

^{226}Ra α decay

| Type | Author | History | Citation | Literature Cutoff Date |
|-----------------|---|---------|---------------------|------------------------|
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Parent: ^{226}Ra : $E=0.0$; $J^\pi=0^+$; $T_{1/2}=1600$ y 7; $Q(\alpha)=4870.62$ 25; $\% \alpha$ decay=100.0

$E\alpha(\text{g.s.})=4784.34$ 25 gives $Q(\alpha)(^{226}\text{Ra})=4870.54$ 25; from their mass adjustment, [2003Au03](#), [2011AuZZ](#) recommend

$Q(\alpha)(^{226}\text{Ra})=4870.62$ 25; the input value is listed as $Q(\alpha)=4870.70$ 25.

See [1994Da26](#) for Bremsstrahlung emission accompanying the ^{226}Ra α decay.

Ag(θ): [1989Po03](#)

| E_γ | E(level) | deduced J^π | rejected spins |
|------------|----------|-----------------|----------------|
| 262 | 448 | 4^+ | 0, 1, 2, 3 |
| 414 | 601 | 1^- | 2, 3 |
| 601 | 601 | 1^- | 2, 3 |
| 449 | 635 | 3^- | 0, 1, 2, 4 |

Other Ag(θ) measurements: [1954Ro06](#), [1954Mi53](#).

(α)(α)(θ):

(^{226}Ra α)(^{222}Rn α)(θ): [1968Bi08](#) observed isotropic correlation.

Ag(θ, H): see [1970Or02](#), [1974Or02](#).

Ag(t): $T_{1/2}(\text{186 level})=0.32$ ns 2 ([1960Be25](#)).

 ^{222}Rn Levels

| E(level) | J^π | $T_{1/2}$ |
|------------|---------|-----------|
| 0.0 | 0^+ | |
| 186.211 13 | 2^+ | 0.32 ns 2 |
| 448.37 12 | 4^+ | |
| 600.66 5 | 1^- | |
| 635.47 15 | 3^- | |

 α radiations

See [1992De44](#), [1987Be43](#), [1986Ch36](#), [1977Ba70](#), [1996De19](#) for theoretical calculations of α -decay widths.

| $E\alpha^\dagger$ | E(level) | $I\alpha^\ddagger@$ | HF# | Comments |
|-------------------|----------|---------------------|---------|--|
| 4160 2 | 635.47 | 0.00027 5 | 8.6 16 | |
| 4191 2 | 600.66 | 0.0010 1 | 4.4 5 | $E\alpha$: 4194.4 3 from level energy and $E\alpha$ (to g.s.). |
| 4340 1 | 448.37 | 0.0065 3 | 10.3 5 | |
| 4601 1 | 186.211 | 6.16 3 | 0.857 6 | $E\alpha$: the original energy has been increased by 3 keV, as recommended by 1991Ry01 , because of a change in the calibration energy. $I(\alpha)$ from 2007Ne01 $E\alpha=4601.7$ 2 was recommended by 1983Co22 and 1987El01 from measurements of 1958Wa16 . $E\alpha=4601.43$ 26 from $E\alpha(\text{g.s.})=4784.34$ 25 and E(level). |
| 4784.34 25 | 0.0 | 93.84 11 | 1.0 | $E\alpha$: from 1971Gr17 . The original energy has been decreased by 0.16 keV, as recommended by 1991Ry01 . Other measurements 1996Wi27 . $I(\alpha)$ from 2007Ne01 . |

† From [1963Ba62](#), except where otherwise noted. Other measurements: [1958Wa16](#), [1953Ba29](#), [1949Ro08](#).

‡ α intensity per 100 α decays; $I\alpha$'s are from [1963Ba62](#). The uncertainties on 4784.34 α and 4601 α are given as recommended by

^{226}Ra α decay (continued) α radiations (continued)

1991Ry01.

Hf(4784 α)=1.0 gives $r_0(^{222}\text{Rn})=1.5397$ 3.

@ Absolute intensity per 100 decays.

 $\gamma(^{222}\text{Rn})$ $\gamma\gamma$: 1971Lo19. For calculated alpha decay life time see 2005Sh42, 2006Xu04, 2007Pe30, 2009Ni06, 2009De32.

| E_γ † | I_γ ‡ | $E_i(\text{level})$ | J_i^π | E_f | J_f^π | Mult. | $\alpha^\#$ | Comments |
|--------------|--------------|---------------------|----------------|---------|----------------|-------|-------------|--|
| (34.8 16) | | 635.47 | 3 ⁻ | 600.66 | 1 ⁻ | | | E_γ : transition was not observed; its energy is from the level scheme. |
| 186.211 13 | 3.64 4 | 186.211 | 2 ⁺ | 0.0 | 0 ⁺ | E2 | 0.693 | $\alpha(\text{K})=0.193$; $\alpha(\text{L})=0.367$; $\alpha(\text{M})=0.0977$; $\alpha(\text{N+..})=0.0340$ E_γ : from 1993Di09 and 1977Zo01. Other measured energies: 186.0 1 (1969Li10), 185.97 5 (1971Lo19), 186.196 12 (1974AlZT), 185.8 2 (1975Ha31), 186.19 10 (1976De48), 186.19 16 (1982Ak03). Earlier measurements: 1951Co15, 1960St20, 1964Ew04. I_γ : absolute photon intensity per 100 ^{226}Ra α decays, as measured by 2001La14. Other absolute measurements: 3.50 5 (1983Ol01), 3.51 6 (1983Sc13), 3.29 3 (1983Co22), 3.59 6 (1991Li11). $I_\gamma=3.28$ 3 from intensity balance at the 186-keV level. Other values: $I_\gamma(186\gamma)/I_\gamma(609\gamma)$ of ^{214}Bi in equilibrium)= 0.0858 5 (1993Di09), 0.0823 3 (1983Bu14), 0.092 10 (1982Ak03), 0.0907 14 (1982Fa10), 0.076 4 (1981We18), 0.0900 11 (1977Zo01), 0.087 15 (1975Ha31), 0.0820 12 (1970Mo28), 0.079 8 (1964Ew04). $I_\gamma(609\gamma)$ of ^{214}Bi in equilibrium)=46.1% 5 is adopted in the Nuclear Data Sheets for $\alpha=214$. Other I_γ measurements: 1976De48, 1974AlZT, 1969Li10, 1969Wa27, 1969Gr33, 1967Ma51. Mult.: from ce ratios measured by 1963Go21, 1955Ju14, 1954Ro05. 1973De50 $\alpha(\text{K})=0.200$ 9, $\alpha(\text{L})=0.380$ 20 were deduced by 1973De50 from $I(\text{K x ray})/I(186\gamma)$, $I(\text{L x ray})/I(186\gamma)$. |
| (187.10 20) | | 635.47 | 3 ⁻ | 448.37 | 4 ⁺ | | | E_γ : transition was not observed; its energy is from the level scheme. $\text{Ti}(34.8\gamma)+\text{Ti}(187.1\gamma)=0.0008$ from the intensity balance at the 635.47-keV level; the intensity balance at the 448.37-keV level yields $\text{Ti}(187.1\gamma)=0.0061$ 6–0.0065 3. See the section on ^{222}Rn Adopted Levels, gammas for the references where E1 transition probabilities and E1/E2 ratios were calculated and discussed in terms of octupole deformations. |
| 262.27 5 | 0.0050 5 | 448.37 | 4 ⁺ | 186.211 | 2 ⁺ | [E2] | 0.212 | $\alpha(\text{K})=0.0928$; $\alpha(\text{L})=0.0880$; $\alpha(\text{M})=0.0232$; $\alpha(\text{N+..})=0.00806$ I_γ : from $I_\gamma(262\gamma)/I_\gamma(186\gamma)=0.0014$ 2 (1993Di09,1971Lo19). Other measured ratios: 0.0029 (1960St20), 0.0025 (1956Ha71). $I(262\gamma)=0.0054$ 3 from $I(4340\alpha)=0.0065$ 3 and $\alpha(262\gamma)=0.212$. |
| 414.60 5 | 0.00030 | 600.66 | 1 ⁻ | 186.211 | 2 ⁺ | [E1] | 0.0164 | I_γ : from $I_\gamma(414.6\gamma)/I_\gamma(186\gamma)=0.000086$ (1971Lo19). Other measured ratio: 0.00021 (1960St20). |

Continued on next page (footnotes at end of table)

^{226}Ra α decay (continued) $\gamma(^{222}\text{Rn})$ (continued)

| E_γ [†] | I_γ [‡] | $E_i(\text{level})$ | J_i^π | E_f | J_f^π | Mult. | α [#] | Comments |
|-------------------------|-------------------------|---------------------|----------------|---------|----------------|-------|-----------------------|--|
| 449.37 10 | 0.00019 | 635.47 | 3 ⁻ | 186.211 | 2 ⁺ | [E1] | 0.0138 | I_γ : from $I_\gamma(449\gamma)/I_\gamma(186\gamma)=5.5\times 10^{-5}$ (1971Lo19). Other measured ratio: 9×10^{-5} (1960St20). |
| 600.66 5 | 0.00049 | 600.66 | 1 ⁻ | 0.0 | 0 ⁺ | [E1] | 0.00766 | I_γ : from $I_\gamma(600\gamma)/I_\gamma(186\gamma)=0.00014$ (1971Lo19). Other measured ratio: 0.00033 (1960St20). |

[†] From 1971Lo19, except where noted otherwise. Other measurements: 1960St20, 1956Ha71.

[‡] Absolute intensity per 100 decays.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^{226}Ra α decay

Decay Scheme

Legend

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

Intensities: $I_{(\gamma+ce)}$ per 100 decays through this branch