# $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | C. D. Nesaraja | NDS 146, 387 (2017) | 31-Aug-2017 |

2016Ho13 (see also 2012TaZO and 2011ChZZ): A $^{208}$Pb beam from ATLAS accelerator at Argonne National Laboratory with an energy of 1430 MeV was incident on a $^{244}$Pu target. Prompt γγγ-coin data were measured using the Gammasphere array. Coincident measurements with prompt gammas, Pu X-rays and the 2615-keV γ transition in $^{208}$Pb were utilized to isolate transitions in $^{244}$Pu.

## $^{244}$Pu Levels

| E(level)[†] | Jπ[‡] | $T_{1/2}$ | Comments |
|---|---|---|---|
| 0.0[#] | $0^+$ | | |
| 44.2[#] *4* | $2^+$ | | Additional information 1. |
| 149.9[#] *6* | $4^+$ | | Additional information 2. |
| 312.9[#] *10* | $6^+$ | | |
| 529.9[#] *15* | $8^+$ | | |
| 796.9[#] *18* | $10^+$ | | |
| 1110.9[#] *20* | $12^+$ | | |
| 1201.0[@] *17* | $7^-$ | | E(level): Indicated as 1206 keV in Fig. 2 (2016Ho13). |
| 1210.8[&] *17* | $8^-$ | 1.75 s *12* | E(level): Indicated as 1216 keV in Fig. 2 (2016Ho13).<br>$T_{1/2}$: From $^{244}$Pu($^{47}$Ti,$^{47}$Ti′γ) (2016Ho13).<br>ν9/2⁻[734]⊗ν7/2⁺[624] configuration confirmed by measurements of in-band M1/E2 branching ratios that were used to extract $g_k$-$g_R/Q_0$ values where $g_k$ is the nucleon g factor, $g_R$ is the rotational g factor and $Q_0$ is the intrinsic quadrupole moment. The value deduced compared with expected values for specific configurations favors the two-quasineutron assignment (2016Ho13). The K-quantum number was also examined from the reduced hindrance factor ($f_v$=177) that was deduced from the measured intensities.<br>Jπ: From systematics with a similar excitation energy and decay pattern of previously observed two-quasineutron $8^-$ isomers in heavier N=150 isotones $^{246}$Cm, $^{250}$Fm, and $^{252}$No (2016Ho13). |
| 1320.8[a] *19* | $9^-$ | | |
| 1390.0[@] *20* | $9^-$ | | |
| 1441.8[&] *19* | $10^-$ | | |
| 1465.9[#] *23* | $14^+$ | | |
| 1574.8[a] *19* | $11^-$ | | |
| 1623.0[@] *22* | $11^-$ | | |
| 1717.9[&] *20* | $12^-$ | | |
| 1857.9[#] *25* | $16^+$ | | |
| 1872.6[a] *20* | $13^-$ | | |
| 1899.0[@] *24* | $13^-$ | | |
| 2037.3[&] *21* | $14^-$ | | |
| 2213.4[a] *21* | $15^-$ | | |
| 2215[@] *3* | $15^-$ | | |
| 2283[#] *3* | $18^+$ | | |
| 2398.4[&] *22* | $16^-$ | | |
| 2568[@] *3* | $17^-$ | | |
| 2594.4[a] *22* | $17^-$ | | |
| 2736[#] *3* | $20^+$ | | |
| 2799.4[&] *23* | $18^-$ | | |

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## $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13 (continued)

### $^{244}$Pu Levels (continued)

| E(level)† | Jπ‡ | E(level)† | Jπ‡ | E(level)† | Jπ‡ |
|---|---|---|---|---|---|
| 2952@ 3 | 19− | 3360@ 4 | 21− | 3784@ 4 | 23− |
| 3013.4a 23 | 19− | 3467.4a 24 | 21− | 3948a 3 | 23− |
| 3209# 3 | 22+ | 3684# 4 | 24+ | 4143# 4 | 26+ |
| 3236.4& 24 | 20− | 3705& 3 | 22− | 4191& 3 | 24− |
| | | | | 4227@ 4 | 25− |

† From least-squares fit to Eγ data by the evaluator, except as noted. E=44.2 keV, and 149.9 keV have been held fixed during the the least-squares fit.
‡ From Adopted Levels except as noted.
# Band(A): K=0+ Ground-state band.
@ Band(B): Octupole vibrational band.
& Band(C): K=8−,(ν9/2−[734]⊗ν7/2+[624]), α=0.
a Band(D): K=8−,(ν9/2−[734]⊗ν7/2+[624]), α=1.

### γ($^{244}$Pu)

| Eγ† | Iγ‡ | Ei(level) | Jiπ | Ef | Jfπ | Comments |
|---|---|---|---|---|---|---|
| (9.7#) | | 1210.8 | 8− | 1201.0 | 7− | Eγ: 2016Ho13 indicated the unobserved gamma in parenthesis as 10 keV in Fig. 2. |
| (44.2# 4) | | 44.2 | 2+ | 0.0 | 0+ | Eγ: 2016Ho13 indicated the unobserved gamma in parenthesis as 44 keV in Fig. 2. |
| (105.7# 7) | | 149.9 | 4+ | 44.2 | 2+ | Eγ: 2016Ho13 indicated the unobserved gamma in parenthesis as 111 keV in Fig. 2. |
| (110#) | | 1320.8 | 9− | 1210.8 | 8− | |
| (121#) | | 1441.8 | 10− | 1320.8 | 9− | |
| 133 | | 1574.8 | 11− | 1441.8 | 10− | |
| 143 | | 1717.9 | 12− | 1574.8 | 11− | |
| 155 | 0.84 9 | 1872.6 | 13− | 1717.9 | 12− | |
| 163 | | 312.9 | 6+ | 149.9 | 4+ | |
| 165 | 0.60 7 | 2037.3 | 14− | 1872.6 | 13− | |
| 176 | 0.63 6 | 2213.4 | 15− | 2037.3 | 14− | |
| 185 | 0.55 6 | 2398.4 | 16− | 2213.4 | 15− | |
| 189 | | 1390.0 | 9− | 1201.0 | 7− | |
| 196 | 0.23 3 | 2594.4 | 17− | 2398.4 | 16− | |
| 205 | | 2799.4 | 18− | 2594.4 | 17− | |
| 214 | | 3013.4 | 19− | 2799.4 | 18− | |
| 217 | | 529.9 | 8+ | 312.9 | 6+ | |
| 223 | | 3236.4 | 20− | 3013.4 | 19− | |
| 231@ | | 1441.8 | 10− | 1210.8 | 8− | |
| 231@ | | 3467.4 | 21− | 3236.4 | 20− | |
| 233 | | 1623.0 | 11− | 1390.0 | 9− | |
| 254 | | 1574.8 | 11− | 1320.8 | 9− | |
| 267 | | 796.9 | 10+ | 529.9 | 8+ | |
| 276 | | 1717.9 | 12− | 1441.8 | 10− | |
| 276 | | 1899.0 | 13− | 1623.0 | 11− | |
| 298 | 1.24 11 | 1872.6 | 13− | 1574.8 | 11− | |
| 314 | | 1110.9 | 12+ | 796.9 | 10+ | |
| 316 | | 2215 | 15− | 1899.0 | 13− | |

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## $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13 (continued)

### γ($^{244}$Pu) (continued)

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Comments |
|---|---|---|---|---|---|---|
| 319 | 0.93 *8* | 2037.3 | $14^-$ | 1717.9 | $12^-$ | |
| 341 | 1.39 *11* | 2213.4 | $15^-$ | 1872.6 | $13^-$ | |
| 353.1 | | 2568 | $17^-$ | 2215 | $15^-$ | |
| 355 | | 1465.9 | $14^+$ | 1110.9 | $12^+$ | |
| 361 | 1.12 *8* | 2398.4 | $16^-$ | 2037.3 | $14^-$ | |
| 381 | 0.56 *6* | 2594.4 | $17^-$ | 2213.4 | $15^-$ | |
| 384 | | 2952 | $19^-$ | 2568 | $17^-$ | |
| 392 | | 1857.9 | $16^+$ | 1465.9 | $14^+$ | |
| 401 | | 2799.4 | $18^-$ | 2398.4 | $16^-$ | |
| 408 | | 3360 | $21^-$ | 2952 | $19^-$ | |
| 419 | | 3013.4 | $19^-$ | 2594.4 | $17^-$ | |
| 424 | | 3784 | $23^-$ | 3360 | $21^-$ | |
| 425 | | 2283 | $18^+$ | 1857.9 | $16^+$ | |
| 437 | | 3236.4 | $20^-$ | 2799.4 | $18^-$ | |
| 443 | | 4227 | $25^-$ | 3784 | $23^-$ | |
| 453 | | 2736 | $20^+$ | 2283 | $18^+$ | |
| 454 | | 3467.4 | $21^-$ | 3013.4 | $19^-$ | |
| 459 | | 4143 | $26^+$ | 3684 | $24^+$ | |
| 469 | | 3705 | $22^-$ | 3236.4 | $20^-$ | |
| 473 | | 3209 | $22^+$ | 2736 | $20^+$ | |
| 475 | | 3684 | $24^+$ | 3209 | $22^+$ | |
| 481 | | 3948 | $23^-$ | 3467.4 | $21^-$ | |
| 486 | | 4191 | $24^-$ | 3705 | $22^-$ | |
| 671 | | 1201.0 | $7^-$ | 529.9 | $8^+$ | |
| (681) | | 1210.8 | $8^-$ | 529.9 | $8^+$ | $E_\gamma$: Not observed in this experiment, but seen in the work of the same group in the $^{244}$Pu($^{47}$Ti,$^{47}$Ti′γ) dataset (2016Ho13). |

† From 2016Ho13 except as noted. No uncertainties were provided in 2016Ho13. An email reply on 28 August, 2016 to the evaluator from third author (P. Chowdhury) in 2016Ho13 estimates uncertainties between 0.5 and 1 keV.

‡ From email reply on 28 August, 2016 to XUNDL coordinator from third author (P. Chowdhury) in 2016Ho13.

# Gamma has not been observed. Its energy is from level energy difference.

@ Multiply placed.

## $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13

Level Scheme

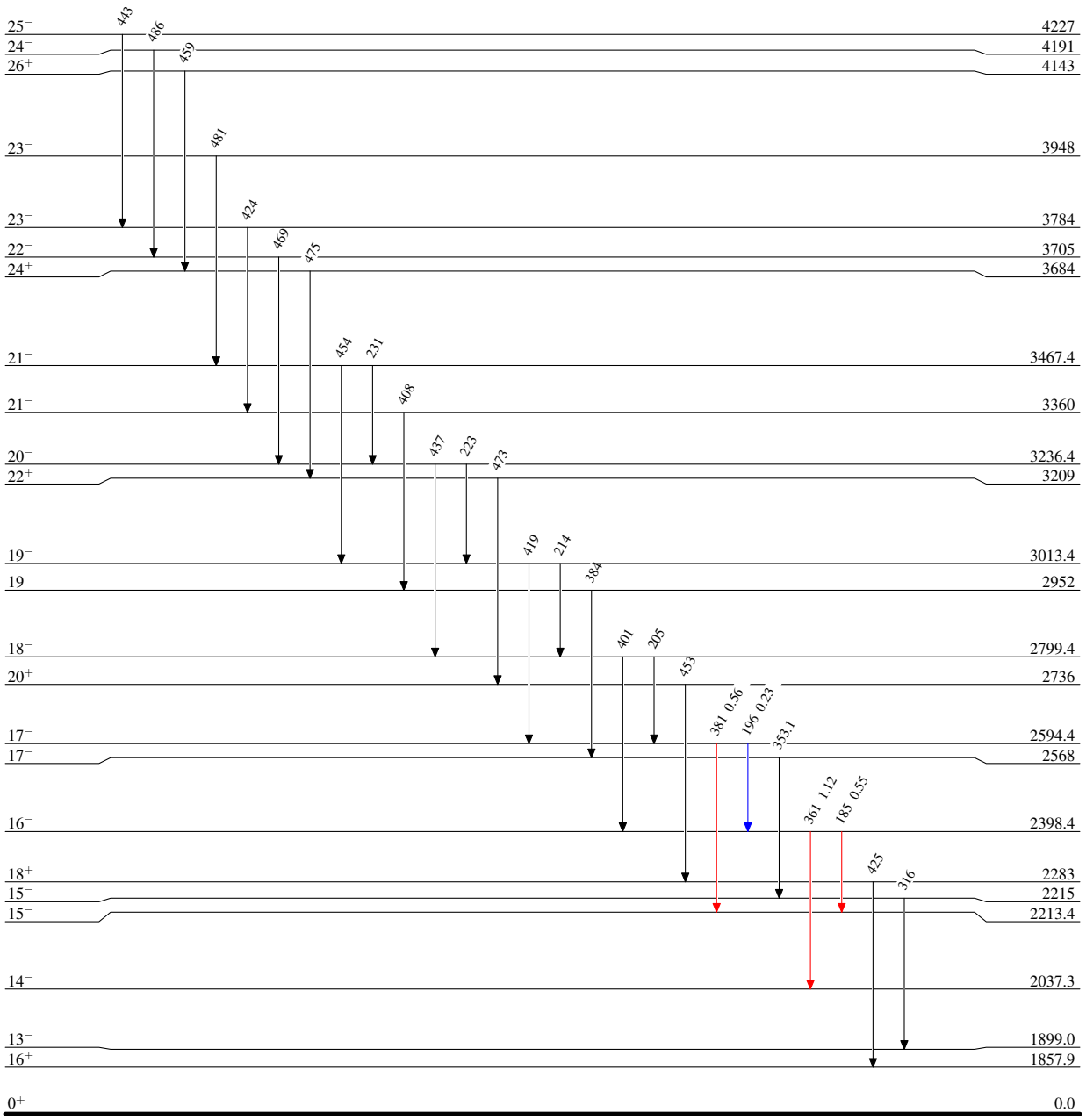
Intensities: Relative $I_\gamma$

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$




$^{244}_{94}Pu_{150}$

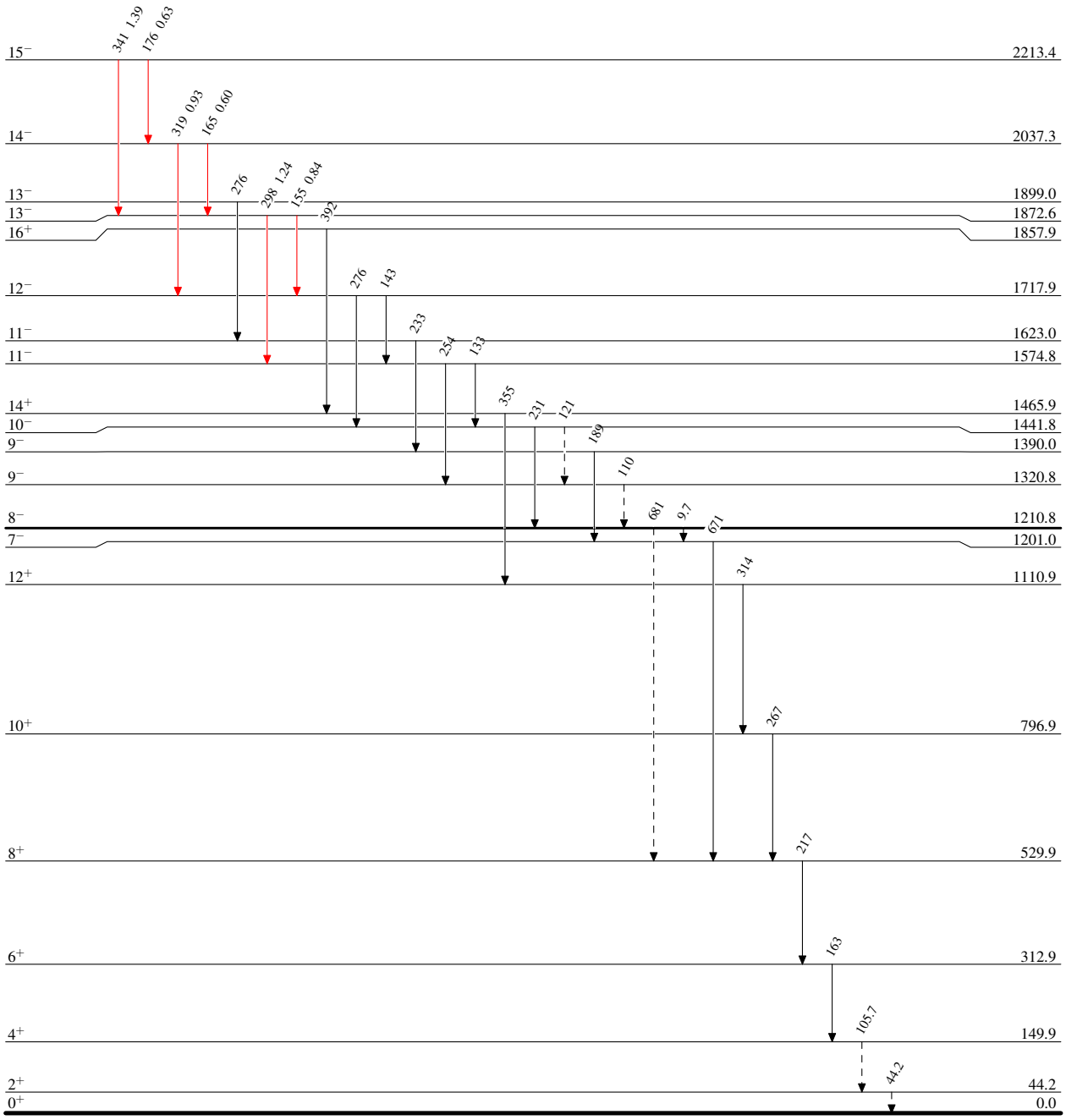
## $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13

Level Scheme (continued)

Intensities: Relative $I_\gamma$

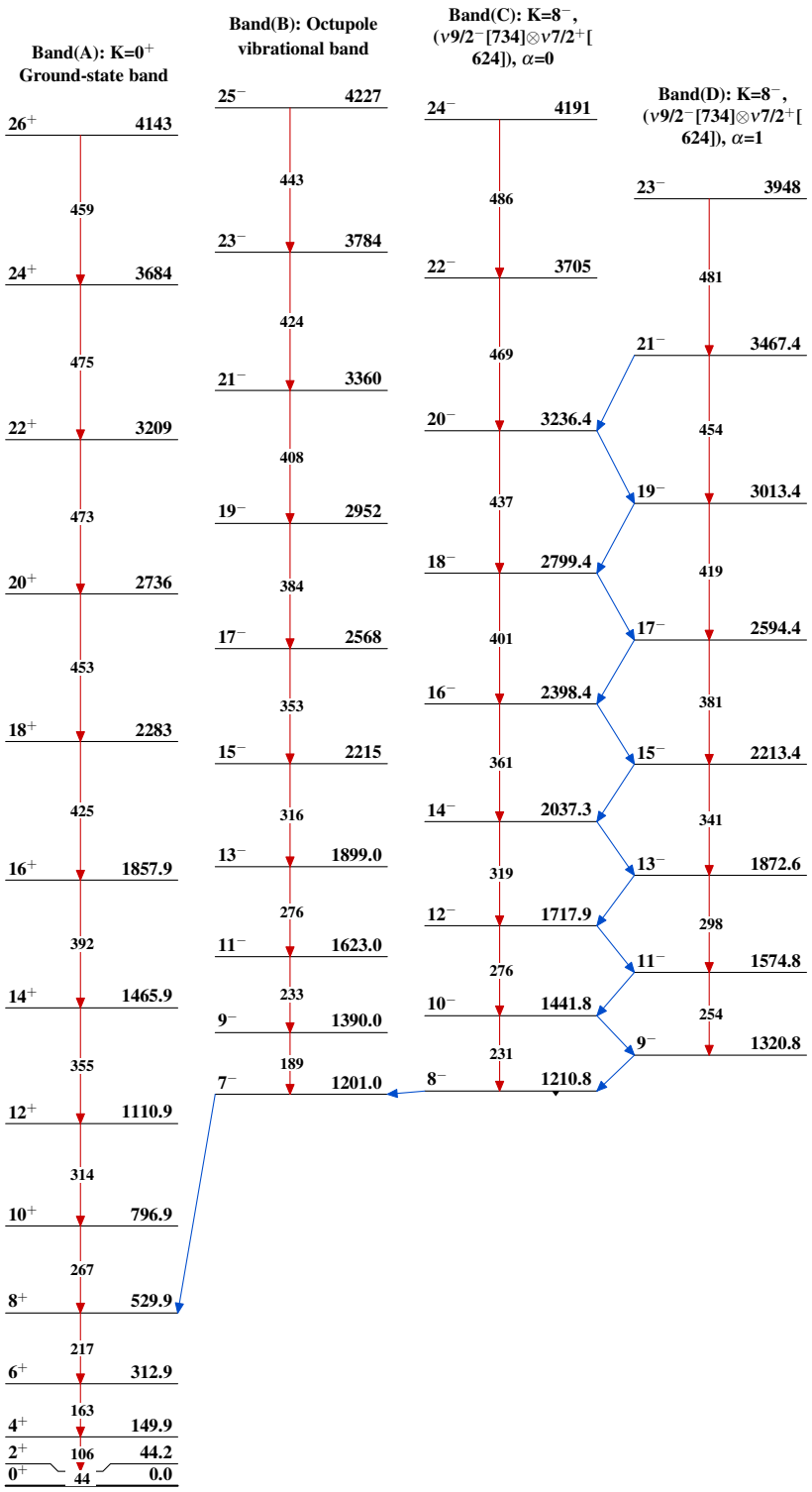
Legend

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




$^{244}_{94}Pu_{150}$

## $^{244}$Pu($^{208}$Pb,$^{208}$Pb′γ) 2016Ho13




$^{244}_{94}Pu_{150}$