

$^{218}\text{Fr}$   $\alpha$  decay (21.9 ms) 1999Sh03,1982Ew01

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Shaofei Zhu and E. A. Mccutchan		NDS 175, 1 (2021)	1-May-2021

Parent:  $^{218}\text{Fr}$ :  $E=86.8$ ;  $J^\pi=(8^-,9^-)$ ;  $T_{1/2}=21.9$  ms 5;  $Q(\alpha)=8013.7$  14;  $\% \alpha$  decay  $\leq 100.0$

$^{218}\text{Fr}$ - $Q(\alpha)$ : from 2021Wa16.

$^{218}\text{Fr}$ - $J^\pi, T_{1/2}$ : from Adopted Levels of  $^{218}\text{Fr}$  (2019Si39).

1999Sh03: Radioactivity of  $^{218}\text{Fr}$  produced from  $^{222}\text{Ac}$  decay (following  $\text{Th}(p,X)^{222}\text{Ac}$ ); ISOCELE mass and chemical separation of source. Measured  $E\alpha$ ,  $E\gamma$ ,  $\alpha\gamma$ -,  $\gamma\gamma$ -coin; deduced levels,  $J^\pi$ ,  $\alpha$ -branching.

1982Ew01: Radioactivity of  $^{218}\text{Fr}$  produced from  $^{238}\text{U}(p,15n6p)$ , ISOCELE isotope separator; measured  $E\alpha$ ,  $I\alpha$ ,  $\alpha\alpha$ -coin,  $T_{1/2}$ ; deduced levels,  $J^\pi$ ,  $\alpha$ -branching.

$\alpha$ : [Additional information 1](#).

 $^{214}\text{At}$  Levels

E(level) <sup>†</sup>	$J^\pi$ <sup>#</sup>	$T_{1/2}$	Comments
0.0	$1^-$	558 ns 10	$T_{1/2}$ : from Adopted Levels.
79 <sup>‡</sup> 6	$(0^-)$		
145.1 5	$(2^-)$		
187.0 10	$(3^-)$		
228.1 12	$(4^-)$		
231 <sup>‡</sup> 7	$9^-$		
277.9 10	$(7^-)$		
302.1 15	$(6^-)$		
343.0 10	$(8^-)$		
412 <sup>‡</sup> 7			
455 <sup>‡</sup> 8			
504.1 23			
565.1 23			
631 <sup>‡</sup> 12			
728.4 15	$(8^-)$		
791 <sup>‡</sup> 8			
864 <sup>‡</sup> 7			
883 <sup>‡</sup> 16			
975 <sup>‡</sup> 9			
1018 <sup>‡</sup> 7			
1138 <sup>‡</sup> 9			

<sup>†</sup> From a least squares fit to  $E\gamma$ 's by evaluators, unless otherwise noted.

<sup>‡</sup> From  $E\alpha$  and  $Q(\alpha)$ .

<sup>#</sup> From the Adopted Levels.

 $\alpha$  radiations

$E\alpha$	E(level)	$I\alpha$ <sup>‡</sup>	HF <sup>†</sup>	Comments
6835 7	1138	0.04 1	$\geq 41$	$E\alpha$ : adjusted from 6837 7 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
6953 5	1018	0.51 3	$\geq 11$	$E\alpha$ : adjusted from 6955 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
6995 8	975	0.037 15	$\geq 137$	$E\alpha$ : adjusted from 6997 8 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.

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$^{218}\text{Fr}$   $\alpha$  decay (21.9 ms) **1999Sh03,1982Ew01 (continued)** $\alpha$  radiations (continued)

$E\alpha$	E(level)	$I\alpha^{\ddagger}$	HF <sup>†</sup>	Comments
7085 15	883	0.33 23	$\geq 16$	$E\alpha$ : adjusted from 7087 15 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7104 5	864	1.61 22	$\geq 11$	$E\alpha$ : adjusted from 7106 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7176 6	791	0.89 13	$\geq 35$	$E\alpha$ : adjusted from 7178 6 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7239 4	728.4	9.5 4	$\geq 6$	$E\alpha$ : weighted average of 7240 5 (1999Sh03) and 7238 5 adjusted from 7240 5 (1982Ew01). $I\alpha$ : weighted average of 8 2 (1999Sh03) and 9.6 4 (1982Ew01).
7333 11	631	0.58 14	$\geq 165$	$E\alpha$ : weighted average of 7335 15 (1999Sh03) and 7331 15 adjusted from 7332 15 (1982Ew01). $I\alpha$ : weighted average of 0.5 2 (1999Sh03) and 0.65 20 (1982Ew01). Partially overlaps with 7317 $\alpha$ from $^{219}\text{Fr}$ (1982Ew01).
7397 5	565.1	3.4 3	$\geq 55$	$E\alpha$ : weighted average of 7398 10 (1999Sh03) and 7397 5 adjusted from 7398 5 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 2 1 (1999Sh03) and 3.4 2 (1982Ew01).
7457 4	504.1	1.3 1	$\geq 230$	$E\alpha$ : weighted average of 7458 8 (1999Sh03) and 7457 5 adjusted from 7458 5 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 1.0 5 (1999Sh03) and 1.3 1 (1982Ew01).
7505 6	455	0.93 10	$\geq 446$	$E\alpha$ : adjusted from 7506 6 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7548 5	412	0.76 9	$\geq 736$	$E\alpha$ : adjusted from 7549 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7616 4	343.0	41.3 13	$\geq 24$	$E\alpha$ : weighted average of 7616 5 (1999Sh03) and 7615 5 adjusted from 7616 5 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 45 5 (1999Sh03) and 41.1 13 (1982Ew01).
7657 5	302.1	10.9 17	$\geq 108$	$E\alpha$ : weighted average of 7657 7 (1999Sh03) and 7656 7 adjusted from 7657 7 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 9 3 (1999Sh03) and 11.9 21 (1982Ew01).
7681 4	277.9	15.9 19	$\geq 91.4$	$E\alpha$ : weighted average of 7682 5 (1999Sh03) and 7680 7 adjusted from 7681 7 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 15 4 (1999Sh03) and 16.1 21 (1982Ew01).
7725 5	231	4.8 8	$\geq 397$	$E\alpha$ : weighted average of 7726 7 (1999Sh03) and 7724 6 adjusted from 7725 6 (1982Ew01) by 1991Ry01. $I\alpha$ : weighted average of 7 2 (1999Sh03) and 4.5 7 (1982Ew01).
7769 5	187.0	1.14 11	$\geq 2457$	$E\alpha$ : adjusted from 7770 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7809 5	145.1	1.6 1	$\geq 2415$	$E\alpha$ : adjusted from 7810 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7874 5	79	1.4 2	$\geq 3962$	$E\alpha$ : adjusted from 7875 5 (1982Ew01) by 1991Ry01. $I\alpha$ : from 1982Ew01.
7952 4	0.0	2.4 1	$\geq 4353$	$E\alpha$ : weighted average of 7952 5 (1999Sh03) and 7951 5 (1991Ry01) adjusted from 7952 5 (1982Ew01). $I\alpha$ : weighted average of 2 1 (1999Sh03) and 2.4 1 (1982Ew01).

<sup>†</sup>  $r_0(^{214}\text{At})=1.5615$  28, unweighted average of  $r_0(^{212}\text{Po})=1.5658$  59,  $r_0(^{214}\text{Po})=1.5606$  7,  $r_0(^{214}\text{Rn})=1.5655$  13,  $r_0(^{216}\text{Rn})=1.5539$  57 (2020Si16). The deduced HF values are lower limits due to the uncertain  $\alpha$  branching from the 21.9-ms isomer.

<sup>‡</sup> For absolute intensity per 100 decays, multiply by  $\leq 1.0$ .

$^{218}\text{Fr}$   $\alpha$  decay (21.9 ms) 1999Sh03,1982Ew01 (continued) $\gamma(^{214}\text{At})$ 

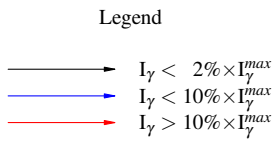
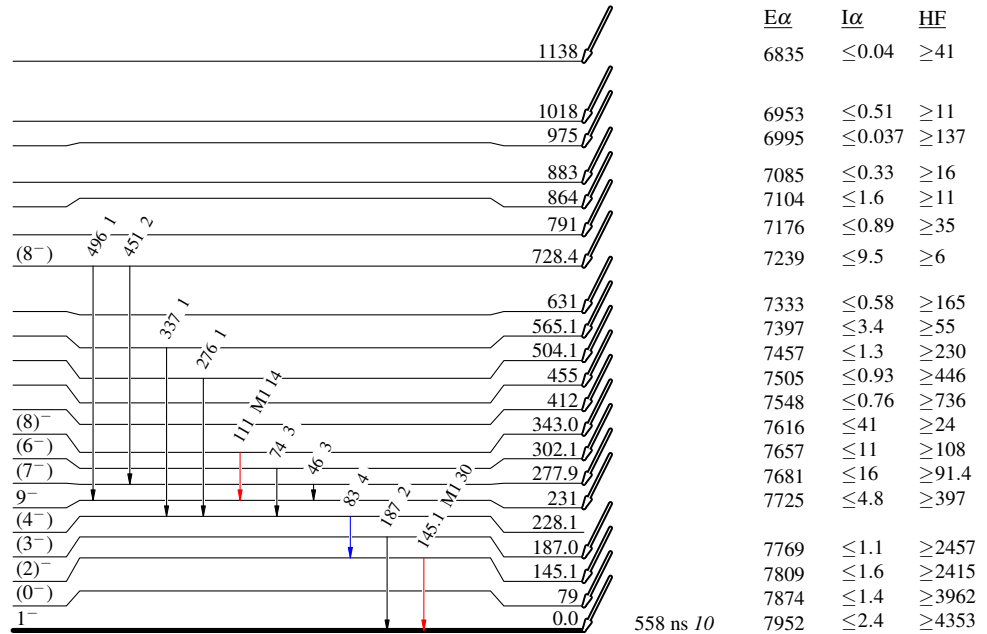
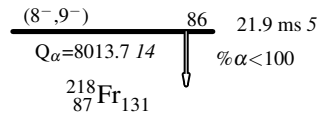
$E_\gamma$ †	$I_\gamma$ †	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult.	$\alpha$	Comments
46 1	3	277.9	(7 <sup>-</sup> )	231	9 <sup>-</sup>			
74 1	3	302.1	(6 <sup>-</sup> )	228.1	(4 <sup>-</sup> )			
83 1	4	228.1	(4 <sup>-</sup> )	145.1	(2 <sup>-</sup> )			
111 1	14	343.0	(8 <sup>-</sup> )	231	9 <sup>-</sup>	M1	8.98 27	$\alpha(\text{K})=7.26$ 21; $\alpha(\text{L})=1.31$ 4; $\alpha(\text{M})=0.310$ 9; $\alpha(\text{N})=0.0804$ 24; $\alpha(\text{O})=0.0172$ 5; $\alpha(\text{P})=0.00238$ 7 Mult.: from the ratio of the IK-x ray to $I_\gamma$ , measured value not explicitly given (1999Sh03).
145.1 5	30	145.1	(2 <sup>-</sup> )	0.0	1 <sup>-</sup>	M1	4.19 7	$\alpha(\text{K})=3.39$ 6; $\alpha(\text{L})=0.608$ 10; $\alpha(\text{M})=0.1438$ 25; $\alpha(\text{N})=0.0373$ 6; $\alpha(\text{O})=0.00798$ 14 $\alpha(\text{P})=0.001102$ 19 Mult.: from the ratio of the IK-x ray to $I_\gamma$ , measured value not explicitly given (1999Sh03).
187 1	2	187.0	(3 <sup>-</sup> )	0.0	1 <sup>-</sup>			
276 2	1	504.1		228.1	(4 <sup>-</sup> )			
337 2	1	565.1		228.1	(4 <sup>-</sup> )			
<sup>x</sup> 347 2	2							
451 2	2	728.4	(8 <sup>-</sup> )	277.9	(7 <sup>-</sup> )			
496 2	1	728.4	(8 <sup>-</sup> )	231	9 <sup>-</sup>			

† From 1999Sh03.

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

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## Decay Scheme

Intensities: Relative  $I_\gamma$  $^{214}_{85}\text{At}_{129}$