

$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  1990Ko49

| Type            | Author                    | History | Citation          | Literature Cutoff Date |
|-----------------|---------------------------|---------|-------------------|------------------------|
| Full Evaluation | Balraj Singh and Jun Chen |         | NDS 158, 1 (2019) | 16-May-2019            |

1990Ko49: E=fast neutrons was produced from a reactor. Target was metallic Ge.  $\gamma$  rays were detected with Ge(Li) and NaI(Tl) detectors. Measured  $E\gamma$ ,  $I\gamma$ ,  $\gamma$ -ray yields. Deduced levels, J,  $\pi$ . Comparisons with theoretical calculations.

Additional information 1.

 $^{73}\text{Ge}$  Levels

| E(level) <sup>†</sup> | J $\pi$ <sup>‡</sup>                | population intensity <sup>#</sup> | Comments                            |
|-----------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| 0.0                   | 9/2 <sup>+</sup>                    |                                   |                                     |
| 13.10 15              | 5/2 <sup>+</sup>                    |                                   |                                     |
| 66.72 19              | 1/2 <sup>-</sup>                    |                                   |                                     |
| 68.69 12              | 7/2 <sup>+</sup>                    |                                   |                                     |
| 353.58 15             | (5/2) <sup>-</sup>                  |                                   |                                     |
| 363.96 17             | 3/2 <sup>-</sup>                    | 7.1 4                             |                                     |
| 392.54 20             | 3/2 <sup>-</sup>                    | 7.3 3                             |                                     |
| 498.89 20             | 7/2 <sup>+</sup>                    | 18.2 4                            | J $\pi$ : 5/2 from 1990Ko49.        |
| 501                   | 5/2 <sup>+</sup>                    |                                   | Level introduced by evaluators.     |
| 554.82 23             | 1/2 <sup>+</sup>                    | 1.7 3                             |                                     |
| 597.67 19             | 5/2 <sup>-</sup>                    | 15.21 4                           | J $\pi$ : 5/2 from 1990Ko49.        |
| 658.70 12             | 9/2 <sup>+</sup>                    | 49 3                              |                                     |
| 741.73 15             | 7/2 <sup>(-)</sup>                  | >20                               |                                     |
| 777.39 18             | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 4.5 5                             | J $\pi$ : 3/2 from 1990Ko49.        |
| 825.61 20             | 13/2 <sup>+</sup>                   | 44 2                              |                                     |
| 867.98 14             | 11/2 <sup>+</sup>                   | 42 2                              |                                     |
| 893.5 11              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 1.1 2                             | J $\pi$ : 1/2 from 1990Ko49.        |
| 906.65 16             | (5/2 <sup>+</sup> )                 | 8.7 6                             |                                     |
| 916.04 23             | 5/2 <sup>+</sup>                    | 9.1 3                             |                                     |
| 929.9 11              | (1/2 <sup>+</sup> )                 | $\approx$ 1                       |                                     |
| 993.97 14             | (9/2 <sup>+</sup> )                 | 26.1 6                            |                                     |
| 1010.14 16            | (5/2 <sup>+</sup> )                 | 7.9 4                             |                                     |
| 1043.15 22            | 3/2 <sup>-</sup>                    | 2.6 3                             |                                     |
| 1130.18 24            | (9/2 <sup>-</sup> )                 | 20.5 4                            |                                     |
| 1131.50 24            | (5/2, 7/2, 9/2) <sup>+</sup>        | 13.2 4                            | J $\pi$ : 7/2 from 1990Ko49.        |
| 1131.9 5              | 1/2 <sup>-</sup>                    | 1.0 3                             |                                     |
| 1262.71 25            | 3/2 <sup>-</sup>                    | 2.6 6                             |                                     |
| 1312.7 3              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 2.2 5                             | J $\pi$ : 3/2 from 1990Ko49.        |
| 1339.3 4              | (5/2 <sup>+</sup> )                 | 0.7 2                             | J $\pi$ : 1/2 from 1990Ko49.        |
| 1388.6 3              | (3/2 <sup>-</sup> )                 | 1.8 3                             |                                     |
| 1525.58 23            | 11/2 <sup>(-)</sup>                 | 3.9 5                             | J $\pi$ : (5/2, 7/2) from 1990Ko49. |
| 1609.96 17            | 9/2 <sup>+</sup>                    | 10.0 6                            |                                     |
| 1757.9 3              | 7/2 <sup>+</sup> , 9/2 <sup>+</sup> | 5.7 2                             | J $\pi$ : 7/2 from 1990Ko49.        |
| 1871.4 3              | 17/2 <sup>(+)</sup>                 | 6 1                               |                                     |
| 1912.2? 6             | 5/2 <sup>+</sup>                    |                                   | J $\pi$ : not given in 1990Ko49.    |
| 1992.5 4              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 1.9 2                             | J $\pi$ : 5/2 from 1990Ko49.        |
| 2003.8 3              | (5/2 <sup>+</sup> )                 | 2.2 3                             |                                     |
| 2037.9 6              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 0.3 2                             | J $\pi$ : 1/2 from 1990Ko49.        |
| 2066.1 7              | 1/2 <sup>+</sup>                    | 0.6 2                             |                                     |
| 2101.9 3              | (5/2 <sup>+</sup> )                 | 1.5 3                             |                                     |
| 2141.4 6              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 0.8 3                             | J $\pi$ : 3/2 from 1990Ko49.        |
| 2188.7 6              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 0.2 1                             | J $\pi$ : 1/2 from 1990Ko49.        |
| 2217.0 3              | 5/2 <sup>+</sup>                    | 1.7 3                             |                                     |
| 2319.6 4              | 3/2 <sup>+</sup>                    | 0.55 10                           |                                     |
| 2361.7 6              | (1/2 <sup>+</sup> )                 | 0.20 5                            |                                     |

Continued on next page (footnotes at end of table)

$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  1990Ko49 (continued) $^{73}\text{Ge}$  Levels (continued)

<sup>†</sup> From least-squares fit to  $\gamma$ -ray energies, assuming  $\Delta E_{\gamma}=0.2$  keV for  $I_{\gamma}>1$ , 0.5 keV for  $I_{\gamma}<1$ , and 1 keV for  $E_{\gamma}$  values quoted to nearest keV, for fitting purpose only.

<sup>‡</sup> From Adopted Levels. The spin assignments for levels above 68.7 from 1990Ko49 based on comparison of experimental yields with Hauser-Feshbach-Moldauer calculations are given under comments if different from Adopted Levels, unless otherwise noted.

<sup>#</sup> From 1990Ko49.

| $\gamma(^{73}\text{Ge})$  |                           |                     |                                     |         |                     |                   | Comments                                                                                                                                                                                                           |
|---------------------------|---------------------------|---------------------|-------------------------------------|---------|---------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $E_{\gamma}$ <sup>†</sup> | $I_{\gamma}$ <sup>†</sup> | $E_i(\text{level})$ | $J_i^{\pi}$                         | $E_f$   | $J_f^{\pi}$         | $I_{(\gamma+ce)}$ |                                                                                                                                                                                                                    |
| 233.6                     | 8.33 <sup>‡</sup> 20      | 597.67              | 5/2 <sup>-</sup>                    | 363.96  | 3/2 <sup>-</sup>    |                   | E <sub>γ</sub> : from Adopted Gammas, based on results from other $\gamma$ spectroscopy studies. E <sub>γ</sub> =286.8 quoted by 1990Ko49 seems to be in error since no 286.8 gamma was reported in other studies. |
| 284.9                     | 63 3                      | 353.58              | (5/2) <sup>-</sup>                  | 68.69   | 7/2 <sup>+</sup>    | 25 3              |                                                                                                                                                                                                                    |
| 297.2                     | 18.1 4                    | 363.96              | 3/2 <sup>-</sup>                    | 66.72   | 1/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 325.8                     | 15.8 3                    | 392.54              | 3/2 <sup>-</sup>                    | 66.72   | 1/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 335.3                     | 1.6 2                     | 993.97              | (9/2) <sup>+</sup>                  | 658.70  | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 340.5                     | 9.1 2                     | 353.58              | (5/2) <sup>-</sup>                  | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 350.7                     | 0.4 2                     | 363.96              | 3/2 <sup>-</sup>                    | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 377.8                     | 4.5 3                     | 741.73              | 7/2 <sup>(-)</sup>                  | 363.96  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 388.1                     | 17.5 5                    | 741.73              | 7/2 <sup>(-)</sup>                  | 353.58  | (5/2) <sup>-</sup>  |                   |                                                                                                                                                                                                                    |
| 412.4                     | 4.0 2                     | 1010.14             | (5/2 <sup>+</sup> )                 | 597.67  | 5/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 430.3                     | 18.5 4                    | 498.89              | 7/2 <sup>+</sup>                    | 68.69   | 7/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 431                       | ≈1                        | 929.9               | (1/2 <sup>+</sup> )                 | 501     | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 485.5                     | 0.8 1                     | 498.89              | 7/2 <sup>+</sup>                    | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 488.2                     | 0.3 1                     | 554.82              | 1/2 <sup>+</sup>                    | 66.72   | 1/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 499.0                     | 0.1                       | 498.89              | 7/2 <sup>+</sup>                    | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 501                       | 1.1 2                     | 893.5               | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 392.54  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 531.0                     | 10.88 <sup>‡</sup> 40     | 597.67              | 5/2 <sup>-</sup>                    | 66.72   | 1/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 541.7                     | 1.4 3                     | 554.82              | 1/2 <sup>+</sup>                    | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 562.5                     | 8.6 3                     | 916.04              | 5/2 <sup>+</sup>                    | 353.58  | (5/2) <sup>-</sup>  |                   |                                                                                                                                                                                                                    |
| 590.0                     | 13 3                      | 658.70              | 9/2 <sup>+</sup>                    | 68.69   | 7/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 617.6                     | 2.5 2                     | 1010.14             | (5/2 <sup>+</sup> )                 | 392.54  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 645.9                     | 6.0 3                     | 658.70              | 9/2 <sup>+</sup>                    | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 650.8                     | 0.3 1                     | 1043.15             | 3/2 <sup>-</sup>                    | 392.54  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 658.9                     | 33.5 5                    | 658.70              | 9/2 <sup>+</sup>                    | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 679.3                     | 0.3 1                     | 1043.15             | 3/2 <sup>-</sup>                    | 363.96  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 708.8                     | 1.1 2                     | 777.39              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 68.69   | 7/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 729.8                     | 1.9 2                     | 1992.5              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 1262.71 | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 739.4                     | 0.5 2                     | 1131.9              | 1/2 <sup>-</sup>                    | 392.54  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 741.6                     | 8.4 5                     | 1609.96             | 9/2 <sup>+</sup>                    | 867.98  | 11/2 <sup>+</sup>   |                   |                                                                                                                                                                                                                    |
| 741.7                     | >1.0                      | 741.73              | 7/2 <sup>(-)</sup>                  | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 764.1                     | 5.3 2                     | 777.39              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 13.10   | 5/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 768                       | 1.1 3                     | 1131.9              | 1/2 <sup>-</sup>                    | 363.96  | 3/2 <sup>-</sup>    |                   |                                                                                                                                                                                                                    |
| 776.6                     | 21.0 4                    | 1130.18             | (9/2 <sup>-</sup> )                 | 353.58  | (5/2) <sup>-</sup>  |                   |                                                                                                                                                                                                                    |
| 783.8                     | 3.5 5                     | 1525.58             | 11/2 <sup>(-)</sup>                 | 741.73  | 7/2 <sup>(-)</sup>  |                   |                                                                                                                                                                                                                    |
| 784.5                     | 0.2 1                     | 1339.3              | (5/2) <sup>+</sup>                  | 554.82  | 1/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 799.1                     | 13.5 5                    | 867.98              | 11/2 <sup>+</sup>                   | 68.69   | 7/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 825.6                     | 50 2                      | 825.61              | 13/2 <sup>+</sup>                   | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 837.9                     | 4.0 5                     | 906.65              | (5/2 <sup>+</sup> )                 | 68.69   | 7/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 851.2                     | 5.7 2                     | 1757.9              | 7/2 <sup>+</sup> , 9/2 <sup>+</sup> | 906.65  | (5/2 <sup>+</sup> ) |                   |                                                                                                                                                                                                                    |
| 867.8                     | 36 2                      | 867.98              | 11/2 <sup>+</sup>                   | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |
| 873.6                     | 0.5 1                     | 2003.8              | (5/2 <sup>+</sup> )                 | 1130.18 | (9/2 <sup>-</sup> ) |                   |                                                                                                                                                                                                                    |
| 906.7                     | 10.4 2                    | 906.65              | (5/2 <sup>+</sup> )                 | 0.0     | 9/2 <sup>+</sup>    |                   |                                                                                                                                                                                                                    |

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$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  **1990Ko49** (continued) $\gamma(^{73}\text{Ge})$  (continued)

| $E_\gamma^\dagger$ | $I_\gamma^\dagger$ | $E_i(\text{level})$ | $J_i^\pi$                           | $E_f$   | $J_f^\pi$                           | Mult. | Comments                                         |
|--------------------|--------------------|---------------------|-------------------------------------|---------|-------------------------------------|-------|--------------------------------------------------|
| 915.8              | 0.7 1              | 916.04              | 5/2 <sup>+</sup>                    | 0.0     | 9/2 <sup>+</sup>                    |       |                                                  |
| 920.2              | 2.2 5              | 1312.7              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 392.54  | 3/2 <sup>-</sup>                    |       |                                                  |
| 925.3              | 1.4 1              | 993.97              | (9/2) <sup>+</sup>                  | 68.69   | 7/2 <sup>+</sup>                    |       |                                                  |
| 934.1              | 0.6 2              | 2066.1              | 1/2 <sup>+</sup>                    | 1131.9  | 1/2 <sup>-</sup>                    |       |                                                  |
| 951.7              | 1.2 1              | 1609.96             | 9/2 <sup>+</sup>                    | 658.70  | 9/2 <sup>+</sup>                    |       |                                                  |
| 975.4              | 0.5 2              | 1339.3              | (5/2) <sup>+</sup>                  | 363.96  | 3/2 <sup>-</sup>                    |       |                                                  |
| 993.9              | 23.1 6             | 993.97              | (9/2) <sup>+</sup>                  | 0.0     | 9/2 <sup>+</sup>                    |       |                                                  |
| 996.1              | 1.8 3              | 1388.6              | (3/2) <sup>-</sup>                  | 392.54  | 3/2 <sup>-</sup>                    |       |                                                  |
| 1010.2             | 1.5 3              | 1010.14             | (5/2) <sup>+</sup>                  | 0.0     | 9/2 <sup>+</sup>                    |       |                                                  |
| 1030.0             | 2.0 3              | 1043.15             | 3/2 <sup>-</sup>                    | 13.10   | 5/2 <sup>+</sup>                    |       |                                                  |
| 1045.8             | 6 1                | 1871.4              | 17/2 <sup>(+)</sup>                 | 825.61  | 13/2 <sup>+</sup>                   |       |                                                  |
| 1062.8             | 14.9 3             | 1131.50             | (5/2, 7/2, 9/2) <sup>+</sup>        | 68.69   | 7/2 <sup>+</sup>                    |       |                                                  |
| 1085.5             | 1.7 3              | 2217.0              | 5/2 <sup>+</sup>                    | 1131.50 | (5/2, 7/2, 9/2) <sup>+</sup>        |       |                                                  |
| 1172.3             | 0.4 1              | 1525.58             | 11/2 <sup>(-)</sup>                 | 353.58  | (5/2) <sup>-</sup>                  | [M3]  | This transition unlikely as it requires mult=M3. |
| 1249.6             | 4.5 6              | 1262.71             | 3/2 <sup>-</sup>                    | 13.10   | 5/2 <sup>+</sup>                    |       |                                                  |
| 1324.5             | 1.5 3              | 2101.9              | (5/2) <sup>+</sup>                  | 777.39  | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> |       |                                                  |
| 1413.3             | 0.33 10            | 1912.2?             | 5/2 <sup>+</sup>                    | 498.89  | 7/2 <sup>+</sup>                    |       |                                                  |
| 1445.6             | 0.20 5             | 2361.7              | (1/2) <sup>+</sup>                  | 916.04  | 5/2 <sup>+</sup>                    |       |                                                  |
| 1541.7             | 0.4 1              | 2319.6              | 3/2 <sup>+</sup>                    | 777.39  | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> |       |                                                  |
| 1591.0             | 0.2 1              | 2188.7              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 597.67  | 5/2 <sup>-</sup>                    |       |                                                  |
| 1609.4             | 0.4 3              | 1609.96             | 9/2 <sup>+</sup>                    | 0.0     | 9/2 <sup>+</sup>                    |       |                                                  |
| 1610.9             | 0.7 2              | 2003.8              | (5/2) <sup>+</sup>                  | 392.54  | 3/2 <sup>-</sup>                    |       |                                                  |
| 1821.1             | 0.15 3             | 2319.6              | 3/2 <sup>+</sup>                    | 498.89  | 7/2 <sup>+</sup>                    |       |                                                  |
| 2004.1             | 1.0 2              | 2003.8              | (5/2) <sup>+</sup>                  | 0.0     | 9/2 <sup>+</sup>                    |       |                                                  |
| 2024.8             | 0.3 2              | 2037.9              | 1/2 <sup>-</sup> , 3/2 <sup>-</sup> | 13.10   | 5/2 <sup>+</sup>                    |       |                                                  |
| 2072.7             | 0.8 3              | 2141.4              | 3/2 <sup>+</sup> , 5/2 <sup>+</sup> | 68.69   | 7/2 <sup>+</sup>                    |       |                                                  |

<sup>†</sup> From **1990Ko49**, unless otherwise noted. No uncertainties in  $E_\gamma$  are given in **1990Ko49**; uncertainties are assumed by the evaluators in the fitting to obtain level energies.

<sup>‡</sup> Uncertainty of 0.02 for 233.6 $\gamma$  and 0.04 for 531.0 $\gamma$  quoted by **1990Ko49** seems unrealistic in view of uncertainties for other  $\gamma$  rays. The evaluators have increased these by a factor of 10.

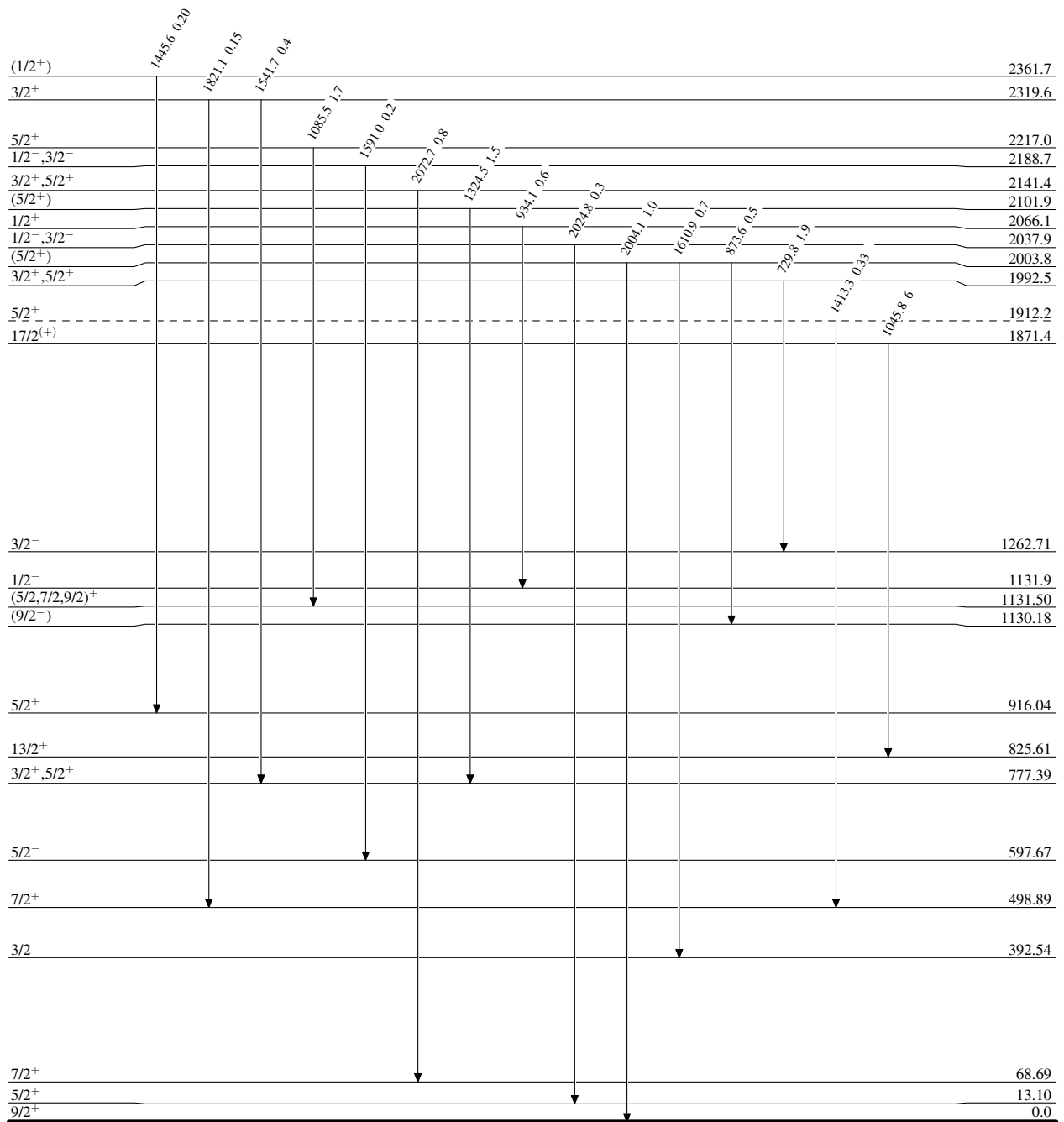
$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  1990Ko49

## Level Scheme

Intensities: Relative  $I_\gamma$ 

## Legend

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

 $^{73}\text{Ge}_{41}$

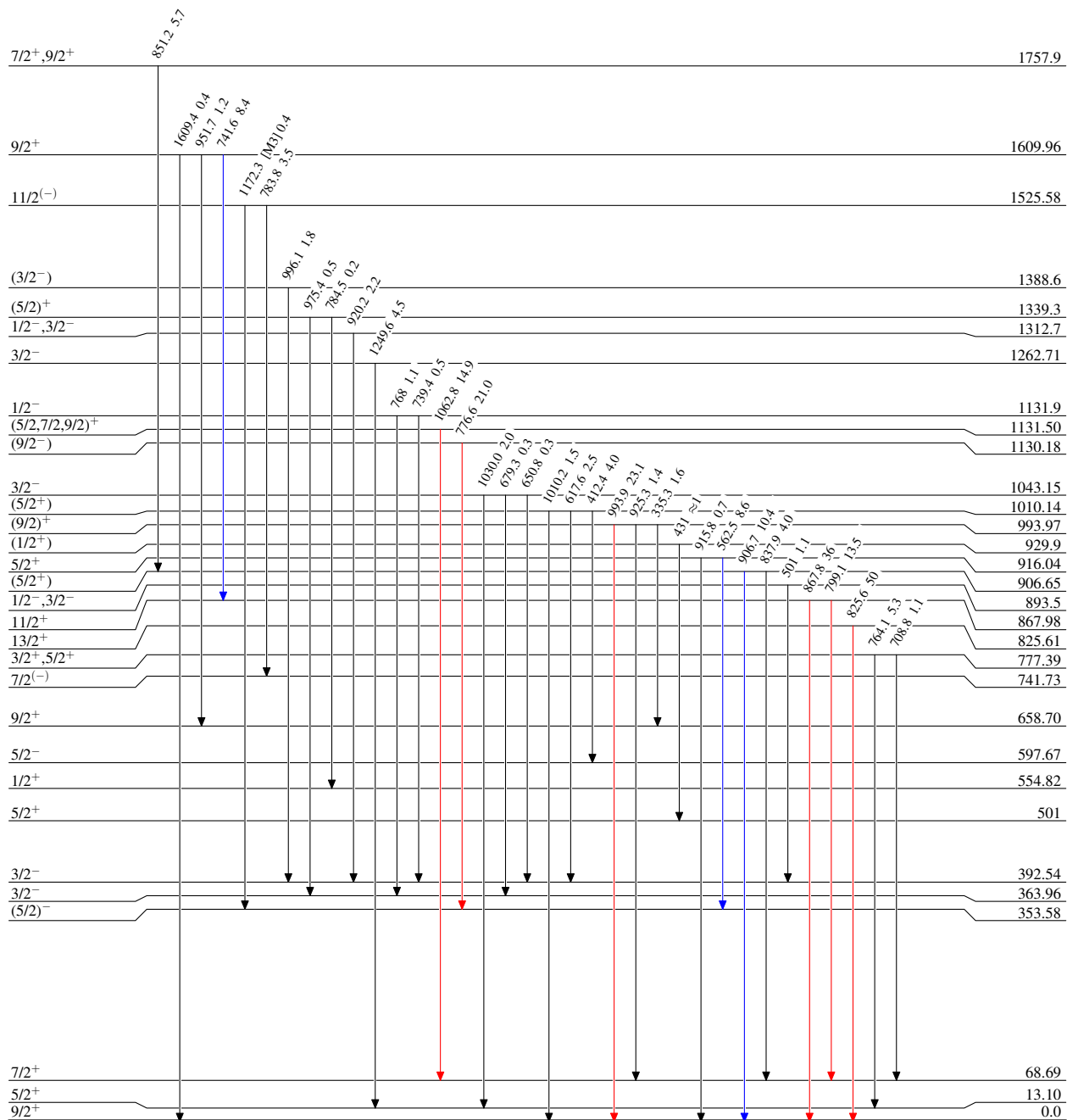
$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  1990Ko49

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

## Legend

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

 $^{73}_{32}\text{Ge}_{41}$

$^{73}\text{Ge}(\text{n},\text{n}'\gamma)$  1990Ko49

## Level Scheme (continued)

Intensities: Relative  $I_\gamma$ 

## Legend

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

