

$^{232}\text{Th}(^{209}\text{Bi}, ^{210}\text{Bi}\gamma)$ **2002AbZV**

| Type | Author | History | Citation | Literature Cutoff Date |
|-----------------|---|---------|---------------------|------------------------|
| Full Evaluation | Balraj Singh, Jagdish K. Tuli, and Edgardo Browne | | NDS 185, 560 (2022) | 31-Aug-2022 |

2002AbZV: $E(^{209}\text{Bi})=1406$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin using Gammasphere array with 101 Compton-suppressed HPGe detectors at ATLAS-ANL facility.

Author mentioned that a firm assignment of the two most strongly populated γ cascades to the signature partners of $\nu 5/2[633]$ band could not be made as these bands could not be connected to the low-lying states. In addition, band members up to $19/2^+$ for the $\nu 5/2[633]$ band proposed by **1993AcZZ** on the basis of $\gamma(\text{ce})$ -coin data in $^{232}\text{Th}(d,p2n\gamma)$ reaction are different from those in **2002AbZV**. Due to tentative nature of the bands in **2002AbZV**, no data from this are given in the Adopted Levels, Gammas dataset.

^{231}Th Levels

| <u>$E(\text{level})^\dagger$</u> | <u>J^π^\ddagger</u> | <u>$E(\text{level})^\dagger$</u> | <u>J^π^\ddagger</u> | <u>$E(\text{level})^\dagger$</u> | <u>J^π^\ddagger</u> | <u>$E(\text{level})^\dagger$</u> | <u>J^π^\ddagger</u> |
|---|------------------------------------|---|------------------------------------|---|------------------------------------|---|------------------------------------|
| 0.0 ^{#@} | 5/2 ⁺ # | 476.3 [@] 7 | 17/2 ⁺ | 1359.2 [@] 12 | 29/2 ⁺ | 2544.9+x ^a 15 | |
| 0+x ^a | | 579.3 ^{&} 9 | 19/2 ⁺ | 1554.8 ^{&} 13 | 31/2 ⁺ | 2829.4 ^{&} 15 | 43/2 ⁺ |
| 41.98 ^{#&} 5 | 7/2 ⁺ # | 663.4+x ^a 9 | | 1696.3+x ^a 13 | | 2975.3 [@] 15 | 45/2 ⁺ |
| 96.09 ^{#@} 2 | 9/2 ⁺ # | 732.4 [@] 9 | 21/2 ⁺ | 1722.6 [@] 13 | 33/2 ⁺ | 3302.8 ^{&} 16 | 47/2 ⁺ |
| 161.4 ^{&} 5 | 11/2 ⁺ | 863.9 ^{&} 10 | 23/2 ⁺ | 1952.3 ^{&} 14 | 35/2 ⁺ | 3440.1 [@] 16 | 49/2 ⁺ |
| 184.4+x ^a 5 | | 968.4+x ^a 10 | | 2107.4+x ^a 14 | | 3799.4 ^{&} 17 | 51/2 ⁺ |
| 263.2 [@] 5 | 13/2 ⁺ | 1028.0 [@] 10 | 25/2 ⁺ | 2114.8 [@] 14 | 37/2 ⁺ | 3924.8 [@] 17 | 53/2 ⁺ |
| 343.0 ^{&} 7 | 15/2 ⁺ | 1191.1 ^{&} 12 | 27/2 ⁺ | 2378.4 ^{&} 15 | 39/2 ⁺ | 4426.7 [@] 18 | 57/2 ⁺ |
| 405.7+x ^a 7 | | 1316.2+x ^a 12 | | 2533.1 [@] 15 | 41/2 ⁺ | | |

[†] From $E\gamma$ data, assuming $\Delta E\gamma=0.5$ keV when not stated.

[‡] As given in **2002AbZV**, unless otherwise stated.

[#] From the Adopted Levels, assuming that the bands 1 and 2 in Fig. 4.10 of **2002AbZV** are connected to the lowest two known excited states at 42 and 96 keV.

[@] Band(A): $\nu 5/2[633], \alpha=+1/2$. Band assignment is tentative in **2002AbZV**, as the structure is not connected to the well-known lower lying states.

[&] Band(a): $\nu 5/2[633], \alpha=-1/2$. Band assignment is tentative in **2002AbZV**, as the structure is not connected to the well-known lower lying states.

^a Band(B): γ cascade. Assignment of this band is tentative.

$\gamma(^{231}\text{Th})$

| <u>E_γ</u> | <u>$E_i(\text{level})$</u> | <u>J_i^π</u> | <u>E_f</u> | <u>J_f^π</u> | <u>E_γ</u> | <u>$E_i(\text{level})$</u> | <u>J_i^π</u> | <u>E_f</u> | <u>J_f^π</u> |
|------------------------------|---------------------------------------|-----------------------------|-------------------------|-----------------------------|------------------------------|---------------------------------------|-----------------------------|-------------------------|-----------------------------|
| 119.4 | 161.4 | 11/2 ⁺ | 41.98 | 7/2 ⁺ | 331.2 | 1359.2 | 29/2 ⁺ | 1028.0 | 25/2 ⁺ |
| 167.1 | 263.2 | 13/2 ⁺ | 96.09 | 9/2 ⁺ | 347.8 | 1316.2+x | | 968.4+x | |
| 181.6 | 343.0 | 15/2 ⁺ | 161.4 | 11/2 ⁺ | 363.4 | 1722.6 | 33/2 ⁺ | 1359.2 | 29/2 ⁺ |
| 184.4 | 184.4+x | | 0+x | | 363.7 | 1554.8 | 31/2 ⁺ | 1191.1 | 27/2 ⁺ |
| 213.1 | 476.3 | 17/2 ⁺ | 263.2 | 13/2 ⁺ | 380.1 | 1696.3+x | | 1316.2+x | |
| 221.3 | 405.7+x | | 184.4+x | | 392.2 | 2114.8 | 37/2 ⁺ | 1722.6 | 33/2 ⁺ |
| 236.3 | 579.3 | 19/2 ⁺ | 343.0 | 15/2 ⁺ | 397.5 | 1952.3 | 35/2 ⁺ | 1554.8 | 31/2 ⁺ |
| 256.1 | 732.4 | 21/2 ⁺ | 476.3 | 17/2 ⁺ | 411.1 | 2107.4+x | | 1696.3+x | |
| 257.7 | 663.4+x | | 405.7+x | | 418.3 | 2533.1 | 41/2 ⁺ | 2114.8 | 37/2 ⁺ |
| 284.6 | 863.9 | 23/2 ⁺ | 579.3 | 19/2 ⁺ | 426.1 | 2378.4 | 39/2 ⁺ | 1952.3 | 35/2 ⁺ |
| 295.6 | 1028.0 | 25/2 ⁺ | 732.4 | 21/2 ⁺ | 437.5 | 2544.9+x | | 2107.4+x | |
| 305.0 | 968.4+x | | 663.4+x | | 442.2 | 2975.3 | 45/2 ⁺ | 2533.1 | 41/2 ⁺ |
| 327.2 | 1191.1 | 27/2 ⁺ | 863.9 | 23/2 ⁺ | 451.0 | 2829.4 | 43/2 ⁺ | 2378.4 | 39/2 ⁺ |

Continued on next page (footnotes at end of table)

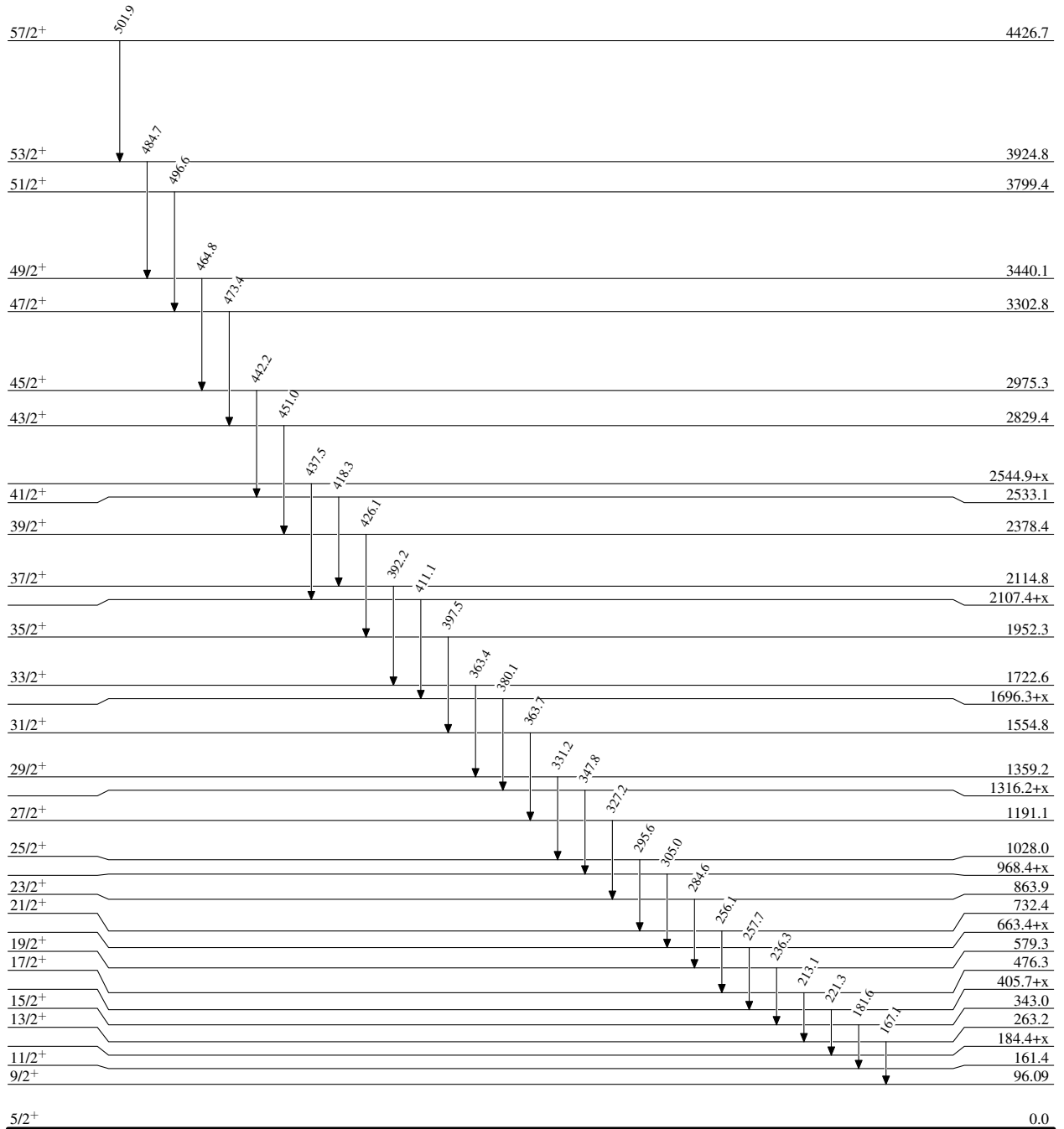
 $^{232}\text{Th}(^{209}\text{Bi}, ^{210}\text{Bi}\gamma)$ **2002AbZV (continued)**

 $\gamma(^{231}\text{Th})$ (continued)

| <u>E_γ</u> | <u>$E_i(\text{level})$</u> | <u>J_i^π</u> | <u>E_f</u> | <u>J_f^π</u> |
|------------------------------|---------------------------------------|-----------------------------|-------------------------|-----------------------------|
| 464.8 | 3440.1 | 49/2 ⁺ | 2975.3 | 45/2 ⁺ |
| 473.4 | 3302.8 | 47/2 ⁺ | 2829.4 | 43/2 ⁺ |
| 484.7 | 3924.8 | 53/2 ⁺ | 3440.1 | 49/2 ⁺ |
| 496.6 | 3799.4 | 51/2 ⁺ | 3302.8 | 47/2 ⁺ |
| 501.9 | 4426.7 | 57/2 ⁺ | 3924.8 | 53/2 ⁺ |

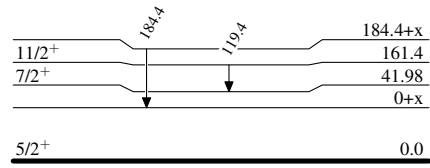
$^{232}\text{Th}(^{209}\text{Bi}, ^{210}\text{Bi}\gamma)$ 2002AbZV

Level Scheme

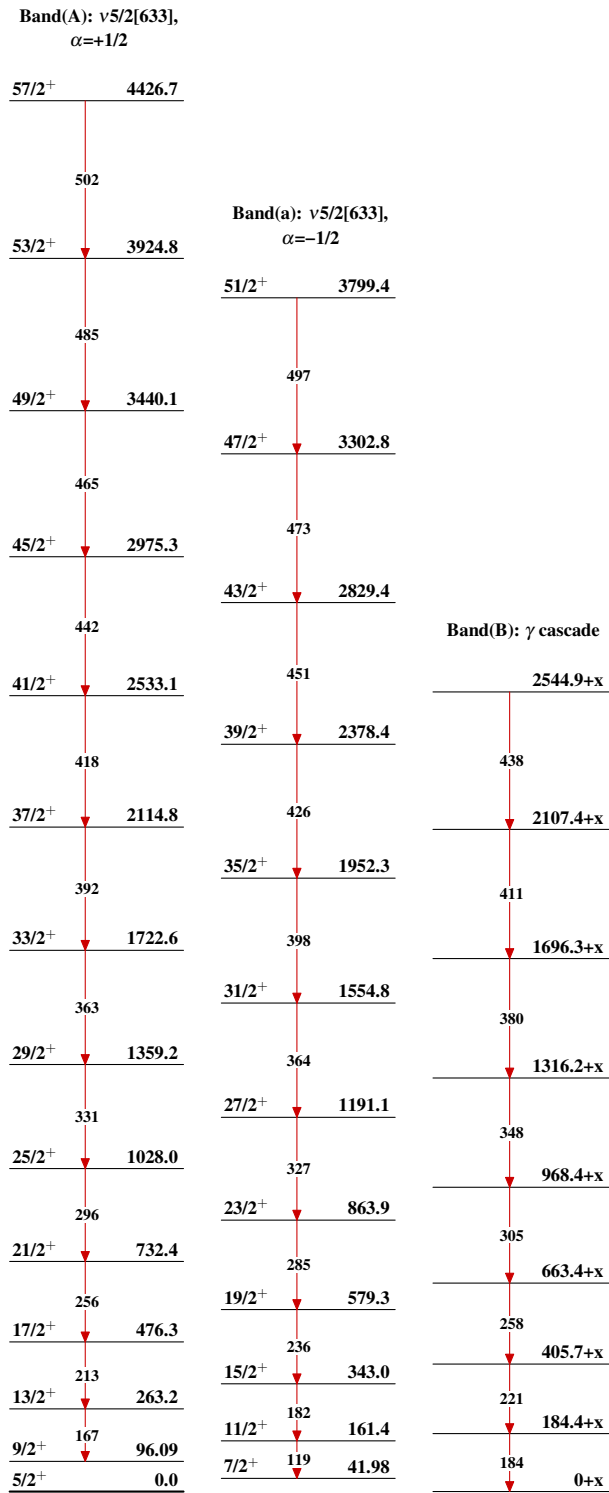
 $^{231}_{90}\text{Th}_{141}$

${}^{232}\text{Th}({}^{209}\text{Bi}, {}^{210}\text{Bi}\gamma)$ 2002AbZV

Level Scheme (continued)



${}^{231}_{90}\text{Th}_{141}$

$^{232}\text{Th}(^{209}\text{Bi}, ^{210}\text{Bi}\gamma)$ 2002AbZV $^{231}_{90}\text{Th}_{141}$