# $^{208}$Pb(x,x′γ)

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | M. J. Martin | NDS 108,1583 (2007) | 1-Jun-2007 |

Additional information 1.

See Separate Dataset For ($^{17}$O,$^{17}$O′γ),($^{17}$O,$^{17}$O′nγ)
1992Sc23 E($^{82}$Se)=420 MeV, E($^{64}$Ni)=350 MeV
1992Wo09 E($^{208}$Pb)=1290 MeV
1993Sc08 E($^{64}$Ni)=359 MeV, E($^{82}$Se)=420 MeV
1993ScZQ See 1993Sc08. This Reference Contains α More Complete Set Of Data Than Is Contained In 1993Sc08

1995Fa18 E($^{84}$Kr)=420 MeV
1995Mo39 E($^{208}$Pb)=1305 MeV. See 1999AmZX
1997Ve05 E($^{154}$Sm)=1000 MeV
1999AmZX E($^{208}$Pb)=1305 MeV, E($^{136}$Xe)=884 MeV
2001Wr02 E($^{76}$Ge)=420 MeV, E($^{136}$Xe)=775 MeV, E($^{208}$Pb)=1352 MeV
2004Br19 E($^{48}$Ca)=210 MeV
Others: 1977ChZH ($^{136}$Xe,$^{136}$Xe′γ)

## $^{208}$Pb Levels

A 2485γ, previously assigned to $^{208}$Pb by 1992Wo09 has been reassigned to $^{207}$Pb (see 1999AmZX, 1997Ve05, 1992Sc23). Data of 1995Fa18 are inconclusive on this point. No evidence has been found for two-phonon octupole vibrational states (see 1999AmZX, 1997Ve05). From the x=$^{136}$Xe work of 1999AmZX, the author concludes that if the lifetime of the members of the two-phonon states is >3 ps, then any photon transition from these states must have an intensity of <0.1% of Iγ(2614γ). For lifetimes between 0.5 and 3 ps, the upper limit will Be time dependent but for 1 ps will Be <0.4% of Iγ(2614γ). For τ<0.5 ps, No meaningful limit can Be extracted.

| E(level)‡ | Jπ† | $T_{1/2}$ | Comments |
|---|---|---|---|
| 0 | $0^+$ | | |
| 2614.522 *10* | $3^-$ | | Additional information 2. |
| 3197.711 *10* | $5^-$ | | Additional information 3. |
| 3474.94 *8* | $4^-$ | | |
| 3708.57 *10* | $5^-$ | | |
| 3920.05 *9* | $6^-$ | | |
| 3947.7 *10* | $4^-$ | | |
| 3961.20 *8* | $5^-$ | | |
| 4037.46 *6* | $7^-$ | | |
| 4124.9 *3* | $5^-$ | | |
| 4206.25 *16* | $6^-$ | | |
| 4324.03 *7* | $4^+$ | | |
| 4423.60 *10* | $6^+$ | | |
| 4480.7 *5* | $6^-$ | | |
| 4610.78 *4* | $8^+$ | | |
| 4679.1 *10* | $(7^-)$ | | |
| 4860.56 *8* | $8^+$ | | |
| 4895.23 *5* | $10^+$ | 0.50# μs *5* | Additional information 4. |
| 5010.38 *18* | $9^+$ | | |
| 5069.31 *13* | $10^+$ | | |
| 5161.83 *16* | $(9)^+$ | | |
| 5195.5 *3* | $6^+$,7 | | |
| 5214.7 *10* | $(6)^+$ | | |
| 5217.5 *10* | $(4^+)$ | | |

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## $^{208}$Pb(x,x′γ) (continued)

### $^{208}$Pb Levels (continued)

| E(level)‡ | Jπ† | E(level)‡ | Jπ† | E(level)‡ | Jπ† | E(level)‡ |
|---|---|---|---|---|---|---|
| 5235.37 *10* | (11$^+$) | 6743.42 *16* | 14$^-$ | 8812.70 *23* | | 10372.2 *11* |
| 5254.0 *10* | | 7528.80 *16* | | 9061.23 *25* | (17$^+$) | 10552.4 *15* |
| 5564.5 *5* | | 7974.04 *19* | (15$^-$) | 9103.1 *3* | | 11361.0 *15* |
| 5749.68 *14* | (11$^+$) | 8026.95 *17* | (14$^-$) | 9394.4 *4* | | 11958.1 *17* |
| 5873.6 *4* | 3$^-$ | 8264.38 *23* | | 10136.8 *4* | | 12949.6 *17* |
| 6100.69 *14* | 12$^+$ | 8350.79 *19* | (15$^-$) | 10196.1 *11* | | 13675.0 *20* |
| 6435.57 *22* | 12$^-$ | 8562.95 *24* | (16$^-$) | 10342.0 *11* | | |
| 6448.40 *14* | (13$^-$) | 8723.51 *22* | | 10357.4 *11* | | |

† From Adopted Levels.

‡ From a least-squares fit to the Eγ values, with the 10$^+$ isomer held fixed At 4895.23 *5* and the first two excited levels also held fixed, the energies for these three levels all being adopted values.

# From Adopted Levels.

### γ($^{208}$Pb)

| $E_i$(level) | $J_i^\pi$ | $E_\gamma$† | $I_\gamma$‡ | $E_f$ | $J_f^\pi$ | Comments |
|---|---|---|---|---|---|---|
| 2614.522 | 3$^-$ | 2614.511 *10* | | 0 | 0$^+$ | |
| 3197.711 | 5$^-$ | 583.187 *2* | | 2614.522 | 3$^-$ | |
| 3474.94 | 4$^-$ | 277.21 *20* | 45 *7* | 3197.711 | 5$^-$ | $I_\gamma$: 1999AmZX report 87 *14*. |
| | | 860.44 *10* | 100 | 2614.522 | 3$^-$ | |
| 3708.57 | 5$^-$ | 233.3 *3* | 3.5 *13* | 3474.94 | 4$^-$ | $I_\gamma$: Iγ/Iγ(511γ)=0.0136 *9* In $\beta^-$ decay suggests that only part of this intensity belongs here. |
| | | 510.82 *13* | 100 | 3197.711 | 5$^-$ | |
| | | 1094 | 6.3 *8* | 2614.522 | 3$^-$ | $E_\gamma$,$I_\gamma$: reported only by 1999AmZX. Iγ/Iγ(511γ)=0.0175 *13* In $\beta^-$ decay suggests that only part of this peak belongs here. |
| 3920.05 | 6$^-$ | 211.72 *20* | 57 *15* | 3708.57 | 5$^-$ | $I_\gamma$: 1999AmZX report 154 *25*. Iγ/Iγ(722γ)=0.89 *12* In $\beta^-$ decay. |
| | | 722.33 *10* | 100 | 3197.711 | 5$^-$ | |
| 3947.7 | 4$^-$ | 750 | | 3197.711 | 5$^-$ | $E_\gamma$: from 1999AmZX. Not reported by 1993ScZQ. |
| 3961.20 | 5$^-$ | 252.27 *18* | 46 *12* | 3708.57 | 5$^-$ | |
| | | 486.40 *17* | | 3474.94 | 4$^-$ | $I_\gamma$: Iγ/Iγ(763γ)=0.24 *8* In the $^{64}$Ni bombardment, and 0.9 *3* In the $^{82}$Se bombardment. In $\beta^-$ decay this ratio is 0.027 *3*. |
| | | 763.50 *14* | 100 *20* | 3197.711 | 5$^-$ | |
| 4037.46 | 7$^-$ | 117.54 *17* | | 3920.05 | 6$^-$ | $I_\gamma$: 5.4 *19*, 7 *4*, and 16 *7* from three different bombardments. Iγ/Iγ(840γ)=0.13 *5* In (d,pγ). |
| | | 839.67 *12* | 100 | 3197.711 | 5$^-$ | |
| 4124.9 | 5$^-$ | 927.2 *3* | | 3197.711 | 5$^-$ | |
| 4206.25 | 6$^-$ | 497 | 25 *7* | 3708.57 | 5$^-$ | $E_\gamma$,$I_\gamma$: from 1999AmZX. Not reported by 1993ScZQ. |
| | | 1008.55 *16* | 100 | 3197.711 | 5$^-$ | |
| 4324.03 | 4$^+$ | 362.81 *7* | 16.7 *13* | 3961.20 | 5$^-$ | $I_\gamma$: 1999AmZX report 19.2 *23*. |
| | | 1126.35 *8* | 100 | 3197.711 | 5$^-$ | |
| 4423.60 | 6$^+$ | 1225.89 *10* | | 3197.711 | 5$^-$ | |
| 4480.7 | 6$^-$ | 1283.0 *5* | | 3197.711 | 5$^-$ | |
| 4610.78 | 8$^+$ | 573.43 *11* | | 4037.46 | 7$^-$ | $I_\gamma$: Iγ=8.7 *23*, 17 *4*, 2.4 *9*, and 2.7 *11* from four different bombardments. |
| | | 1413.13 *8* | 100 | 3197.711 | 5$^-$ | |
| 4679.1 | (7$^-$) | 759 | | 3920.05 | 6$^-$ | $E_\gamma$: from 1999AmZX. Not reported by 1993ScZQ. |
| 4860.56 | 8$^+$ | 249.80 *7* | 100 | 4610.78 | 8$^+$ | |
| | | 823.00 *16* | 23.7 *20* | 4037.46 | 7$^-$ | $I_\gamma$: from 1999AmZX. 1993ScZQ report 38 *8*. |
| 4895.23 | 10$^+$ | 34.5 | 0.041 *14* | 4860.56 | 8$^+$ | $E_\gamma$: from E(level) difference. Transition not observed, but is required by observation In a delayed spectrum of the 250γ from |

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## $^{208}$Pb(x,x′γ) (continued)

### γ($^{208}$Pb) (continued)

| $E_i$(level) | $J_i^\pi$ | $E_\gamma$[†] | $I_\gamma$[‡] | $E_f$ | $J_f^\pi$ | Comments |
|---|---|---|---|---|---|---|
| | | | | | | the 4860.9 level.<br>$I_\gamma$,$I_{(\gamma+ce)}$: Iγ is from I(γ+ce) with α=1010 (E2 theory). I(γ+ce) is from the requirement of an intensity balance At the 4860.9 level. |
| 4895.23 | $10^+$ | 284.49 *5* | 100 *8* | 4610.78 | $8^+$ | |
| | | 857.71 *10* | 20 *4* | 4037.46 | $7^-$ | |
| 5010.38 | $9^+$ | 399.60 *17* | | 4610.78 | $8^+$ | $E_\gamma$: from 1993ScZQ. Not reported by 2004Br19. |
| 5069.31 | $10^+$ | 174.21 *15* | | 4895.23 | $10^+$ | $E_\gamma$: from 1993ScZQ. 2004Br19 report Eγ=174.1 *2*. |
| 5161.83 | $(9)^+$ | 301.3 *3* | 53 *26* | 4860.56 | $8^+$ | $E_\gamma$,$I_\gamma$: from 1993ScZQ. Not reported by 2004Br19. |
| | | 551.04 *18* | 100 | 4610.78 | $8^+$ | $E_\gamma$,$I_\gamma$: from 1993ScZQ. Not reported by 2004Br19. |
| 5195.5 | $6^+$,7 | 771.89 *25* | | 4423.60 | $6^+$ | $E_\gamma$: from 1993ScZQ. Not reported by 2004Br19. |
| 5214.7 | $(6)^+$ | 2017 | | 3197.711 | $5^-$ | $E_\gamma$: reported only by 1999AmZX. |
| 5217.5 | $(4^+)$ | 2603 | | 2614.522 | $3^-$ | $E_\gamma$: reported only by 1999AmZX. |
| 5235.37 | $(11^+)$ | 340.16 *10* | | 4895.23 | $10^+$ | $E_\gamma$: from 1993ScZQ. 2004Br19 report Eγ=340.2 *2*. |
| 5254.0 | | 1779 | | 3474.94 | $4^-$ | $E_\gamma$: reported only by 1999AmZX. |
| 5564.5 | | 2089.5 *5* | | 3474.94 | $4^-$ | $E_\gamma$: reported only by 1993ScZQ. The placement is questionable according to the authors; however, the transition is observed and placed from this level In (d,pγ) so the evaluator assigns the level As definite. |
| 5749.68 | $(11^+)$ | 680.6 *2* | 100 | 5069.31 | $10^+$ | |
| | | 854.6 *2* | 14 *10* | 4895.23 | $10^+$ | |
| 5873.6 | $3^-$ | 2398.6 *4* | | 3474.94 | $4^-$ | $E_\gamma$: reported only by 1993ScZQ. The placement is questionable according to the authors; however, the transition is observed and placed from this level In (d,pγ) so the evaluator assigns the level As definite. |
| 6100.69 | $12^+$ | 351.4 *2* | 20 *4* | 5749.68 | $(11^+)$ | |
| | | 865.34 *20* | 100 | 5235.37 | $(11^+)$ | $E_\gamma$: from 1993ScZQ. 2004Br19 report Eγ=865.3 *2*. |
| 6435.57 | $12^-$ | 1200.2 *2* | | 5235.37 | $(11^+)$ | |
| 6448.40 | $(13^-)$ | 348.00 *15* | 100 | 6100.69 | $12^+$ | $E_\gamma$: from 1993ScZQ. 2004Br19 report Eγ=347.8 *2*. |
| | | 1552.7 *2* | 15 *4* | 4895.23 | $10^+$ | |
| 6743.42 | $14^-$ | 295.31 *25* | 51 *11* | 6448.40 | $(13^-)$ | $E_\gamma$: from 1993ScZQ. 2004Br19 report 295.0 *2*. |
| | | 1508.1 *2* | 100 | 5235.37 | $(11^+)$ | |
| 7528.80 | | 1080.2 *2* | | 6448.40 | $(13^-)$ | |
| | | 1428.0 *2* | | 6100.69 | $12^+$ | |
| 7974.04 | $(15^-)$ | 445.1 *2* | | 7528.80 | | |
| | | 1230.8 *2* | | 6743.42 | $14^-$ | |
| 8026.95 | $(14^-)$ | 498.0 *2* | | 7528.80 | | |
| | | 1283.4 *2* | | 6743.42 | $14^-$ | |
| | | 1578.6 *2* | | 6448.40 | $(13^-)$ | |
| 8264.38 | | 237.5 *2* | | 8026.95 | $(14^-)$ | |
| 8350.79 | $(15^-)$ | 323.7 *2* | | 8026.95 | $(14^-)$ | |
| | | 376.8 *2* | | 7974.04 | $(15^-)$ | |
| | | 1607.6 *2* | | 6743.42 | $14^-$ | |
| 8562.95 | $(16^-)$ | 212.3 *2* | | 8350.79 | $(15^-)$ | |
| 8723.51 | | 459.2 *2* | | 8264.38 | | |
| | | 1980.0 *2* | | 6743.42 | $14^-$ | |
| 8812.70 | | 249.9 *2* | | 8562.95 | $(16^-)$ | |
| | | 785.6 *2* | | 8026.95 | $(14^-)$ | |
| 9061.23 | $(17^+)$ | 2317.8 *2* | | 6743.42 | $14^-$ | |
| 9103.1 | | 42 | | 9061.23 | $(17^+)$ | |
| | | 290.4 *2* | | 8812.70 | | |
| 9394.4 | | 291.3 *2* | | 9103.1 | | |
| 10136.8 | | 742.4 *2* | | 9394.4 | | |
| 10196.1 | | 801.7 | | 9394.4 | | |
| 10342.0 | | 947.6 | | 9394.4 | | |
| 10357.4 | | 963.0 | | 9394.4 | | |

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## $^{208}$Pb(x,x′γ) (continued)

### γ($^{208}$Pb) (continued)

| $E_i$(level) | $E_\gamma$ † | $E_f$ | $E_i$(level) | $E_\gamma$ † | $E_f$ |
|---|---|---|---|---|---|
| 10372.2 | 235.4 | 10136.8 | 11958.1 | 597.0 | 11361.0 |
| 10552.4 | 356.3 | 10196.1 | 12949.6 | 991.4 | 11958.1 |
| 11361.0 | 1019.0 | 10342.0 | | 1588.7 | 11361.0 |
| | | | 13675.0 | 725.4 | 12949.6 |

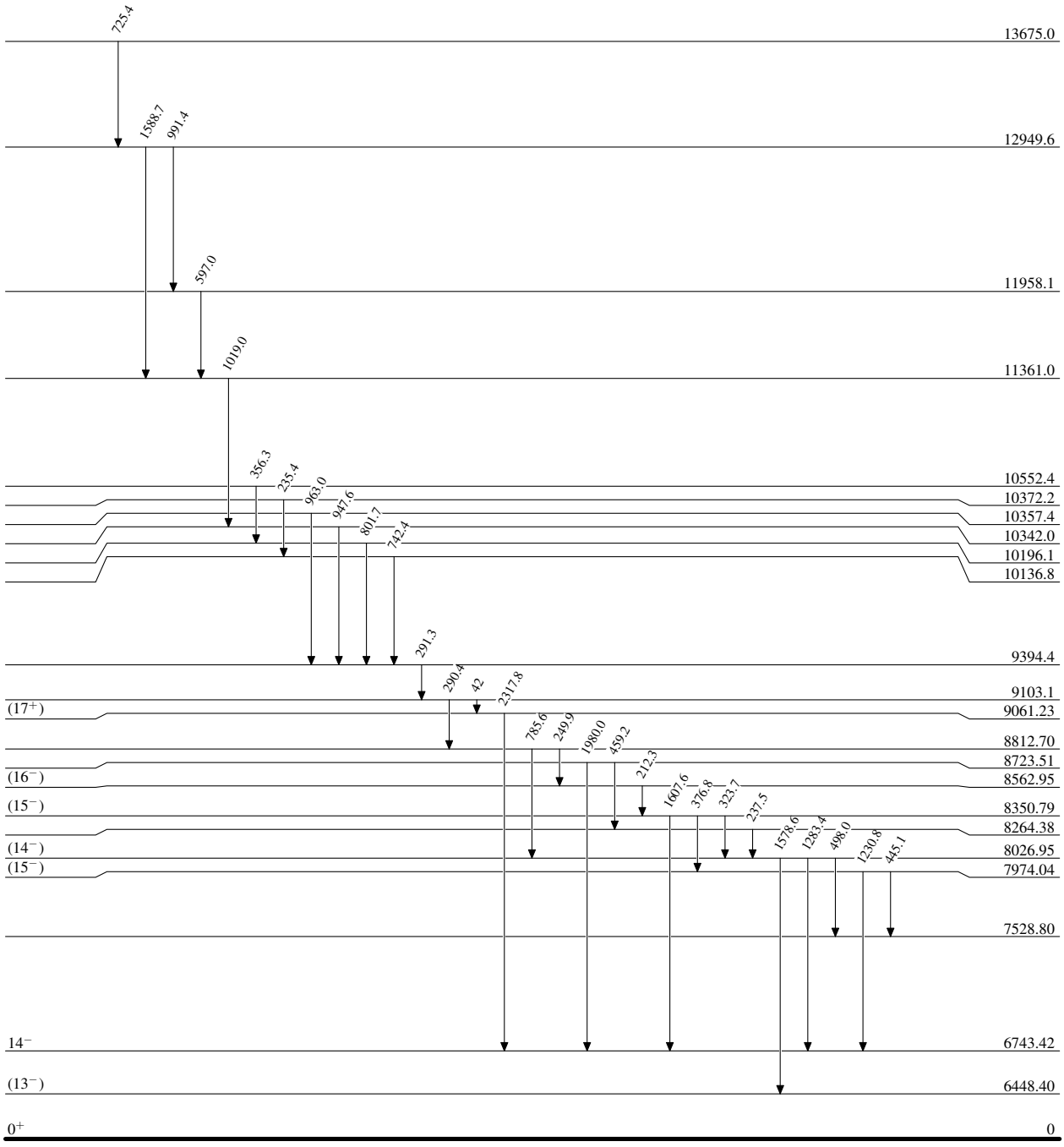
† From 2004Br19 for transitions above the $10^+$ isomer At 4895, and from 1993ScZQ for transitions below the isomer, except where noted otherwise. The evaluator has applied a linear correction to the energies of 1993ScZQ so that Eγ=2614.511 *10* and Eγ=583.187 *2* for the transitions measured In β decay, reported As 2614.55 *1* and 583.19 *1*, respectively by 1993ScZQ (see 2000He14). 2001Wr02 state that typical uncertainties are 0.2 keV, and the evaluator has assigned this uncertainty to the later work of this group, 2004Br19. Data for the 4895 level are from 1993Sc08.

‡ 1999AmZX give relative photon intensities from their singles and their coincidence spectra for x=$^{208}$Pb. 2001Wr02 give relative intensities from their coincidence spectra for both x=$^{208}$Pb and x=$^{76}$Ge. 1993Sc08 give branching ratios for the 4895, $10^+$ level. 1993ScZQ give relative intensities from coincidence data for both x=$^{64}$Ni and x=$^{82}$Se. Data below the 4895 level are averaged branchings from 1993ScZQ, except where noted otherwise, with values from 1999AmZX given In comments data above the 4895 level are averaged branchings from 2001Wr02 with statistical uncertainties only. 2004Br19 do not give intensities. Data for the 4895 level are branchings from 1993Sc08.

## $^{208}$Pb(x,x′γ)

### Level Scheme

Intensities: Relative photon branching from each level

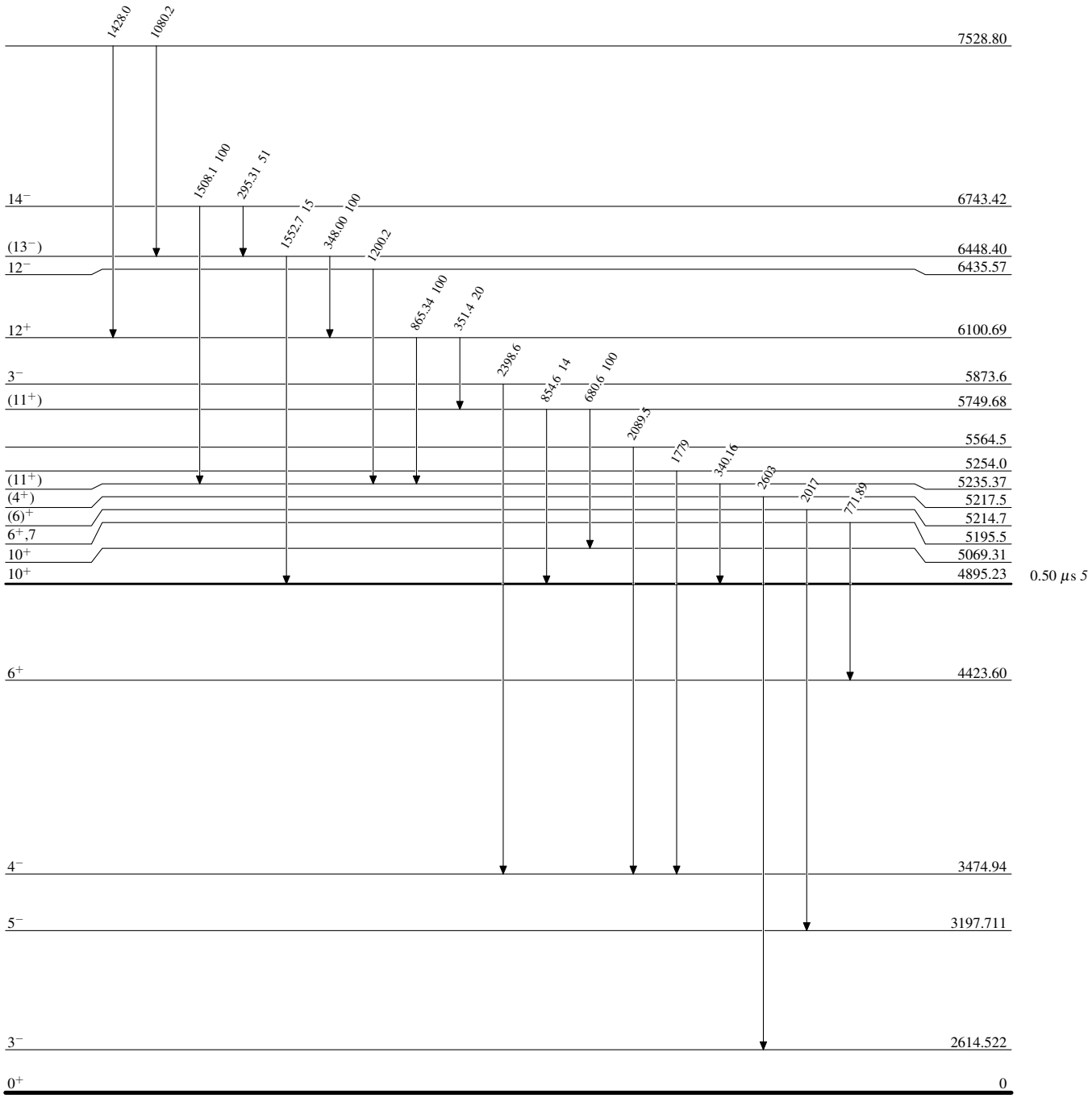



$^{208}_{82}Pb_{126}$

## $^{208}$Pb(x,x′γ)

### Level Scheme (continued)

Intensities: Relative photon branching from each level

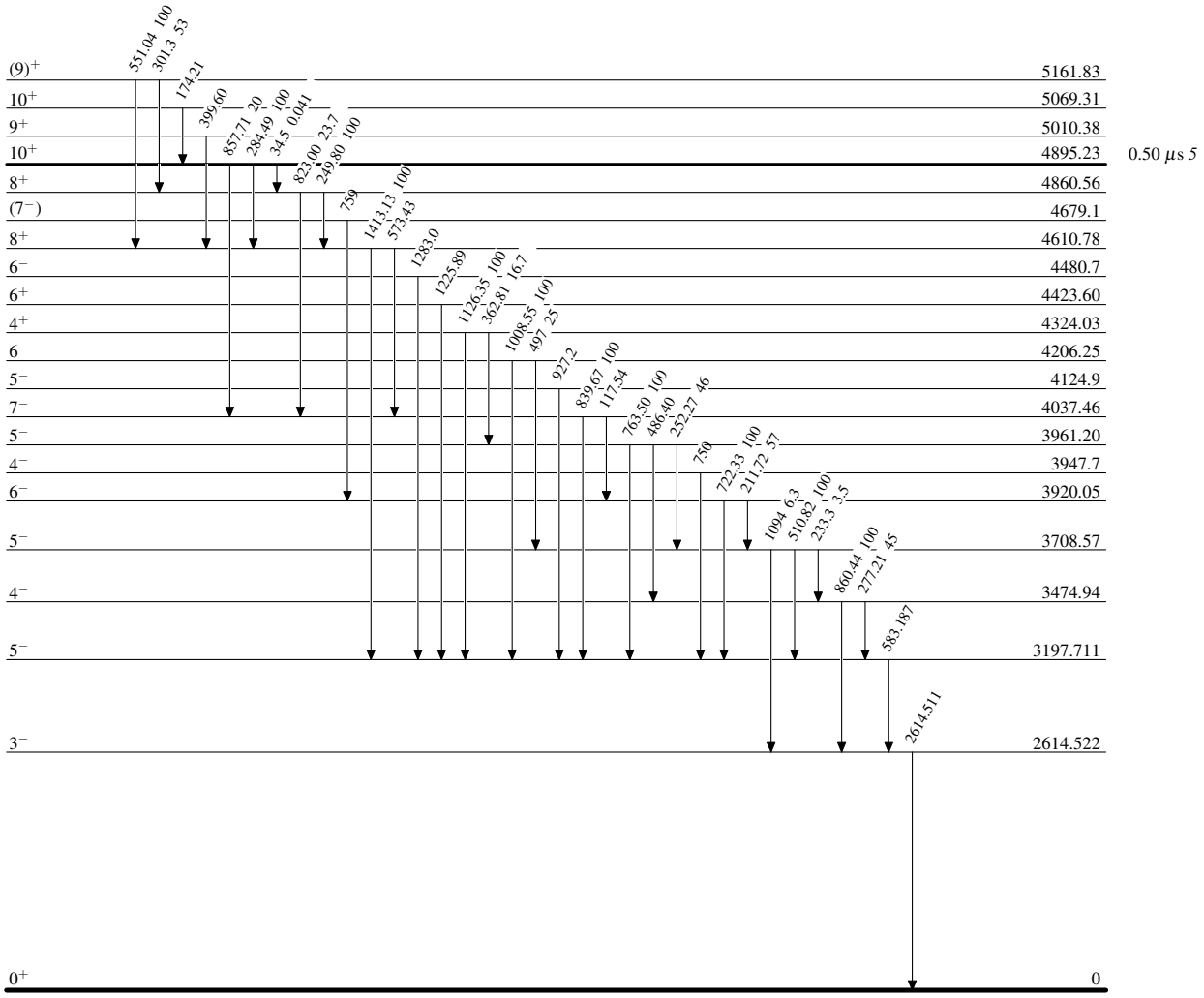



$^{208}_{82}Pb_{126}$

## $^{208}$Pb(x,x′γ)

### Level Scheme (continued)

Intensities: Relative photon branching from each level




$^{208}_{82}Pb_{126}$