re05 (continued)**


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 $\gamma(^{164}\text{Tm})$  (continued)

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<sup>†</sup> Uncertainties are assigned as follows: 0.3 keV for  $I_\gamma > 50$ , 0.5 keV for  $I_\gamma \leq 50$ , and 0.7 or 1 keV for others; based on a general statement by [1999Re05](#) that these range from 0.3 keV for the strongest transitions up to 0.7 keV for the weakest transitions.

<sup>‡</sup> Typical uncertainties are 3% for the strongest transitions and up to 10% for the weakest transitions.

<sup>#</sup> Assignments by evaluators based on DCO data in [1999Re05](#), and authors' statement that with gates on stretched quadrupole transitions, expected DCO is  $\approx 1.0$  for stretched quadrupole and  $\approx 0.6$  for stretched dipole. Further, the evaluators assign mult=D+Q for DCO value of  $\approx 0.8$ . Mult=Q indicated  $\Delta J=2$ , stretched quadrupole, and mult=D+Q for indicates  $\Delta J=1$ , unstretched transition, the former is likely to be E2, and the latter M1+E2 from band structures and RUL. Mult=D indicates  $\Delta J=1$ , stretched dipole, likely to be E1 in cases of transitions between opposite-parity bands, and M1 otherwise. Below 200-keV transitions,  $\Delta J=2$ , stretched quadrupole are assigned here as (E2), and  $\Delta J=1$ , D+Q transitions as (M1+E2), based on RUL, assuming that the level half-life is not longer than  $\approx 100$  ns.

<sup>@</sup> DCO is also consistent with  $\Delta J=2$ , quadrupole.

<sup>&</sup> DCO is low for implied  $\Delta J=2$ , quadrupole.

<sup>a</sup>  $\Delta J=2$ , Q from DCO; RUL favors E2, assuming level  $T_{1/2} < 100$  ns.

<sup>b</sup>  $\Delta J=1$ , D+Q from DCO; RUL favors M1+E2, , assuming level  $T_{1/2} < 100$  ns.



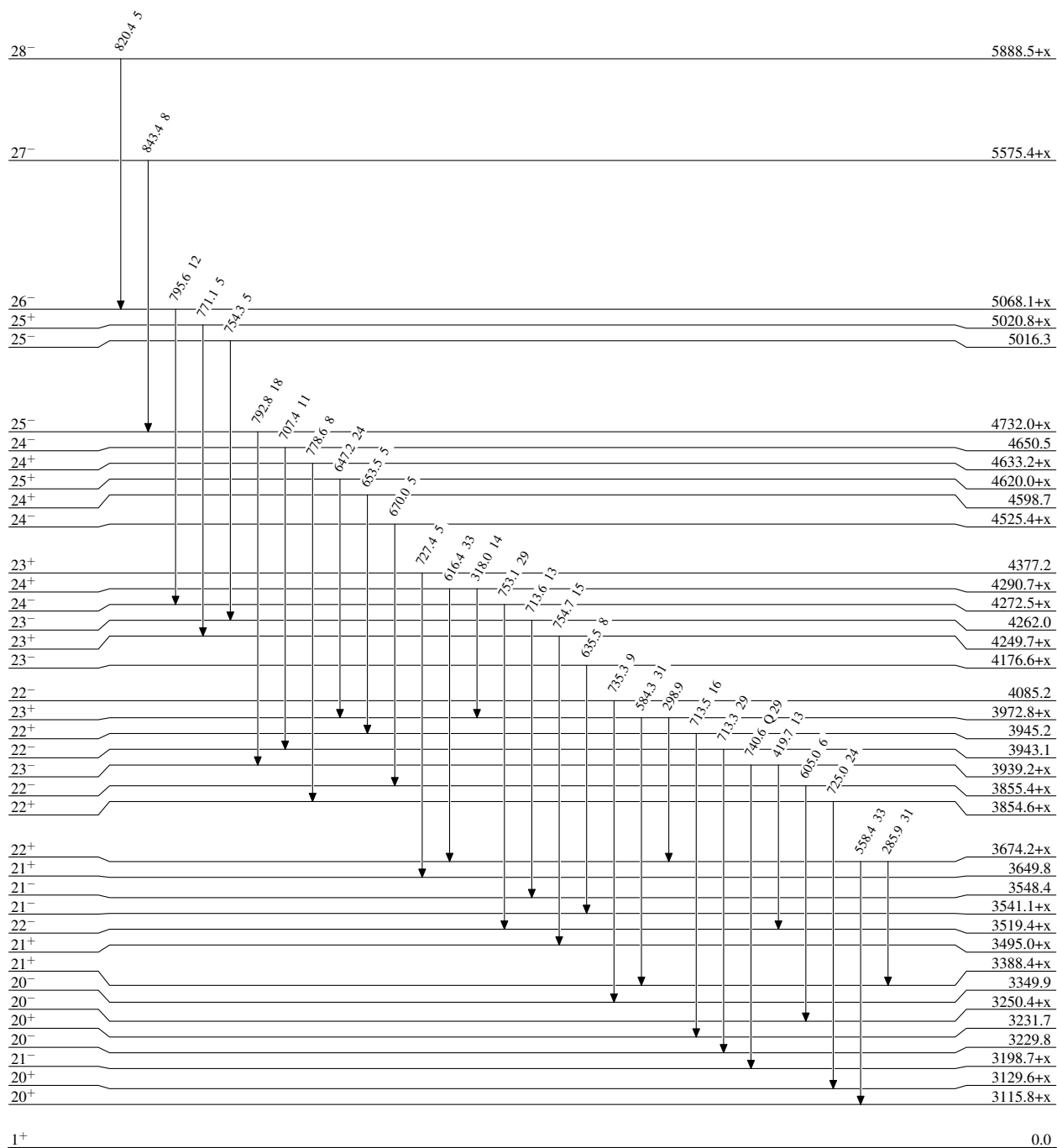
$^{150}\text{Nd}(^{19}\text{F}, 5\text{n}\gamma)$  1999Re05

## Level Scheme

Intensities: Relative  $I_\gamma$ 

## Legend

- $\longrightarrow$   $I_\gamma < 2\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma < 10\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{164}_{69}\text{Tm}_{95}$

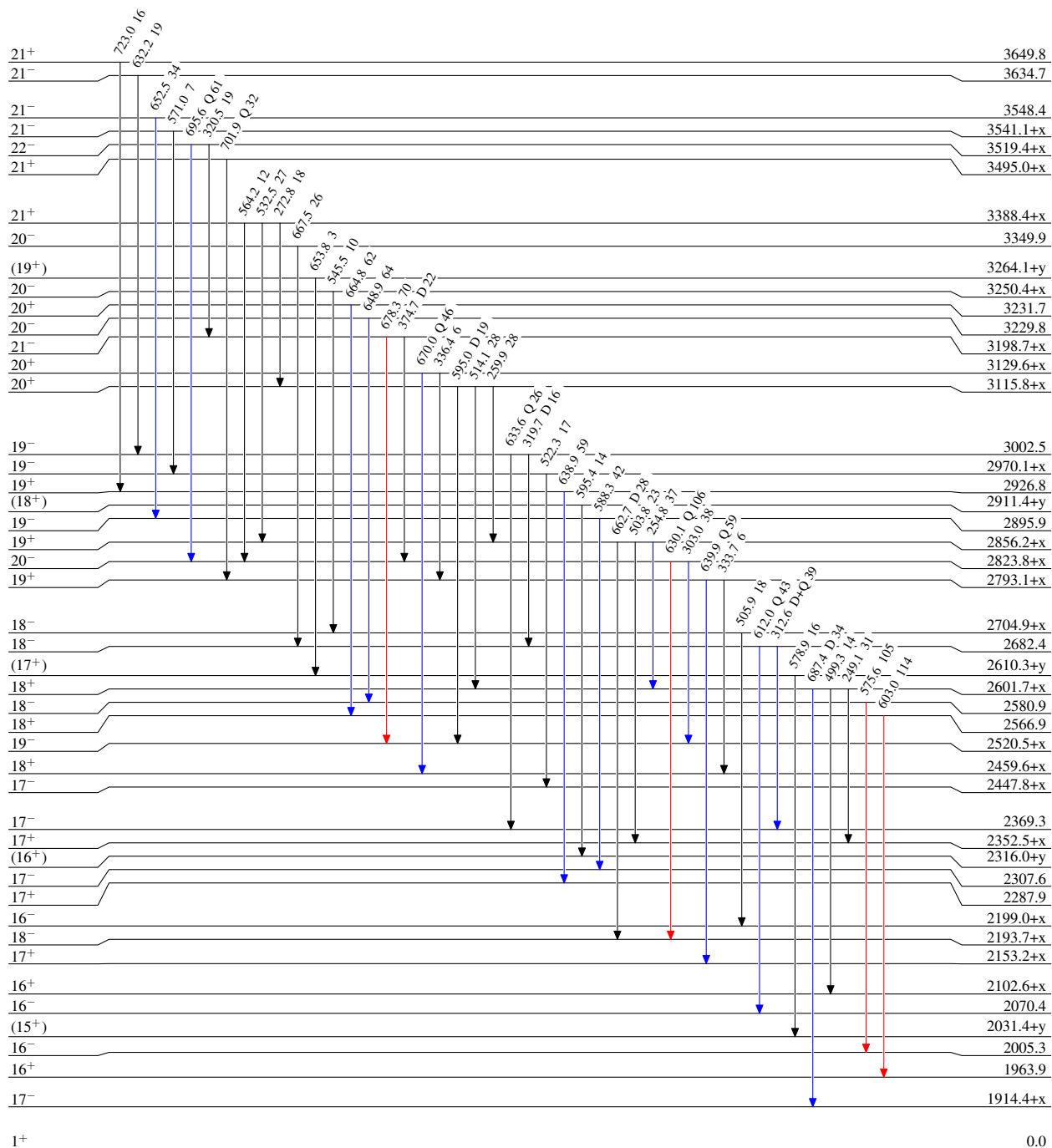
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

## Legend

- $\longrightarrow$   $I_\gamma < 2\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma < 10\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{164}\text{Tm}_{95}$

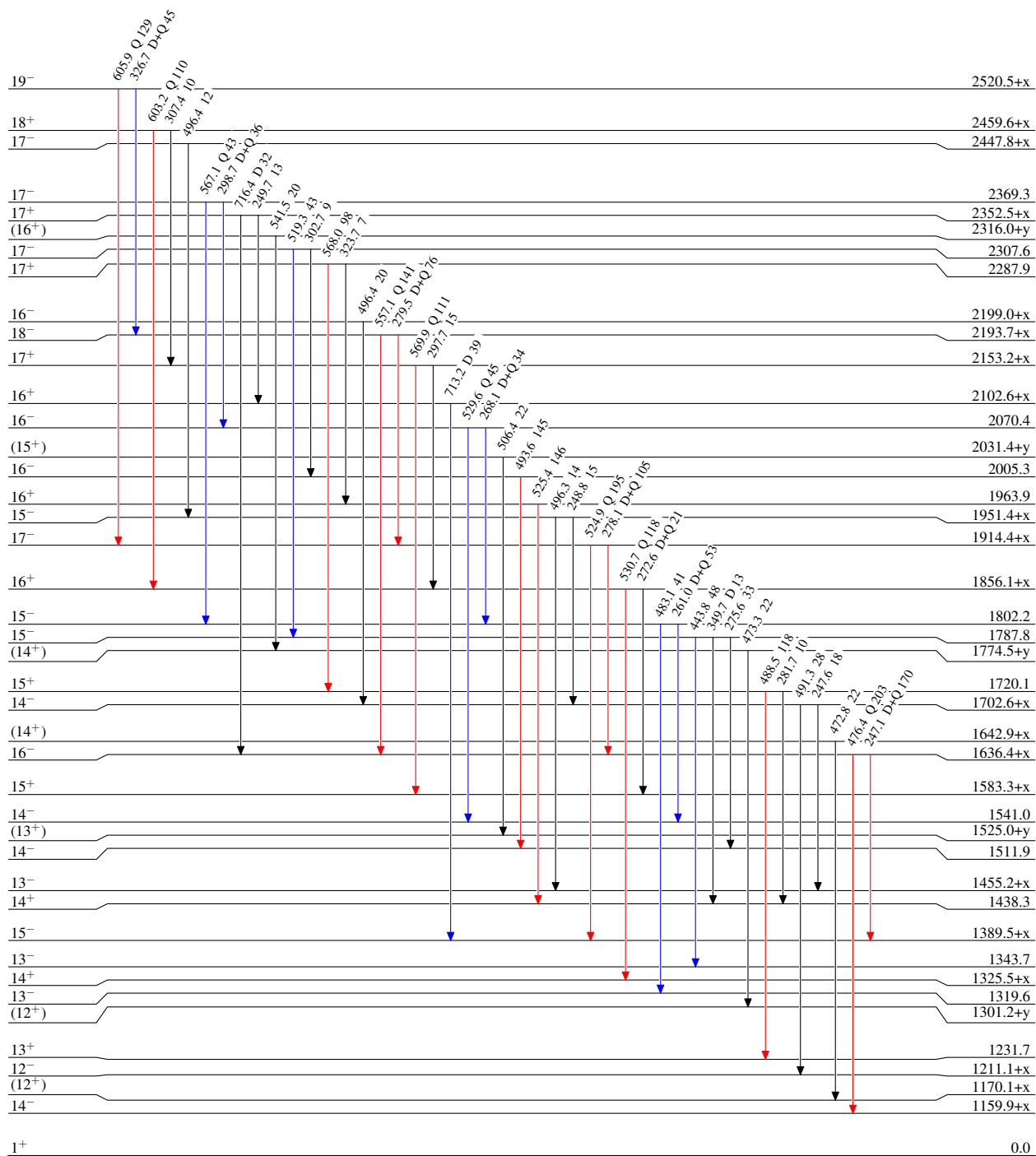
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

## Legend

- $\longrightarrow$   $I_\gamma < 2\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma < 10\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



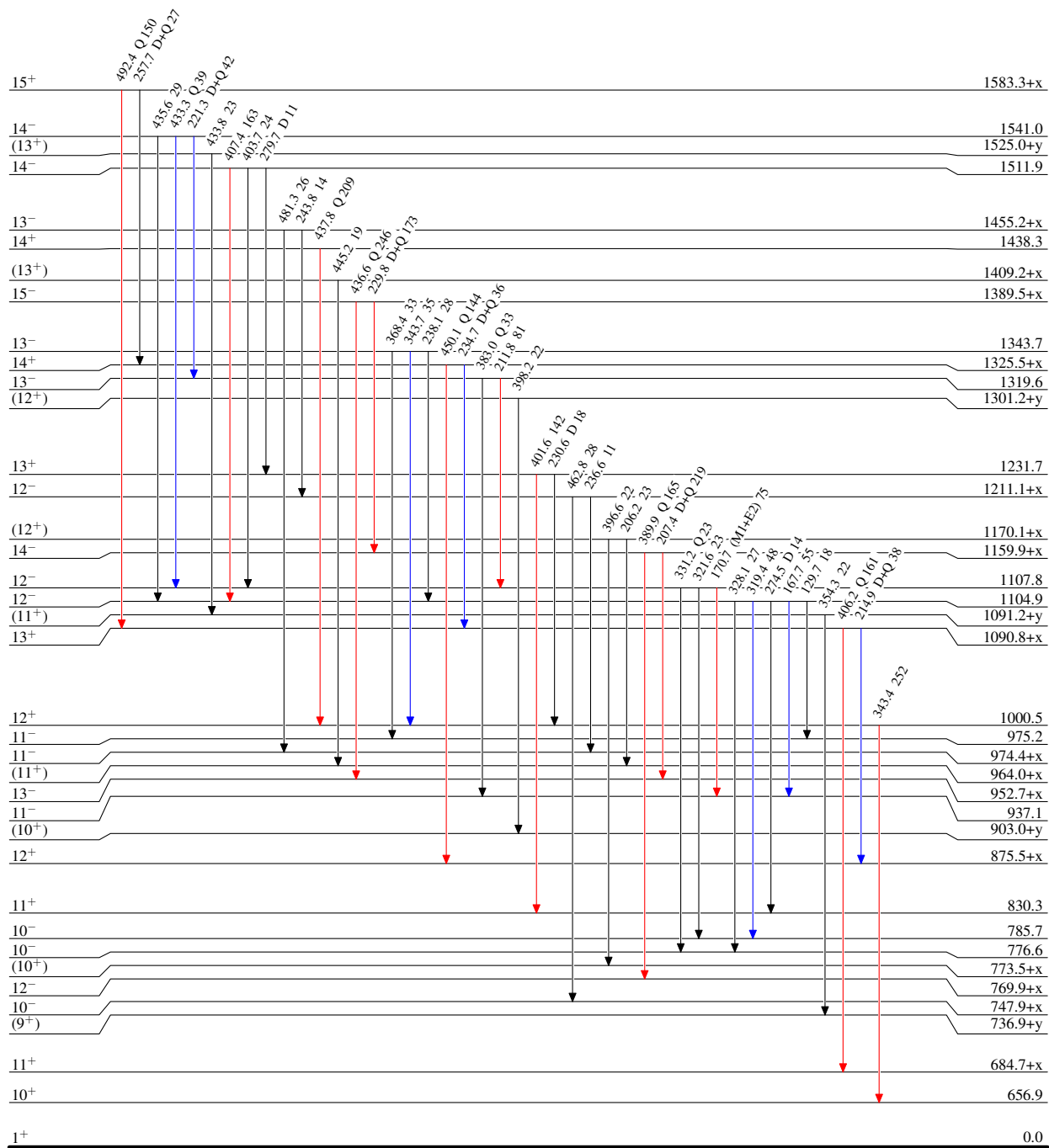
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

## Legend

- $\longrightarrow$   $I_\gamma < 2\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma < 10\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



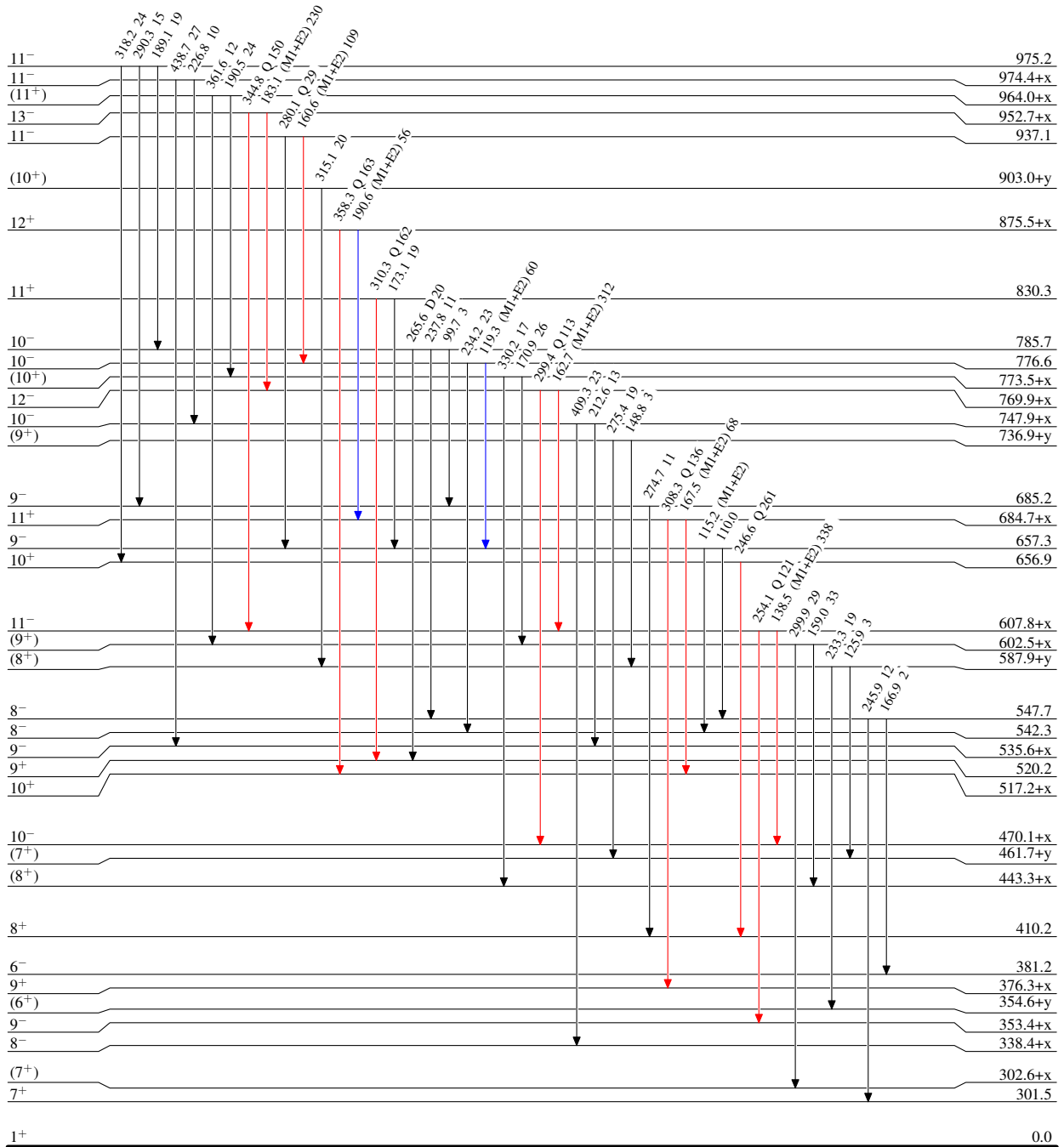
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

Legend

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



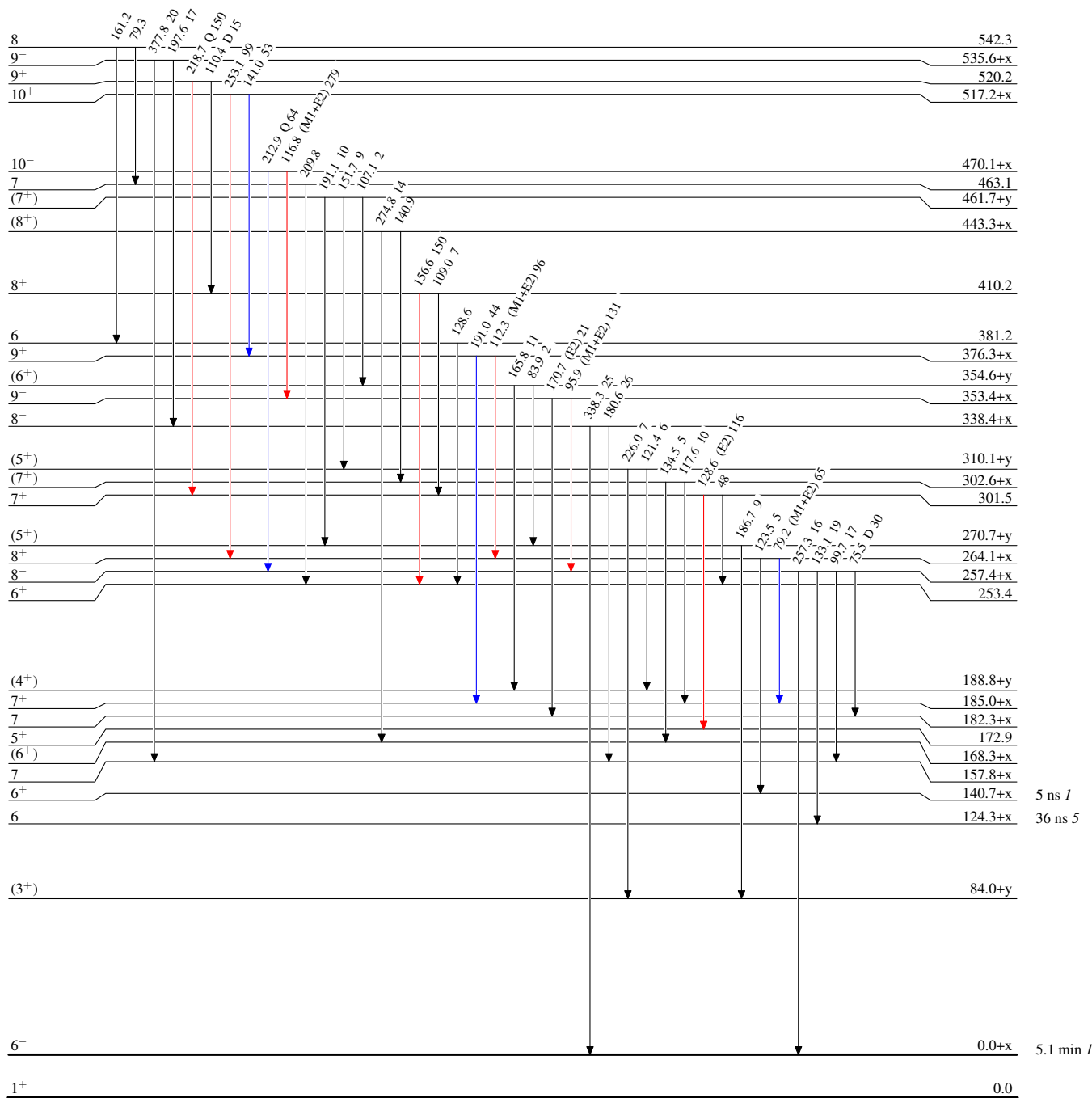
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

Legend

- $\longrightarrow$   $I_\gamma < 2\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma < 10\% \times I_\gamma^{\text{max}}$   
 $\longrightarrow$   $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



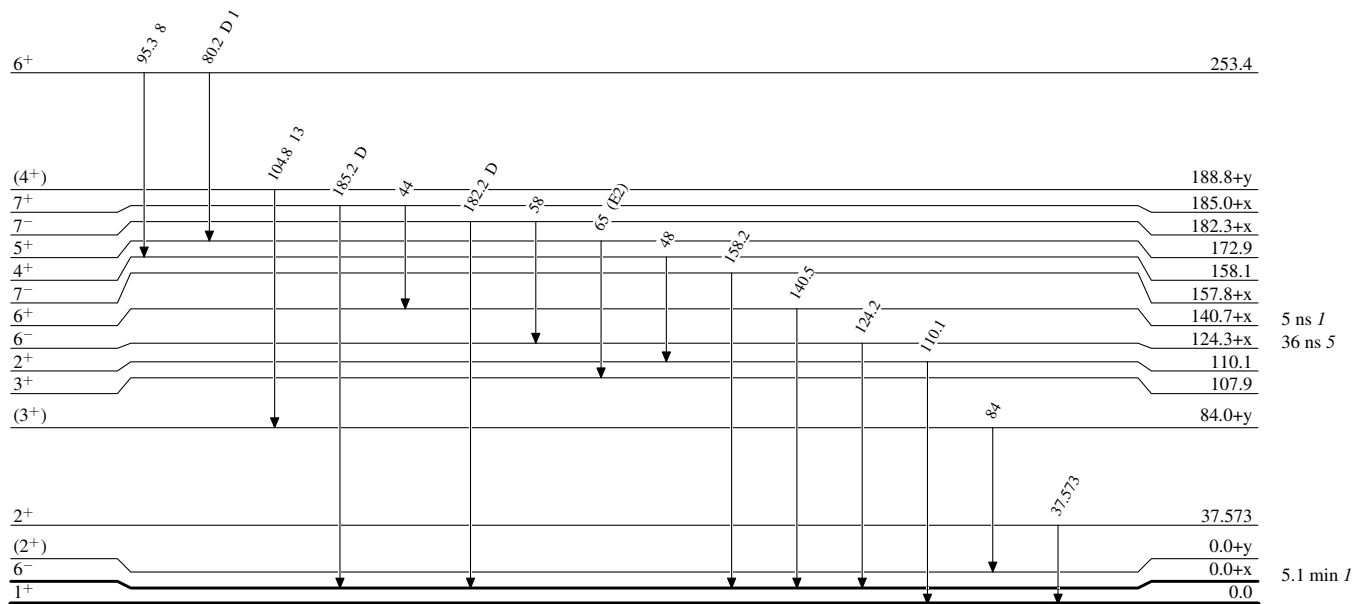
$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05

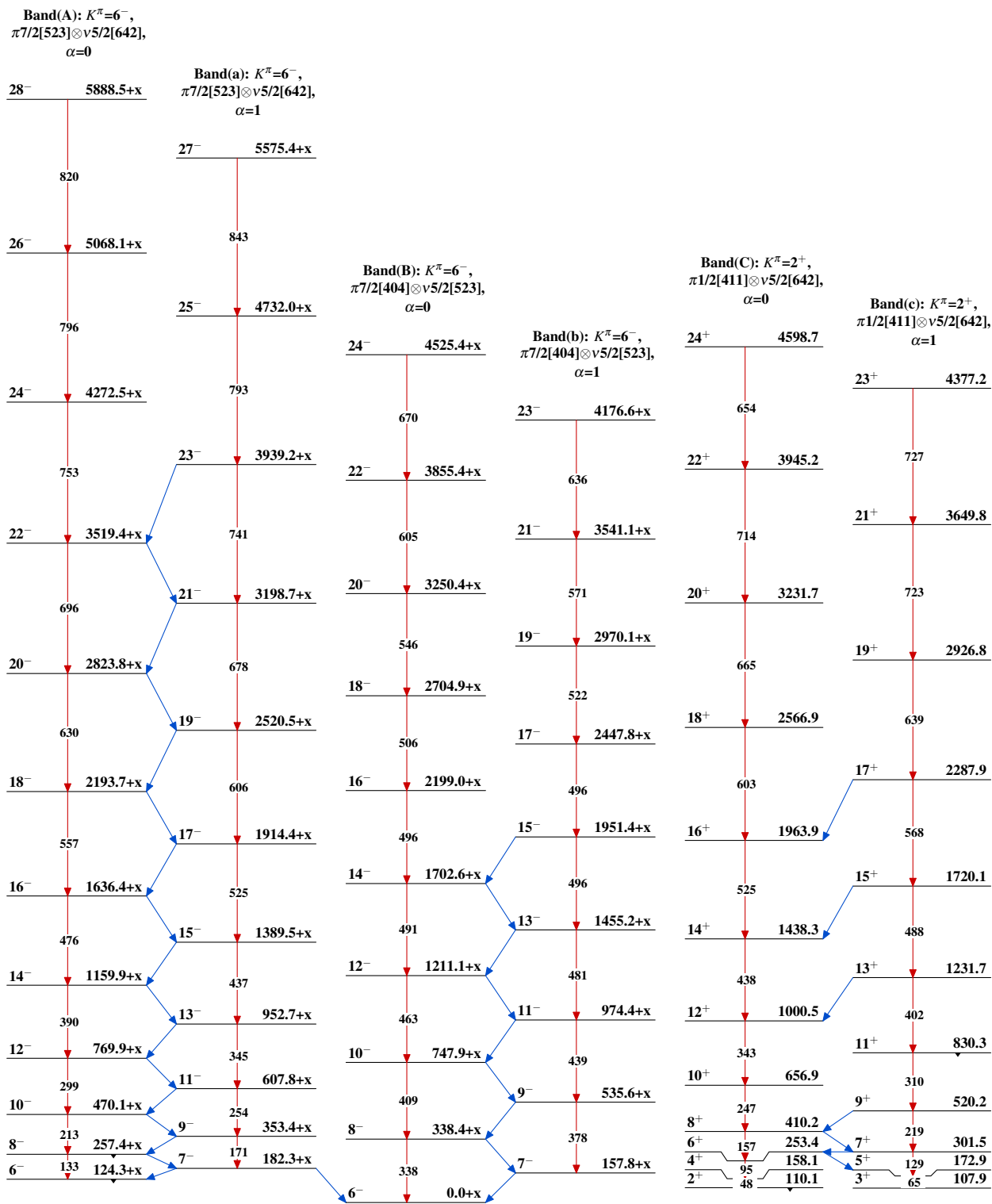
Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

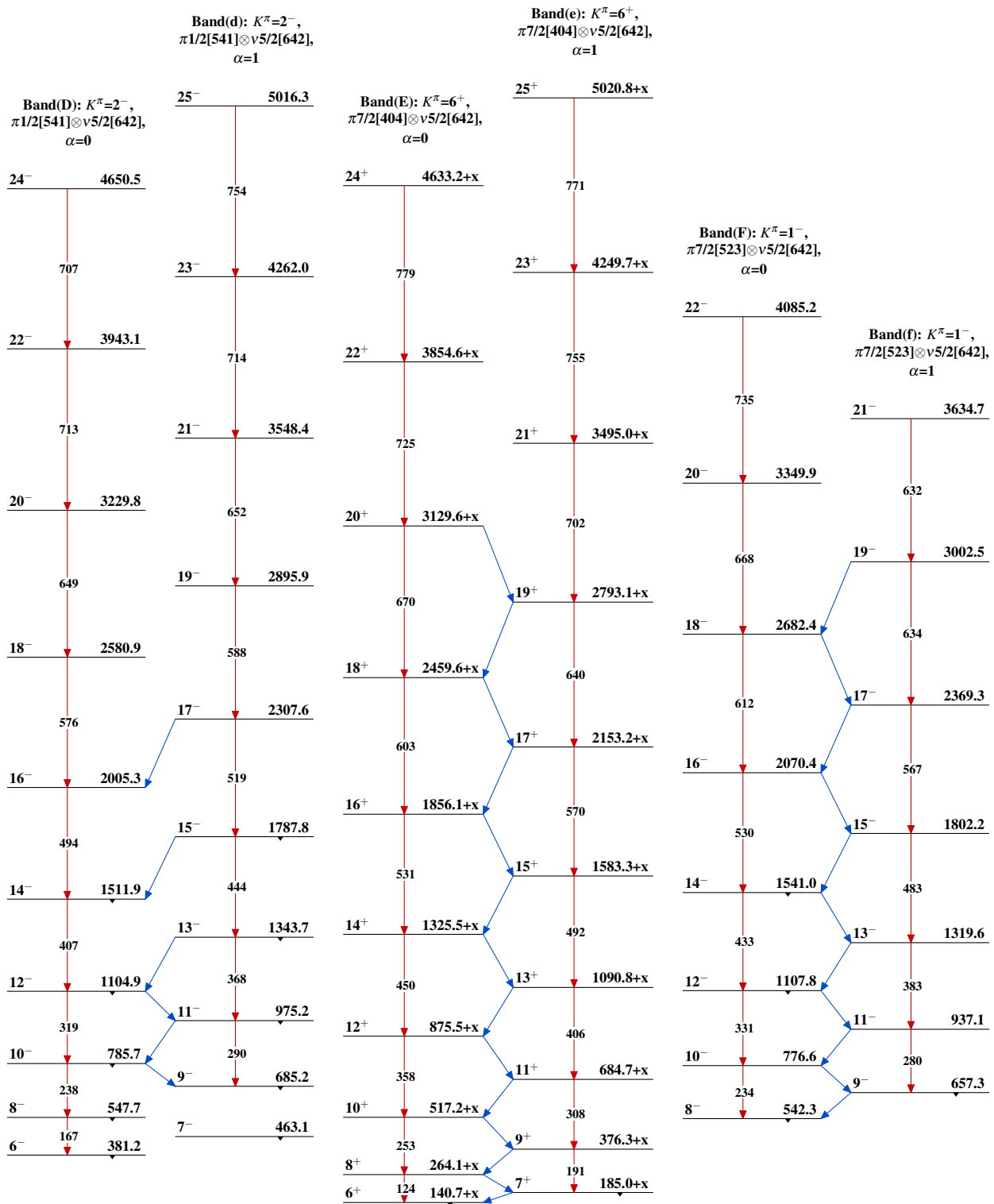
Legend

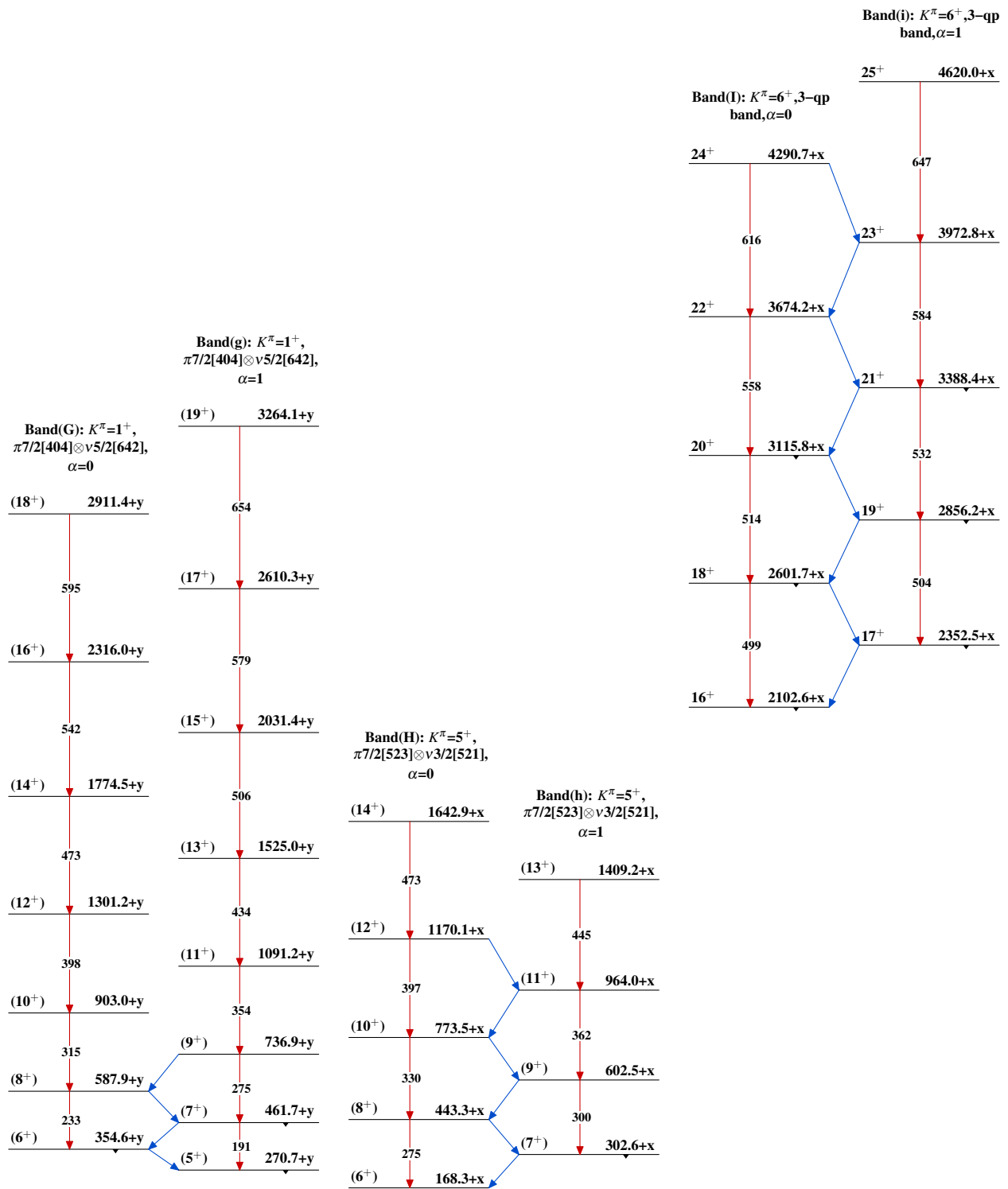
- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$


 $^{164}_{69}\text{Tm}_{95}$

$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05 $^{164}_{69}\text{Tm}_{95}$

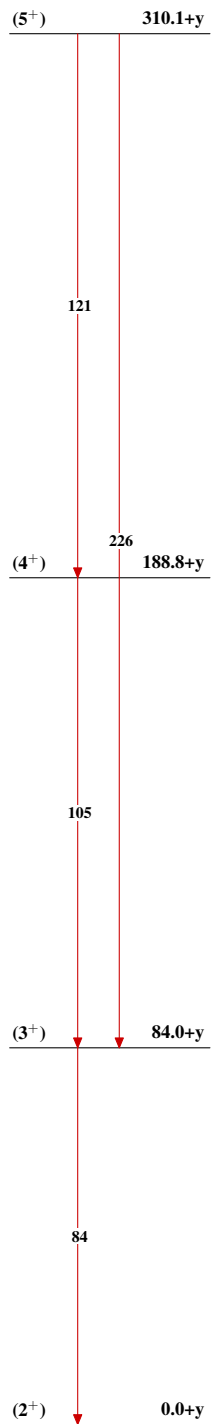


$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05 (continued) $^{164}_{69}\text{Tm}_{95}$

$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05 (continued)

$^{150}\text{Nd}(^{19}\text{F},5\text{n}\gamma)$  1999Re05 (continued)

Band(J): Band based on  
(2<sup>+</sup>)



$^{164}_{69}\text{Tm}_{95}$