

^{219}Fr α decay (20 ms) [1993Li07](#),[1968Ba73](#),[1966Gr07](#)

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

Parent: ^{219}Fr : $E=0.0$; $J^\pi=9/2^-$; $T_{1/2}=20$ ms 2; $Q(\alpha)=7448.5$ 18; $\% \alpha$ decay=100.0

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

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

[1993Li07](#): ^{219}Fr activity was produced as descendant of a mass-separated source of ^{223}Ac . Measured $E\alpha$, $I\alpha$, $E\gamma$, $I\gamma$, $\alpha\gamma$ coin.

Detectors: Ge(Li) for γ rays, Si(Li) for α particles.

[1968Ba73](#): descendant of ^{227}Pa . Measured $E\alpha$, $I\alpha$. Detector: magnetic spectrograph.

[1966Gr07](#): descendant of ^{227}Pa . Measured $E\alpha$, $I\alpha$, $E\gamma$, $\alpha\gamma$ coin. Detectors: semi, scint.

[1982Bo04](#): ^{219}Fr source produced by spallation of 5-GeV protons on targets of U and Th. Measured $E\alpha$, $I\alpha$. Detectors: semi.

Other: [1982Bo04](#).

 ^{215}At Levels

Shell-model configuration assignments are based on predicted level energies, and on those assigned in ^{214}Po and ^{216}Rn .

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$
0.0 [#]	9/2 ⁻	0.10 ms 2
169.88 [@] 10	(7/2) ⁻	
352.00 [#] 10	(5/2) ⁻	
364.0 ^{&} 10	(13/2) ⁺	
472.29 [#] 17	(7/2) ⁻	
517.00 [#] 20	(13/2) ⁻	
580 [#]	(3/2) ⁻	

[†] Deduced by evaluators from a least-squares fit to γ -ray energies.

[‡] From Adopted Levels.

[#] Member of configuration= $\pi h_{9/2}^3 \otimes \nu g_{9/2}^4$.

[@] Member of configuration= $\pi h_{9/2}^2 \otimes \pi f_{7/2} \otimes \nu g_{9/2}^4$.

[&] Member of configuration= $\pi h_{9/2}^2 \otimes \pi i_{13/2} \otimes \nu g_{9/2}^4$.

 α radiations

$E\alpha^\dagger$	$E(\text{level})$	$I\alpha^{\ddagger\#}$	$HF^{\ddagger}$	Comments
6744	580	<0.03	>26	$E\alpha, I\alpha$: from 1993Li07 .
6802.9 20	517.00	0.25	6	Other value: $E\alpha=6780$ 10, value deduced by 1977Ma30 from an α spectrum presented in 1966Gr07 . Original $E\alpha=6680$ is probably a typographical error. $I\alpha=0.3$ 1 (1966Gr07). $E\alpha=6805$, $I\alpha=0.25$ (1993Li07).
6846.2 25	472.29	0.05	44	$I\alpha$: 0.20 4, deduced by evaluators from γ -ray transition intensity balance. Other value: $E\alpha=6820$ 10; value deduced by 1977Ma30 from an α spectrum presented in 1966Gr07 . Original $E\alpha=6720$ is probably a typographical error. $I\alpha=0.2$ 1 (1966Gr07). $E\alpha=6849$, $I\alpha=0.05$ (1993Li07).
6956.6 30	364.0	≈ 0.02	≈ 271	$I\alpha$: 0.06 2, deduced by evaluators from γ -ray transition intensity balance. Other values: $E\alpha=6958$, $I\alpha \approx 0.02$ (1993Li07).
6967.3 20	352.00	0.6	10	Other values: $E\alpha=6950$ 10, $I\alpha(6967\alpha + 6957\alpha)=0.8$ 1 (1966Gr07); $E\alpha=6968$, $I\alpha=0.6$ (1993Li07).
7145.7 20	169.88	0.25 7	103 31	$I\alpha$: 0.61 5, deduced by evaluators from γ -ray transition intensity balance. $I\alpha$: weighted average of 0.3 1 (1966Gr07) and 0.2 1 (1968Ba73 , 1977Ma30).

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^{219}Fr α decay (20 ms) 1993Li07,1968Ba73,1966Gr07 (continued) α radiations (continued)

$E\alpha^{\dagger}$	E(level)	$I\alpha^{\ddagger\#}$	HF ‡	Comments
				$I\alpha$: 0.30 3, deduced by evaluators from γ -ray transition intensity balance. Other value: 0.2 (1993Li07).
				$E\alpha$: other values: 7140 10 (1966Gr07), 7148 (1993Li07).
7312.3 18	0.0	98.8 2	0.97 10	$E\alpha$: value adjusted from $E\alpha=7312.2$ 20 (1968Ba73) and $E\alpha=7317$ 4 (1982Bo04), as recommended by 1991Ry01. Other values: $E\alpha=7300$ 10, $I\alpha=98.4$ (1966Gr07); $E\alpha=7307$ 20, energy has been increased by 7 keV to account for changes in calibration energies (1951Me10,1977Ma30); $E\alpha=7313$ (1993Li07). $I\alpha$: from 1991Ry01.

 † From 1968Ba73, unless otherwise specified. ‡ Using $r_0(^{215}\text{At})=1.5575$ 80, interpolated value deduced from $r_0(^{214}\text{Po})=1.559$ 8, and $r_0(^{216}\text{Rn})=1.556$ 8 (1998Ak04). $^{\#}$ Absolute intensity per 100 decays. $\gamma(^{215}\text{At})$ I γ normalization: Measured absolute γ -ray intensities (1993Li07).Measured intensity of $K_{\alpha}+K_{\beta}$ x rays=0.22 3.

$E_{\gamma}^{\ddagger}$	$I_{\gamma}^{\ddagger@}$	$E_i(\text{level})$	J_i^{π}	E_f	J_f^{π}	Mult. $^{\#}$	δ	$\alpha^{\dagger}$	Comments
153 $^{\&}$	≈ 0.006	517.00	(13/2) $^-$	364.0	(13/2) $^+$	[E1]		0.1617	$\alpha(K)=0.1290$ 18; $\alpha(L)=0.0249$ 4; $\alpha(M)=0.00591$ 9; $\alpha(N)=0.001513$ 22; $\alpha(O)=0.000312$ 5
169.9 1	0.10 1	169.88	(7/2) $^-$	0.0	9/2 $^-$	M1+E2	0.73 16	2.06 19	$\alpha(P)=3.87\times 10^{-5}$ 6 $\alpha(K)=1.50$ 20; $\alpha(L)=0.425$ 13; $\alpha(M)=0.106$ 5; $\alpha(N)=0.0274$ 12; $\alpha(O)=0.00566$ 19 $\alpha(P)=0.000702$ 10 Mult., δ : from $\alpha(K)\text{exp}=1.5$ 2 (1993Li07). E_{γ} : uncertain γ ray.
x225 302.6 3	≈ 0.01 ≈ 0.006	472.29	(7/2) $^-$	169.88	(7/2) $^-$				
352.0 1	0.56 5	352.00	(5/2) $^-$	0.0	9/2 $^-$	E2		0.0830	$\alpha(K)=0.0479$ 7; $\alpha(L)=0.0262$ 4; $\alpha(M)=0.00679$ 10; $\alpha(N)=0.001756$ 25; $\alpha(O)=0.000354$ 5 $\alpha(P)=4.01\times 10^{-5}$ 6 Mult.: from $\alpha(K)\text{exp}=0.06$ 1 (1993Li07).
472.2 2	0.050 15	472.29	(7/2) $^-$	0.0	9/2 $^-$	(M1)		0.1613	$\alpha(K)=0.1312$ 19; $\alpha(L)=0.0229$ 4; $\alpha(M)=0.00542$ 8; $\alpha(N)=0.001403$ 20; $\alpha(O)=0.000301$ 5 $\alpha(P)=4.16\times 10^{-5}$ 6 Mult.: from $\alpha(K)\text{exp}\approx 0.1$ (1993Li07).
517.0 2	0.19 4	517.00	(13/2) $^-$	0.0	9/2 $^-$	E2		0.0310	$\alpha(K)=0.0214$ 3; $\alpha(L)=0.00725$ 11; $\alpha(M)=0.00183$ 3; $\alpha(N)=0.000473$ 7; $\alpha(O)=9.69\times 10^{-5}$ 14 $\alpha(P)=1.166\times 10^{-5}$ 17 Mult.: from $\alpha(K)\text{exp}=0.03$ 1 (1993Li07).

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^{219}Fr α decay (20 ms) [1993Li07](#), [1968Ba73](#), [1966Gr07](#) (continued)

$\gamma(^{215}\text{At})$ (continued)

[†] [Additional information 1.](#)

[‡] From [1993Li07](#). Other: [1968Gr07](#).

[#] From K x ray/I γ ratios in coincidence with individual α -particle groups ([1993Li07](#)).

[@] Absolute intensity per 100 decays.

[&] Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

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