

^{219}Ra α decay (10 ms) [1987El02](#),[1970Va13](#),[1994Sh02](#)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation		NDS 114, 2023 (2013)	23-Sep-2013

Parent: ^{219}Ra : $E=0.0$; $J^\pi=(7/2)^+$; $T_{1/2}=10$ ms 3; $Q(\alpha)=8138$ 3; % α decay=100.0

^{219}Ra - J^π , $T_{1/2}$: From ^{219}Ra Adopted Levels in ENSDF database.

^{219}Ra - $Q(\alpha)$: From [2012Wa38](#).

[1994Sh02](#): ^{219}Ra activity was produced as the daughter nuclide of ^{223}Th through the $^{208}\text{Pb}(^{18}\text{O},3n)^{223}\text{Th}$ reaction. Measured $E\alpha$, $I\alpha$, $\alpha\gamma$ coin from a source in equilibrium with ^{223}Th . Detectors: Semiconductor, Ge(Li) detector.

[1987El02](#): ^{219}Ra activity was produced as descendant of ^{223}Th . Measured $E\alpha$, $E\gamma$, $I\gamma$, $I\alpha$, $\alpha\gamma$ coin, α -ce coin. Detectors: semi, Ge(Li), Si(Li). Assignment of α -particle groups to ^{219}Ra has been based on the agreement with $E\alpha$ from [1970Va13](#), and on the observation of Rn K x ray in coincidence with α particles.

Because of the decay scheme normalization, evaluators interpreted absolute γ -ray transition intensities reported by authors as absolute $I(\gamma+\text{ce})$ (photons plus conversion electrons) intensities.

[1970Va13](#): ^{219}Ra activity was produced by $^{208}\text{Pb}(^{16}\text{O},\alpha n)$, and identified by excitation functions, cross bombardment, and genetic relationship to its α -decay daughter nucleus ^{215}Rn . Measured $E\alpha$, $I\alpha$. Semiconductor detector.

[1969Ha32](#): ^{219}Ra activity was produced as descendant of ^{227}U , ^{223}Th , and identified by its genetic relationship to its α -decay daughter nucleus ^{215}Rn . Measured $E\alpha$, $I\alpha$. Semiconductor detector.

 ^{215}Rn Levels

[1994Sh02](#) interpreted the level structure in ^{215}Rn in terms of both the reflection asymmetric model and the shell model.

E(level)&	J^π @	$T_{1/2}$ @
0.0 [#]	9/2 ⁺	2.30 μs 10
213.96 [#] 18	(7/2,9/2) ⁺	
290.8 [‡] 3	(7/2,9/2,11/2) ⁻	
315.82 [†] 4	(11/2) ⁺	
805.7 [†] 4	(7/2) ⁺	

[†] Member of configuration= $\nu g_{9/2}^2 \otimes \nu i_{11/2}$.

[‡] Configuration= $\nu g_{9/2}^2 \otimes \nu j_{15/2}$.

[#] Member of configuration= $\nu g_{9/2}^3$.

@ From Adopted Levels.

& From least squares fit to γ -ray energies of [1987El02](#).

 α radiations

$E\alpha$	E(level)	$I\alpha$ [#]	HF [‡]	Comments
7198 6	805.7	2.4 [†] 3	3.3 11	$E\alpha$: weighted average of 7220 20 (in coin with 592 γ), 7250 40 (in coin with 805 γ)(1987El02), and 7196 5 (1994Sh02).
7678 3	315.82	66.2 15	4.7 15	$E\alpha$: weighted average of 7675 5 (1987El02), 7675 10 (1970Va13), 7700 (20) 1969Ha32 , 7679 3 (1994Sh02). $I\alpha$: $I\alpha=65.7$ 15 deduced by evaluators from γ -ray transition intensity balance. Other values: $I\alpha=65$ 5 (1970Va13), $I\alpha=70$ 10 (1969Ha32), $I\alpha=62$ (1994Sh02).
7706 10	290.8	0.9 [†] 2	4.1 $\times 10^2$ 16	$E\alpha$: weighted average of 7720 20 (measured in coin with 291 γ , 1987El02), and 7703 10 (1994Sh02).
7780 10	213.96	≈ 0.5	≈ 1274	$E\alpha, I\alpha$: inferred from $\alpha\gamma$ coin (1994Sh02).
7988 3	0.0	30.5 15	90 28	$I\alpha$: deduced by evaluators using $\Sigma I\alpha=100\%$. Other values: $I\alpha=30$ 10 (1969Ha32),

Continued on next page (footnotes at end of table)

²¹⁹Ra α decay (10 ms) [1987El02,1970Va13,1994Sh02](#) (continued)

α radiations (continued)

<u>Eα</u>	<u>E(level)</u>	<u>Comments</u>
		I α =35 2 (1970Va13), I α =34 (1994Sh02). Other: 1952Me13 . I α =30.7 16 deduced by evaluators from γ -ray transition intensity balance. E α : weighted average of 7980 10 (1970Va13), 7990 20 (1969Ha32), and 7989 3 (1994Sh02).

[†] Deduced by evaluators from γ -ray transition intensity balance.
[‡] Using r₀(²¹⁵Rn)=1.5595 60, interpolated value deduced from r₀(²¹⁴Rn)=1.563 4, and r₀(²¹⁶Rn)=1.556 8 ([1998Ak04](#)).
[#] Absolute intensity per 100 decays.

²¹⁹Ra α decay (10 ms) [1987El02](#),[1970Va13](#),[1994Sh02](#) (continued)

$\gamma(^{215}\text{Rn})$

See [1989Ha26](#) for $\alpha\gamma(\theta)$.

E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	δ	α @	$I_{(\gamma+ce)}\ddagger\#$	Comments
214.1 & 2	213.96	(7/2,9/2) ⁺	0.0	9/2 ⁺	(M1+E2)		1.0 6	1.5 3	Mult.: K x ray/ $\gamma \approx 1$ ($\alpha(K)\text{exp} \approx 0.1$) (1994Sh02), $\alpha(L)\text{exp} = 0.14$ 3 (1987El02). Assignment to ²¹⁹ Ra α decay is not definite. α : overlaps M1 and E2.
290.8 3	290.8	(7/2,9/2,11/2) ⁻	0.0	9/2 ⁺	E1		0.0357	0.91 18	$\alpha(K) = 0.0291$; $\alpha(L) = 0.00520$; $\alpha(M) = 0.00123$ E_γ : other value: 290.6 (1994Sh02). Mult.: from $\alpha(K)\text{exp} < 0.05$ (1987El02).
315.82 4	315.82	(11/2) ⁺	0.0	9/2 ⁺	M1(+E2)	<0.2	0.503	66.2 15	$\alpha(K) = 0.406$ 6; $\alpha(L) = 0.0739$ 11; $\alpha(M) = 0.01756$ 25; $\alpha(N) = 0.00458$ 7; $\alpha(O) = 0.001000$ 14 $I_{(\gamma+ce)}$: from a precise measurement of 7675 α abundance (1987El02). Mult.: from $\alpha(K)\text{exp} = 0.55$ 8, $\alpha(L)\text{exp} = 0.10$ 2, and $\alpha(M)\text{exp} = 0.020$ 3 (1987El02). δ : from ce data. Additional information 1.
489 & 1	805.7	(7/2) ⁺	315.82	(11/2) ⁺				≤ 0.5	
592.0 3	805.7	(7/2) ⁺	213.96	(7/2,9/2) ⁺	M1(+E2)	<0.7	0.0721	1.2 2	$\alpha(K) = 0.0578$ 9; $\alpha(L) = 0.01090$ 16; $\alpha(M) = 0.00260$ 4; $\alpha(N) = 0.000678$ 10; $\alpha(O) = 0.0001476$ 21 Mult.: from $\alpha(K)\text{exp} = 0.07$ 2 and $\alpha(L)\text{exp} = 0.03$ 1 (1987El02). δ : from ce data.
805.2 4	805.7	(7/2) ⁺	0.0	9/2 ⁺	M1+E2		0.028 16	0.7 2	$\alpha(K) = 0.022$ 13; $\alpha(L) = 0.0042$ 19; $\alpha(M) = 0.0010$ 5; $\alpha(N) = 0.00026$ 12; $\alpha(O) = 6.E-5$ 3 Mult.: from $\alpha(K)\text{exp} = 0.03$ 2 (1987El02). α : overlaps M1 and E2.

† From [1987El02](#), unless otherwise specified.

‡ Absolute transition intensity measured relative to % $I(\gamma+ce) = 66.2$ 15 for 316 γ . This value resulted from a precise measurement of the α -particle abundance that populates the 316 level ([1987El02](#)).

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 multiplicities, and mixing ratios, unless otherwise specified.

& Placement of transition in the level scheme is uncertain.

