

Energy levels and branching ratios [92Ak01].

**<sup>213</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Branching ratios in percentage							
			$E_f^*:$ $2J_f^\pi:$	0.0 9 <sup>-</sup>	1188.8 13 <sup>-</sup>	1411.0 17 <sup>-</sup>	1590.4 21 <sup>-</sup>	1856.3 23 <sup>-</sup>	2537.6 29 <sup>+</sup>	2740.3 27 <sup>-</sup>
0.0	9 <sup>-</sup>	34.6(3) s								
498	$\langle 7^- \rangle$			x						
1105	$\langle 13 \rangle^+$			x						
1188.8(1)	13 <sup>-</sup>	<2.1 ns		x						
1411.0(2)	17 <sup>-</sup>	18(1) ns			x					
1590.4(2)	21 <sup>-</sup>	499(21) ns				x				
1856.3(2)	23 <sup>-</sup>	<1.4 ns					x			
2537.6(3)	29 <sup>+</sup>	243(21) ns								
2740.3(3)	27 <sup>-</sup>	<7 ns						x		
2950.5(3)	31 <sup>-</sup>	<2.1 ns							x	
3427.3(3)	33 <sup>+</sup>	<2.1 ns							100	<33
3489.2(5)	$\langle 33 \rangle$								69(3)	
3655.4(4)	37 <sup>+</sup>	2.4(7) ns								
4029.2(6)										
4082.9(4)	39 <sup>+</sup>	<1.4 ns								
4653.4(8)										
4675.4(5)		<2.1 ns								
4695.7(5)	39 <sup>-</sup>	<2.1 ns								
4898.4(4)	41 <sup>-</sup>	<2.8 ns								
4981.9(7)										
4992.7(4)	45 <sup>-</sup>	13(2) ns								
5002.0(6)										
5219.9(8)										
5505.9(6)	43 <sup>-</sup>	<2.1 ns								
5785.7(5)	47 <sup>-</sup>	<1.4 ns								
5814.6(8)	$\langle 45^+ \rangle$									
5951.7(5)										
6102.5(6)	49 $\langle^- \rangle$									
6334.4(6)										
6572.8(6)	49 <sup>+</sup>	<2.1 ns								
6715.1(6)	53 <sup>+</sup>	6.2(14) ns								
6724.3(7)	$\langle 55^+ \rangle$									
6802.4(10)	$\langle 55 \rangle$									
6813.1(8)										
7135.3(10)										
7247.1(10)										
7287.6(8)	$\langle 57^+ \rangle$	<2.1 ns								
7374.1(11)	$\langle 57, 59 \rangle$									
7541.2(9)	$\langle 57 \rangle$									
7723.3(8)	$\langle 59^+ \rangle$									
7983.4(8)	$\langle 61^- \rangle$	<3.5 ns								
8094.7(8)	$\langle 65^- \rangle$	3.1(2) $\mu$ s								

Additional data on this isotope can be found in [05Ku06].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [92Ak01]. Part 2

**<sup>213</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*$ : $2J_f^\pi$ :	2950.5 31 <sup>-</sup>	3427.3 33 <sup>+</sup>	3489.2 ⟨33⟩	3655.4 37 <sup>+</sup>	4029.2	4082.9 39 <sup>+</sup>	4653.4	4675.4	4695.7 39 <sup>-</sup>	4898.4 41 <sup>-</sup>
3427.3(3)	33 <sup>+</sup>		31.4(14)									
3489.2(5)	⟨33⟩		x									
3655.4(4)	37 <sup>+</sup>			x								
4029.2(6)					x							
4082.9(4)	39 <sup>+</sup>					x						
4653.4(8)							x					
4675.4(5)								100				
4695.7(5)	39 <sup>-</sup>					100	x		x			
4898.4(4)	41 <sup>-</sup>							x				
4981.9(7)										x		
4992.7(4)	45 <sup>-</sup>							97(8)				3.3(9)
5002.0(6)										x		
5219.9(8)										100		
5505.9(6)	43 <sup>-</sup>										x	

Energy levels and branching ratios [92Ak01]. Part 3

**<sup>213</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*$ : $2J_f^\pi$ :	4981.9	4992.7 45 <sup>-</sup>	5002.0	5219.9	5505.9 43 <sup>-</sup>	5785.7 47 <sup>-</sup>	5814.6 ⟨45 <sup>+</sup> ⟩	5951.7	6102.5 49 <sup>(-)</sup>	6334.4
5219.9(8)			x	x								
5785.7(5)	47 <sup>-</sup>			68(11)	0.016(5)		32(3)					
5814.6(8)	⟨45 <sup>+</sup> ⟩					62(12)	38(12)					
5951.7(5)				52(15)	48(19)							
6102.5(6)	49 <sup>(-)</sup>							x				
6334.4(6)										x		
6572.8(6)	49 <sup>+</sup>							80(8)	13(3)		x	7.1(4)
6715.1(6)	53 <sup>+</sup>							59(12)				
6724.3(7)	⟨55 <sup>+</sup> ⟩										100	
6813.1(8)												x

Energy levels and branching ratios [92Ak01]. Part 4

**<sup>213</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*$ : $2J_f^\pi$ :	6572.8 49 <sup>+</sup>	6715.1 53 <sup>+</sup>	6724.3 ⟨55 <sup>+</sup> ⟩	6802.4 ⟨55⟩	6813.1	7135.3	7247.1	7287.6 ⟨57 <sup>+</sup> ⟩	7374.1 ⟨57,59⟩	7541.2 ⟨57⟩
6715.1(6)	53 <sup>+</sup>		41(5)									
6724.3(7)	⟨55 <sup>+</sup> ⟩			x								
6802.4(10)	⟨55⟩				x							

(continued)

 **$^{213}_{87}\text{Fr}$** 

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*$ : $2J_f^\pi$ :	6572.8 49 <sup>+</sup>	6715.1 53 <sup>+</sup>	6724.3 55 <sup>+</sup>	6802.4 55	6813.1	7135.3	7247.1	7287.6 57 <sup>+</sup>	7374.1 57,59	7541.2 57
7135.3(10)							x					
7247.1(10)								x				
7287.6(8)	57 <sup>+</sup>				x							
7374.1(11)	57,59								100	x		
7541.2(9)	57				11(4)	9.1(11)			9(2)	71(5)		
7723.3(8)	59 <sup>+</sup>				9(3)					6(2)	55(3)	31(6)
7983.4(8)	61 <sup>-</sup>				100					x		

Energy levels and branching ratios [92Ak01]. Part 5

 **$^{213}_{87}\text{Fr}$** 

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage	
		$E_f^*$ : $2J_f^\pi$ :	7723.3 59 <sup>+</sup>
8094.7(8)	65 <sup>-</sup>		61(5)
			7983.4 61 <sup>-</sup>

Energy levels and branching ratios [95El07].

 **$^{214}_{87}\text{Fr}$** 

$E^*$ [keV]	$J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.	Branching ratios in percentage							
				$E_f^*$ : $J_f^\pi$ :	122 8 <sup>-</sup>	167 9 <sup>-</sup>	638 11 <sup>+</sup>	938 11 <sup>+</sup>	1081 12 <sup>+</sup>	1368 12 <sup>+</sup>	1545 12 <sup>+</sup>
0.0	1 <sup>-</sup>	5.0(2) ms									
122(6) <sup>e</sup>	8 <sup>-</sup>	3.35(5) ms									
167(6) <sup>e</sup>	9 <sup>-</sup>			x							
638(6) <sup>f</sup>	11 <sup>+</sup>	103(4) ns		3.4(12)	97(3)						
938(7)	11 <sup>+</sup>						x				
1081(6)	12 <sup>+</sup>						68(5)	32(3)			
1368(7) <sup>b</sup>	12 <sup>+</sup>					x					
1545(6) <sup>f</sup>	12 <sup>+</sup>						71(6)	25(7)		4.0(11)	
1598(7) <sup>e</sup>	13 <sup>-</sup>								95(7)		4.7(2)
1636(8)							x				
1662(6) <sup>a</sup>	14 <sup>-</sup>	11(2) ns					87(3)		10.8(11)		
1733(7) <sup>e</sup>	15 <sup>-</sup>	10(2) ns									
1851(7) <sup>g</sup>	16 <sup>-</sup>										
2164(7) <sup>f</sup>	17 <sup>+</sup>	≤7 ns									
2165+x <sup>f</sup>	19 <sup>+</sup>										
2780+x											
2811+x <sup>g</sup>	20 <sup>-</sup>										
2903+x	20 <sup>-</sup>										
3056+x <sup>f</sup>	21 <sup>+</sup>										

(continued)

 **$^{214}_{87}\text{Fr}$** 

$E^*$	$J^\pi$	$T_{1/2}$ or	Ref.	Branching ratios in percentage							
[keV]		$\Gamma_{\text{cm}}$		$E_f^*$ : $J_f^\pi$ :	122 $\langle 8^- \rangle$	167 $\langle 9^- \rangle$	638 $\langle 11^+ \rangle$	938 $\langle 11^+ \rangle$	1081 $\langle 12^+ \rangle$	1368 $\langle 12^+ \rangle$	1545 $\langle 12^+ \rangle$
3089+x											
3214+x	$\langle 21^- \rangle$										
3265+x <sup>f</sup>	$\langle 23^+ \rangle$	4.2(7)	ns								
3331+x	22										
3340+x	$\langle 24^+ \rangle$										
3465+x											
3520+x	$\langle 22^- \rangle$										
3566+x <sup>c</sup>	$\langle 24^+ \rangle$	$\approx 10$	ns								
3841+x	24										
3897+x <sup>c</sup>	$\langle 25^+ \rangle$										
4012+x											
4198+X	$\langle 25^- \rangle$										
4231+x <sup>d</sup>	$\langle 25^- \rangle$										
4318+x <sup>d</sup>	$\langle 27^- \rangle$	8.0(2)	ns								
4577+x	$\langle 26^+ \rangle$										
4706+x											
4927+x	$\langle 28^- \rangle$										
4977+x	$\langle 26^+, 27^+ \rangle$										
5002+x											
5207+x											
5333+x	$\langle 28^+ \rangle$										
5437+x											
5559+x											
5629+x											
5640+x	$\langle 28^+ \rangle$										
5771+x	$\langle 29^- \rangle$										
6092+x	$\langle 30^- \rangle$										
6181+x	$\langle 30^- \rangle$										
6363+x	$\langle 30^- \rangle$										
6477+x	$\langle 31^- \rangle$										
6477+y	$\langle 33^+ \rangle$	108(7)	ns								
6523+x											
6814+y	$\langle 34^+ \rangle$										
6918+x											
7258+y											
7545+y	$\langle 36^- \rangle$	4.9(4)	ns								
7549+y	$\langle 35^+ \rangle$										
7848+y											
8144+y											
8659+y											

Additional data on this isotope can be found in [94By01, 93De26, 93By01].

7 nucleon configuration (marked here a-g) are considered in [95El07].

Energy levels and branching ratios [95El07]. Part 2

**<sup>214</sup>Fr**  
**87**

$E^*$ [keV]	$J^\pi$	Branching ratios in percentage									
		$E_f^*$ : $J_f^\pi$ :	1598 ⟨13 <sup>-</sup> ⟩	1662 ⟨14 <sup>-</sup> ⟩	1733 ⟨15 <sup>-</sup> ⟩	1851 ⟨16 <sup>-</sup> ⟩	2165+X ⟨19 <sup>+</sup> ⟩	2811+X ⟨20 <sup>-</sup> ⟩	2903+X ⟨20 <sup>-</sup> ⟩	3056+X ⟨21 <sup>+</sup> ⟩	3089+X
1662(6) <sup>a</sup>	⟨14 <sup>-</sup> ⟩		1.7(6)								
1733(7) <sup>e</sup>	⟨15 <sup>-</sup> ⟩		29(4)	71(10)							
1851(7) <sup>g</sup>	⟨16 <sup>-</sup> ⟩				x						
2164(7) <sup>f</sup>	⟨17 <sup>+</sup> ⟩					x					
2780+x							x				
2811+x <sup>g</sup>	⟨20 <sup>-</sup> ⟩						x				
2903+x	⟨20 <sup>-</sup> ⟩						x				
3056+x <sup>f</sup>	⟨21 <sup>+</sup> ⟩						92(4)	8.0(5)			
3089+x									x		
3214+x	⟨21 <sup>-</sup> ⟩							29(6)	58(10)		13(4)
3265+x <sup>f</sup>	⟨23 <sup>+</sup> ⟩									x	
3331+x	22									x	
3520+x	⟨22 <sup>-</sup> ⟩										16(5)

Energy levels and branching ratios [95El07]. Part 3

**<sup>214</sup>Fr**  
**87**

$E^*$ [keV]	$J^\pi$	Branching ratios in percentage									
		$E_f^*$ : $J_f^\pi$ :	3214+X ⟨21 <sup>-</sup> ⟩	3265+X ⟨23 <sup>+</sup> ⟩	3340+X ⟨24 <sup>+</sup> ⟩	3520+X ⟨22 <sup>-</sup> ⟩	3566+X ⟨24 <sup>+</sup> ⟩	3897+X ⟨25 <sup>+</sup> ⟩	4198+X ⟨25 <sup>-</sup> ⟩	4231+X ⟨25 <sup>-</sup> ⟩	4318+X ⟨27 <sup>-</sup> ⟩
3340+x	⟨24 <sup>+</sup> ⟩			x							
3465+x		x									
3520+x	⟨22 <sup>-</sup> ⟩	84(8)									
3566+x <sup>c</sup>	⟨24 <sup>+</sup> ⟩			x		x					
3841+x	24			x							
3897+x <sup>c</sup>	⟨25 <sup>+</sup> ⟩						x				
4012+x							x				
4198+X	⟨25 <sup>-</sup> ⟩				x						
4231+x <sup>d</sup>	⟨25 <sup>-</sup> ⟩				≤24		100				
4318+x <sup>d</sup>	⟨27 <sup>-</sup> ⟩				33(4)		40(6)		8(2)	19(12)	
4577+x	⟨26 <sup>+</sup> ⟩							x			
4706+x								x			
4927+x	⟨28 <sup>-</sup> ⟩										x
4977+x	⟨26 <sup>+</sup> , 27 <sup>+</sup> ⟩							26(11)			
5002+x											x
5207+x											95(12)
5333+x	⟨28 <sup>+</sup> ⟩										x
5559+x											22(9)
5629+x											x
5640+x	⟨28 <sup>+</sup> ⟩										x
5771+x	⟨29 <sup>-</sup> ⟩										7(2)

Energy levels and branching ratios [95El07]. Part 4

**<sup>214</sup>Fr<sub>87</sub>**

$E^*$	$J^\pi$	Branching ratios in percentage								
[keV]		$E_f^*$ : $J_f^\pi$ :	4577+X $\langle 26^+ \rangle$	4706+X	4927+X $\langle 28^- \rangle$	4977+X	5207+X	5559+X	5640+X $\langle 28^+ \rangle$	5771+X $\langle 29^- \rangle$
4977+x	$\langle 26^+, 27^+ \rangle$		74(11)							
5207+x					4.9(25)					
5437+x					42(16)	58(16)				
5559+x				65(22)			13(5)			
5771+x	$\langle 29^- \rangle$				66(5)			14(3)	13(2)	
6092+x	$\langle 30^- \rangle$									x
6181+x	$\langle 30^- \rangle$									95(9)
6363+x	$\langle 30^- \rangle$									x
6523+x							x			

Energy levels and branching ratios [95El07]. Part 5

**<sup>214</sup>Fr<sub>87</sub>**

$E^*$	$J^\pi$	Branching ratios in percentage								
[keV]		$E^*_f$ : $J^\pi_f$ :	6092+X $\langle 30^- \rangle$	6181+X $\langle 30^- \rangle$	6363+X $\langle 30^- \rangle$	6477+Y $\langle 33^+ \rangle$	6523+X	6814+Y $\langle 34^+ \rangle$	7545+Y $\langle 36^- \rangle$	7848+Y
6181+x	$\langle 30^- \rangle$		5.3(8)							
6477+x	$\langle 31^- \rangle$			95(16)	4.8(16)					
6814+y	$\langle 34^+ \rangle$					x				
6918+x							x			
7258+y						x				
7545+y	$\langle 36^- \rangle$					x				
7549+y	$\langle 35^+ \rangle$							x		
7848+y									x	
8144+y									x	
8659+y										100

Energy levels and branching ratios [01Br31].

**<sup>215</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Branching ratios in percentage							
			$E_f^*:$ $2J_f^\pi:$	0.0 9 <sup>-</sup>	670.3 $\langle 13 \rangle^-$	700.0 $\langle 11 \rangle^-$	835.5 $\langle 13 \rangle^+$	1121.5 $\langle 17 \rangle^-$	1149.0 $\langle 15 \rangle^-$	1440.0 $\langle 19 \rangle^-$
0.0	9 <sup>-</sup>	86(5) ns								
670.3(1)	$\langle 13 \rangle^-$			100						
700.0(1)	$\langle 11 \rangle^-$			100						
835.5(1)	$\langle 13 \rangle^+$				36(2)	64(3)				
1121.5(1)	$\langle 17 \rangle^-$				100					
1149.0(1)	$\langle 15 \rangle^-$				39(3)	52(2)	9(1)	x		
1440.0(1)	$\langle 19 \rangle^-$							17(1)	83(2)	
1457.4(2)	$\langle 21 \rangle^-$							100		

(continued)

**<sup>215</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Branching ratios in percentage							
			$E_f^*$ : $2J_f^\pi$ :	0.0 9 <sup>-</sup>	670.3 ⟨13⟩ <sup>-</sup>	700.0 ⟨11⟩ <sup>-</sup>	835.5 ⟨13⟩ <sup>+</sup>	1121.5 ⟨17⟩ <sup>-</sup>	1149.0 ⟨15⟩ <sup>-</sup>	1440.0 ⟨19⟩ <sup>-</sup>
1573.1(2)	⟨23⟩ <sup>-</sup>	3.5(14) ns								95(9)
1680.5(2)	⟨25⟩ <sup>-</sup>									
1813.6(2)	⟨27⟩ <sup>-</sup>	2.1(14) ns								
2015.9(2)	⟨29⟩ <sup>+</sup>	4.7(12) ns								
2251.3(3)	⟨33⟩ <sup>+</sup>	5.3(11) ns								
2806.8(3)	⟨35⟩ <sup>-</sup>									
2900.4(3)	⟨35⟩ <sup>-</sup>									
3013.9(4)	⟨37⟩ <sup>-</sup>									
3068.9(3)	⟨39⟩ <sup>-</sup>	14.6(14) ns								
3207.5(4)	⟨41⟩ <sup>-</sup>									
3409.2(3)										
3417.1(4)	⟨45⟩ <sup>-</sup>									
3419.4(3)										
3462.3(5)	⟨47⟩ <sup>+</sup>	23(2) ns								

Energy levels and branching ratios [01Br31]. Part 2

**<sup>215</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage										
		$E_f^*$ : $2J_f^\pi$ :	1457.4 ⟨21⟩ <sup>-</sup>	1573.1 ⟨23⟩ <sup>-</sup>	1680.5 ⟨25⟩ <sup>-</sup>	1813.6 ⟨27⟩ <sup>-</sup>	2015.9 ⟨29⟩ <sup>+</sup>	2251.3 ⟨33⟩ <sup>+</sup>	2806.8 ⟨35⟩ <sup>-</sup>	2900.4 ⟨35⟩ <sup>-</sup>	3013.9 ⟨37⟩ <sup>-</sup>	3068.9 ⟨39⟩ <sup>-</sup>
1573.1(2)	⟨23⟩ <sup>-</sup>		5.0(6)									
1680.5(2)	⟨25⟩ <sup>-</sup>			100								
1813.6(2)	⟨27⟩ <sup>-</sup>			71(3)	29(8)							
2015.9(2)	⟨29⟩ <sup>+</sup>					100						
2251.3(3)	⟨33⟩ <sup>+</sup>						100					
2806.8(3)	⟨35⟩ <sup>-</sup>							100				
2900.4(3)	⟨35⟩ <sup>-</sup>							100				
3013.9(4)	⟨37⟩ <sup>-</sup>									100		
3068.9(3)	⟨39⟩ <sup>-</sup>							25(2)	75(2)			
3207.5(4)	⟨41⟩ <sup>-</sup>										66(13)	34(7)
3409.2(3)												100
3419.4(3)										100		

Energy levels and branching ratios [01Br31]. Part 3

**<sup>215</sup>Fr**  
**87**

$E^*$	$2J^\pi$	$E_f^*:$ $2J_f^\pi:$	Branching ratios in percentage	
[keV]			3207.5 $\langle 41^- \rangle$	3417.1 $\langle 45^- \rangle$
3417.1(4)	$\langle 45^- \rangle$		100	
3462.3(5)	$\langle 47^+ \rangle$			100

Energy levels and branching ratios [97Ar04].

**<sup>216</sup>Fr**  
**87**

$E^*$	$J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.	$E_f^*:$ $J_f^\pi:$	0 $\langle 1^- \rangle$	133.3 $\langle 3^- \rangle$	191.2 $\langle 5^- \rangle$	212.0	226.1	249.4	254.4
[keV]											
0	$\langle 1^- \rangle$	0.70(2) $\mu\text{s}$									
133.3(1)	$\langle 3^- \rangle$	71(5) ns		x							
141.6(2)	$\langle 0^--2^- \rangle$			x							
191.2(2)	$\langle 5^- \rangle$					x					
212.0(2)						x					
226.1(2)	$\langle 3^-, 4, 5^- \rangle$					95(13)	$\approx 5$				
247.8(4)				x							
249.4(2)								x			
254.4(2)	$\langle 1^-, 2, 3^- \rangle$				33(10)	49(9)		$\approx 18$			
290.4(2)									x		
344.2(2)							31(6)		23(6)	42(7)	
349.3(3)								x			
409.3(2)										x	
0+x <sup>a</sup>	$\langle 9^- \rangle$										
493.4(2)									37(8)	37(8)	
532.1(2)									28(11)		
539.4(4)									78(11)		
550.9(2)										29(9)	44(11)
568.8(4)							$\approx 6$		94(13)		
581.5(3)	$\langle 3^-, 4, 5^- \rangle$					$\approx 15$	49(18)				
527.70+x <sup>a</sup>	$\langle 11^- \rangle$										
762.6+x <sup>b</sup>	$\langle 12^+ \rangle$										
969.4+x <sup>a</sup>	$\langle 13^- \rangle$										
1261.1+x <sup>b</sup>	$\langle 14^+ \rangle$										
1383.2+x <sup>a</sup>	$\langle 15^- \rangle$										
1659.9+x <sup>b</sup>	$\langle 16^+ \rangle$										
1834.8+x <sup>a</sup>	$\langle 17^- \rangle$										
1973.0+x <sup>b</sup>	$\langle 18^+ \rangle$										

Two bands (with negative- and positive-parity levels marked here a,b) are given in [97Ar04].

Nucleon configuration of low-lying levels can be found in [97Sh09].



Energy levels and branching ratios [97Ar04]. Part 2

**<sup>216</sup>Fr<sub>87</sub>**

$E^*$	$J^\pi$	Branching ratios in percentage										
[keV]		$E_f^*$ : $J_f^\pi$ :	290.4	344.2	349.3	409.3	0+X $\langle 9^- \rangle$	527.7+X $\langle 11^- \rangle$	762.6+X $\langle 12^+ \rangle$	969.4+X $\langle 13^- \rangle$	1261+X $\langle 14^+ \rangle$	1383+X $\langle 15^- \rangle$
<hr/>												
344.2(2)		$\approx 5$										
493.4(2)		$\approx 6$		20(6)								
532.1(2)				41(9)	16(4)	16(4)						
539.4(4)						$\approx 22$						
550.9(2)				27(7)								
581.5(3)	$\langle 3^-, 4, 5^- \rangle$					37(10)						
527.70+x <sup>a</sup>	$\langle 11^- \rangle$						x					
762.6+x <sup>b</sup>	$\langle 12^+ \rangle$							x				
969.4+x <sup>a</sup>	$\langle 13^- \rangle$						89(10)		10.9(10)			
1261.1+x <sup>b</sup>	$\langle 14^+ \rangle$								79(10)	20.8(13)		
1383.2+x <sup>a</sup>	$\langle 15^- \rangle$									95(9)	4.7(9)	
1659.9+x <sup>b</sup>	$\langle 16^+ \rangle$										28(3)	72(7)
1834.8+x <sup>a</sup>	$\langle 17^- \rangle$											51(8)

Energy levels and branching ratios [97Ar04]. Part 3

**<sup>216</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$J^\pi$	Branching ratios in percentage	
		$E_f^*$ : $J_f^\pi$ :	1660+X ⟨16 <sup>+</sup> ⟩
1834.8+x <sup>a</sup>	⟨17 <sup>-</sup> ⟩		49(5)
1973.0+x <sup>b</sup>	⟨18 <sup>+</sup> ⟩		81(9)
			1835+X ⟨17 <sup>-</sup> ⟩
			19(6)

Energy levels and branching ratios [03Ak06].

**<sup>217</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or Ref.	Branching ratios in percentage							
			$E_f^*$ : $2J_f^\pi$ :	0.0 9 <sup>-</sup>	363.6 13 <sup>-</sup>	704.2 17 <sup>-</sup>	1077.0 21 <sup>-</sup>	1256.1	1355.0 23 <sup>+</sup>	1509.7 25 <sup>-</sup>
0.0 <sup>a</sup>	9 <sup>-</sup>	19(3) $\mu$ s								
209(20)										
275(15)										
363.6(3) <sup>a</sup>	13 <sup>-</sup>			x						
484(15)										
704.2(5) <sup>a</sup>	17 <sup>-</sup>				x					
1077.0(6) <sup>a</sup>	21 <sup>-</sup>					x				
1256.1(6) <sup>c</sup>							x			
1355.0(6) <sup>b</sup>	23 <sup>+</sup>						x			
1509.7(6) <sup>a</sup>	25 <sup>-</sup>						x			
1688.9(7) <sup>c</sup>	X <sup>(+)</sup>							x	x	
1713.8(7) <sup>b</sup>	27 <sup>+</sup>								x	x

(continued)

**<sup>217</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or Ref. $\Gamma_{\text{cm}}$	Branching ratios in percentage							
			$E_f^*:$ $2J_f^\pi:$	0.0 9 <sup>-</sup>	363.6 13 <sup>-</sup>	704.2 17 <sup>-</sup>	1077.0 21 <sup>-</sup>	1256.1	1355.0 23 <sup>+</sup>	1509.7 25 <sup>-</sup>
1988.5(7) <sup>a</sup>	29 <sup>-</sup>									x
2111.1(8) <sup>b</sup>	31 <sup>+</sup>									
2154.5(8) <sup>c</sup>										
2516.5(9) <sup>b</sup>	⟨35 <sup>+</sup> ⟩									
2582.0(9) <sup>c</sup>										
2618(9)										
3002.3(9) <sup>b</sup>	⟨39 <sup>+</sup> ⟩									

Three bands (A,B,C marked here a,b,c) are assigned to excited states of this nucleus in [03Ak06].  
Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [03Ak06]. Part 2

**<sup>217</sup>Fr**  
**87**

$E^*$	$2J^\pi$	Branching ratios in percentage						
[keV]	$E_f^*:$ $2J_f^\pi:$	1688.9 $X^{(+)}$	1713.8 $27^+$	1988.5 $29^-$	2111.1 $31^+$	2154.5	2516.5 $\langle 35^+ \rangle$	
1988.5(7) <sup>a</sup>	$29^-$		x					
2111.1(8) <sup>b</sup>	$31^+$		x	x				
2154.5(8) <sup>c</sup>		x						
2516.5(9) <sup>b</sup>	$\langle 35^+ \rangle$				x			
2582.0(9) <sup>c</sup>						x		
2618(9)					x			
3002.3(9) <sup>b</sup>	$\langle 39^+ \rangle$						x	

Energy levels [95El08, 00De36, 06Ja03].

**<sup>218</sup>Fr**  
**87**

$E^*$ [keV]	$J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$
0.0	1 <sup>-</sup>	1.0(6) ms
46(11)		
86(8)		22.0(5) ms
0+X		
31(28)+X		
112(28)+X		
163(28)+X		
193(28)+X		
255(28)+X		
295(28)+X		
550(28)+X		

(continued)

**<sup>218</sup>Fr**  
**87**

$E^*$	$J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$
[keV]		
0+y <sup>b</sup>	$\langle 9^- \rangle$	
272.9+y <sup>b</sup>	$\langle 11^- \rangle$	
450.0+y <sup>a</sup>	$\langle 10^- \rangle$	
586.8+y <sup>c</sup>	$\langle 12^+ \rangle$	
596.0+y <sup>b</sup>	$\langle 13^- \rangle$	
776.6+y <sup>a</sup>	$\langle 12^- \rangle$	
862.7+y <sup>c</sup>	$\langle 14^+ \rangle$	
940.0+y		
973.1+y <sup>b</sup>	$\langle 15^- \rangle$	
1143.8+y <sup>a</sup>	$\langle 14^- \rangle$	
1192.1+y <sup>c</sup>	$\langle 16^+ \rangle$	
1421.7+y <sup>b</sup>	$\langle 17^- \rangle$	
1572.4+y <sup>c</sup>	$\langle 18^+ \rangle$	
1582.9+y <sup>a</sup>	$\langle 16^- \rangle$	
1921.7+y <sup>b</sup>	$\langle 19^- \rangle$	
2035.1+y <sup>c</sup>	$\langle 20^+ \rangle$	
2065.1+y <sup>a</sup>	$\langle 18^- \rangle$	
2477.9+y <sup>b</sup>	$\langle 21^- \rangle$	
2527.5+y <sup>c</sup>	$\langle 22^+ \rangle$	
3045.1+y <sup>c</sup>	$\langle 24^+ \rangle$	

A,B,C bands (here a,b,c) are from the evaluation [06Ja03].

Energy levels and branching ratios [01Br31, 91Li19].

**<sup>219</sup>Fr**  
**87**

$E^*$	$2J^\pi$	$T_{1/2}$ or Ref.	Branching ratios in percentage						
[keV]		$\Gamma_{\text{cm}}$	$E^*_\text{f}$ : $2J^\pi_\text{f}$ :	0.0 9 <sup>−</sup>	15.0 ⟨5 <sup>−</sup> ⟩	56.1 ⟨3 <sup>−</sup> ⟩	98.58 ⟨7 <sup>−</sup> ⟩ <sup>−</sup>	134.4 ⟨5 <sup>−</sup> ⟩ <sup>−</sup>	139.8 ⟨3 <sup>−</sup> ⟩ <sup>−</sup>
0.0 <sup>a</sup>	9 <sup>−</sup>	20(2) ms							
15.0(1) <sup>a</sup>	⟨5 <sup>−</sup> ⟩			100					
56.1(1)	⟨3 <sup>−</sup> ⟩				100				
73(1) <sup>a</sup>	⟨13 <sup>−</sup> ⟩			100					
81.0(5) <sup>a</sup>	⟨1 <sup>−</sup> ⟩				100				
98.58(4)	⟨7 <sup>−</sup> ⟩ <sup>−</sup>			60(1)	39(2)	0.8(2)			
134.4(1)	⟨5 <sup>−</sup> ⟩ <sup>−</sup>				57(5)	29(3)	14(2)		
139.8(1) <sup>a</sup>	⟨3 <sup>−</sup> ⟩ <sup>−</sup>				100				
191.29(5)	⟨7 <sup>+</sup> ⟩ <sup>+</sup>			52(4)	10(2)		34(2)	3.3(5)	
210.4(2)	⟨3 <sup>+</sup> ⟩				100				
216.0(1)	⟨11 <sup>+</sup> ⟩ <sup>+</sup>			100					
269.2(1) <sup>a</sup>	⟨7 <sup>−</sup> ⟩			56(11)	39(11)			6(3)	
305.5(1)	⟨9 <sup>−</sup> ⟩			43(5)			45(10)		
325(2)									
333.5(1) <sup>a</sup>	⟨11 <sup>−</sup> ⟩			85(31)					

(continued)

**<sup>219</sup>Fr**  
**87**

$E^*$	$2J^\pi$	$T_{1/2}$ or Ref.	$E_f^*$ :	0.0	Branching ratios in percentage				
[keV]		$\Gamma_{\text{cm}}$	$2J_f^\pi$ :	$9^-$	15.0 $\langle 5^- \rangle$	56.1 $\langle 3^- \rangle$	98.58 $\langle 7^- \rangle$	134.4 $\langle 5^- \rangle$	139.8 $\langle 3^- \rangle$
340.3(1)	$\langle 5^+ \rangle$				83(17)	8(1)	7(1)	2(1)	
369.5(2)	$\langle 3^+ \rangle$								100
372.4(1)	$\langle 7^+ \rangle$			35(7)	39(7)		11(2)	15(2)	
374.8(2)	$\langle 7^- \rangle$			100					
384.3(1)	$\langle 5^+ \rangle$						100		
432.0(2)	$\langle 9^- \rangle$								
445(4)									
462.2(5)	$\langle 9^+ \rangle$			100					
490.3(1)	$\langle 5^- \rangle$				31(5)	62(6)			
506.5(3)	$\langle 9^+ \rangle$			75(50)					
530.0(5)	$\langle 11^+ \rangle$			100					
533.8(4)	$\langle 7^- \rangle$				100				
589(1)	$\langle 9^- \rangle$								
650(3)	$\langle 11^- \rangle$								
705.5(5)	$\langle 5^+ \rangle$								
778(1)	$\langle 7^+ \rangle$								

6 bands marked here a-f were considered in [91Li19, 01Br31], see [NnΛ] assignment therein.

Energy levels and branching ratios [01Br31, 91Li19]. Part 2

**<sup>219</sup>Fr**  
**87**

$E^*$	$2J^\pi$	Branching ratios in percentage								
[keV]		$E_f^*$ : $2J_f^\pi$ :	191.29 $\langle 7 \rangle^+$	210.4 $\langle 3 \rangle^+$	216.0 $\langle 11 \rangle^+$	269.2 $\langle 7 \rangle^-$	305.5 $\langle 9 \rangle^-$	506.5 $\langle 9 \rangle^+$	533.8 $\langle 7 \rangle^-$	705.5 $\langle 5 \rangle^+$
305.5(1)	$\langle 9^- \rangle$				12(2)					
333.5(1) <sup>a</sup>	$\langle 11^- \rangle$					$\approx 15$				
432.0(2)	$\langle 9 \rangle$				80(40)		$\approx 20$			
490.3(1)	$\langle 5^- \rangle$		3.5(12)	3.5(12)						
506.5(3)	$\langle 9^+ \rangle$		25							
589(1)	$\langle 9^- \rangle$							100		
705.5(5)	$\langle 5^+ \rangle$								100	
778(1)	$\langle 7^+ \rangle$									100

Energy levels and branching ratios [97Ar04, 92Li31].

**<sup>220</sup>Fr**  
**87**

$E^*$	$J^\pi$	$T_{1/2}$ or Ref.	Branching ratios in percentage							
[keV]		$\Gamma_{\text{cm}}$	$E^*_\text{f}:$	0	6.9	12.4	19.9	48.4	55.8	73.0
			$J^\pi_\text{f}:$	$1^+$	$\langle 3 \rangle^+$	$2^+$	$\langle 4 \rangle^+$	$2^+$	$\langle 5^+ \rangle$	$\langle 3 \rangle^+$
$0^a$	$1^+$	27.4(3) s								
6.9(1) <sup>c</sup>	$\langle 3 \rangle^+$			x						

(continued)

 **$^{220}_{87}\text{Fr}$** 

$E^*$	$J^\pi$	$T_{1/2}$ or Ref.	Branching ratios in percentage							
[keV]		$\Gamma_{\text{cm}}$	$E^*_f$ : $J^\pi_f$ :	0 1 <sup>+</sup>	6.9 $\langle 3 \rangle^+$	12.4 2 <sup>+</sup>	19.9 $\langle 4 \rangle^+$	48.4 2 <sup>+</sup>	55.8 $\langle 5^+ \rangle$	73.0 $\langle 3 \rangle^+$
12.4(1) <sup>c</sup>	2 <sup>+</sup>			x						
19.9(1) <sup>c</sup>	$\langle 4 \rangle^+$				x					
48.4(1) <sup>a</sup>	2 <sup>+</sup>			90(7)	5(2)	5(3)				
55.8(1) <sup>c</sup>	$\langle 5^+ \rangle$						100			
73.0(1) <sup>a</sup>	$\langle 3 \rangle^+$			5(2)	24(4)	49(2)	11(2)	≈11		
127.3(1) <sup>a</sup>	$\langle 4^+ \rangle$									x
140.7(1) <sup>b</sup>	1 <sup>−</sup>			73(6)		17(4)		10.6(10)		
156.8(1) <sup>b</sup>	2 <sup>−</sup>			56(3)	8.6(14)	15.6(14)		7.3(7)		12.3(7)
177.2(1) <sup>b</sup>	$\langle 3 \rangle^−$					49(10)		35(10)		13(3)
200.2(2) <sup>a</sup>	$\langle 5^+ \rangle$									
214.4(1) <sup>b</sup>	$\langle 4 \rangle^−$				21(6)		4.1(12)		9(2)	62(12)
246.8(10)										
257.0(15)										
273.7(1)	1 <sup>+</sup>			4.7(13)		81(7)		14(4)		
276.1(2)						x				
290.8(3) <sup>b</sup>	$\langle 5^− \rangle$						67(20)			
300.0(2)	$\langle 1 \rangle^+$			34(8)		14(6)		52(14)		
306.9(15)										
314.8(4)									≈50	
340.3(2) <sup>d</sup>	$\langle 0 \rangle^−$			5(2)						
347.9(4)							100			
355.2(2)	$\langle 0^−, 2^− \rangle$									
361.1(4)										
364.2(2)	3 <sup>+</sup> , 4 <sup>−</sup>				≈20					
376.5(2) <sup>d</sup>	$\langle 2^− \rangle$					66(9)		22(9)		
380.1(10)										
414.6(20)										
442.2(15)										
452.4(11)										
479.6(20)										
501.2(4)										
511.1(10)							x			
579.9(20)										

4 bands (marked here a-d) are assigned to excited states of this nucleus in [97Ar04].

Data for this isotope are considered in vol. LB I/18C.

Energy levels and branching ratios [97Ar04, 92Li31]. Part 2

**<sup>220</sup>Fr**  
**87**

$E^*$	$J^\pi$	Branching ratios in percentage										
[keV]		$E_f^*$ : $J_f^\pi$ :	127.3 $\langle 4^+ \rangle$	140.7 $1^-$	156.8 $2^-$	177.2 $\langle 3 \rangle^-$	200.2 $\langle 5^+ \rangle$	273.7 $1^+$	276.1	290.8 $\langle 5^- \rangle$	300.0 $\langle 1 \rangle^+$	355.2 $\langle 0^-, 2^- \rangle$
156.8(1) <sup>b</sup>	2 <sup>-</sup>			x								
177.2(1) <sup>b</sup>	$\langle 3 \rangle^-$		4(1)		x							
200.2(2) <sup>a</sup>	$\langle 5^+ \rangle$		100									
214.4(1) <sup>b</sup>	$\langle 4 \rangle^-$					3.5(6)						
290.8(3) <sup>b</sup>	$\langle 5^- \rangle$		≈33									
314.8(4)							50(30)					
340.3(2) <sup>d</sup>	$\langle 0 \rangle^-$			30(10)				60(5)			5(2)	
355.2(2)	$\langle 0^-, 2^- \rangle$	x						40(4)	53(6)		7(2)	
361.1(4)								x				
364.2(2)	3 <sup>+</sup> , 4 <sup>-</sup>					40(13)				40(20)		
376.5(2) <sup>d</sup>	$\langle 2^- \rangle$							≈12				
452.4(11)												x
501.2(4)								50(16)			50(25)	

Energy levels and branching ratios [97Ar04, 92Li31]. Part 3

**<sup>220</sup>Fr**  
**87**

$E^*$ [keV]	$J^\pi$	Branching ratios in percentage	
		$E_f^*$ : $J_f^\pi$ :	452.4
501.2(4)			x

Energy levels and branching ratios [90Ak05].

**<sup>221</sup>Fr**  
**87**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.	Branching ratios in percentage						
				$E_f^*$ : $2J_f^\pi$ :	0.0 $5^-$	26.0	36.6	38.5 $\langle 9 \rangle^-$	99.6 $\langle 5, 7 \rangle^-$	99.9 $\langle 5, 7 \rangle^+$
0.0 <sup>a</sup>	5 <sup>-</sup>	4.8(2) m	03Gr33							
26.0(1) <sup>a</sup>	$\langle 1 \rangle^-$		03Gr33	x						
36.65(3) <sup>b</sup>	$\langle 3 \rangle^-$	1.5(2) ns	03Gr33	100		x				
38.53(3) <sup>b</sup>	$\langle 9 \rangle^-$		03Ku44	x						
99.60(4) <sup>a</sup>	$\langle 3 \rangle^-$	80(30) ps	03Gr33	58(3)		0.9(2)	41(2)			
99.87(5) <sup>c</sup>	$\langle 3 \rangle^+$	160(30) ps	03Gr33	76(5)		23.7(11)				
100.93(6) <sup>b</sup>	$\langle 5 \rangle^-$		03Gr33	58(9)		15(2)	27(3)			
108.39(4) <sup>b</sup>	$\langle 7 \rangle^-$	≈280 ps	03Gr33	93(7)			5.2(6)	1.8(5)		
145.85(5)	$\langle 1 \rangle^+$		03Gr33			93(15)			7(4)	
150.04(2) <sup>c</sup>	$\langle 7 \rangle^+$	80(20) ps	03Ku44	71(4)				28(1)		
195.79(5) <sup>a</sup>	$\langle 7 \rangle^-$	20(5) ps	00Ar23	18(2)				40(2)	3.4(4)	
224.65(5) <sup>d</sup>	$\langle 3, 5 \rangle^+$	35(10) ps	03Gr33	12.7(12)		3.1(7)	71(4)			3.4(3)
234.51(10) <sup>d</sup>	$\langle 5 \rangle^+$		03Gr33						58(6)	

(continued)

 **$^{221}_{87}\text{Fr}$** 

$E^*$	$2J^\pi$	$T_{1/2}$ or	Ref.	$E_f^*$ :	0.0	Branching ratios in percentage				
[keV]		$\Gamma_{\text{cm}}$		$2J_f^\pi$ :	$5^-$	26.0	36.6	38.5	99.6	99.9
								$\langle 9 \rangle^-$	$\langle 5, 7 \rangle^-$	$\langle 5, 7 \rangle^+$
253.54(5) <sup>c</sup>	$\langle 5 \rangle^+$	35(15) ps	03Gr33		15.4(7)		40(8)		23(1)	
273.5(3)	$\langle 5^- - 9^- \rangle$				x					
279.26(4)	$\langle 7 \rangle^+$		03Ku44		45(3)				17(2)	
288.0(3)								61(28)		
294.76(6) <sup>d</sup>	$\langle 9 \rangle^+$		03Gr33					1.5(4)		
310(5)										
318(7)										
338(4)										
348.5(1)					x					
$\approx 368$										
393.4(1)	$\langle 7^+, 9^+ \rangle$		03Gr33					2(1)		
401.0(2)	$\langle 7^- \rangle$		03Ku44					75(26)		
411.1			03Ku44							
422.63	$\langle X^+ \rangle$		00Ar23							
447(4)										
$\approx 460$										
$\approx 482$										
496.9(3)			03Ku44		x					
517.78(5)	$\langle 5^+ \rangle$		03Ku44		27(4)		62(6)		11(2)	
552.05(5) <sup>e</sup>	$\langle 5, 3 \rangle^-$		03Ku44		2.4(6)	18(2)	10.9(12)		65(6)	
571.0(1)	$\langle 7, 5^+ \rangle$		03Ku44		[36(9)]					
601.1(1)	$\langle 5^- \rangle$		00Ar23		x					
630.8(2) <sup>e</sup>	$\langle 5 \rangle$		03Ku44				9(5)		23(6)	
637.6(1)			03Ku44				$\approx 30$		$\approx 5$	
645.9(1)			00Ar23							
679.35	$\langle 7^- \rangle$		00Ar23		x					
714.2*			03Ku44							
749.1(2)			03Ku44							25(8)
766.5			00Ar23							
780.2*			03Ku44			50(12)				50(12)
808.5			00Ar23							
824.2*			03Ku44							
852.1			00Ar23							
942.8(2)	$\langle 3^- \rangle$		00Ar23							

Additional data on this isotope can be found in [03Ku44, 03Gr33].

\* Parameters were determined in [03Ku44, 03Gr33], see branching ratios therein.

4 bands (marked a,b,c,d and e – the possible band) are considered in [90Ak05].

Energy levels and branching ratios [90Ak05]. Part 2

**<sup>221</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage											
		$E_f^*$ : $2J_f^\pi$ :	100.9 $\langle 5,7 \rangle^-$	108.4 $\langle 5,7 \rangle^-$	145.8	150.0 $\langle 7 \rangle^+$	195.8 $\langle 7 \rangle^-$	224.6	234.5	273.5	288.0	348.5	517.8
150.04(2) <sup>c</sup>	$\langle 7 \rangle^+$		0.7(2)										
195.79(5) <sup>a</sup>	$\langle 7 \rangle^-$		10(1)	28(2)									
224.65(5) <sup>d</sup>	$\langle 3,5 \rangle^+$		9.5(9)										
234.51(10) <sup>d</sup>	$\langle 5 \rangle^+$		27(5)	15(5)									
253.54(5) <sup>c</sup>	$\langle 5 \rangle^+$		2.2(3)	18.3(8)		0.6(3)	0.6(3)						
279.26(4)	$\langle 7 \rangle^+$		21(2)	11(1)		5(1)							
288.0(3)				39(12)									
294.76(6) <sup>d</sup>	$\langle 9 \rangle^+$			96(6)		2.6(10)							
393.4(1)	$\langle 7^+, 9^+ \rangle$			4(2)		1(1)	55(5)	18(2)		20(2)			
401.0(2)	$\langle 7^- \rangle$										25(13)		
552.05(5) <sup>e</sup>	$\langle 5,3 \rangle^-$				4.2(12)								
571.0(1)	$\langle 7,5^+ \rangle$		[36(9)]				[27(9)]						
630.8(2) <sup>e</sup>	$\langle 5 \rangle$		35(17)	9(2)								23(12)	
637.6(1)									65(20)				
645.9(1)				x									
749.1(2)					38(19)								38(19)
808.5										x			
942.8(2)	$\langle 3^- \rangle$						x						

Energy levels [96El01].

**<sup>222</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$
0.0 40(22)	$2^-$	14.2(3) m

Energy levels and branching ratios [01Br31].

**<sup>223</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.	Branching ratios in percentage					
				$E_f^*$ : $2J_f^\pi$ :	0.0 $3^{\langle - \rangle}$	12.882 $\langle 5^- \rangle$	54.98 $1^{\langle - \rangle}$	82.129 $\langle 7^- \rangle$	99.53 $\langle 3^- \rangle$
0.0 <sup>a</sup>	$3^{\langle - \rangle}$	22.00(7) m							
12.882(22) <sup>a</sup>	$\langle 5^- \rangle$		01Br31		100				
54.98(4) <sup>c</sup>	$1^{\langle - \rangle}$		01Br31		100				
82.129(21) <sup>a</sup>	$\langle 7^- \rangle$		01Br31		19.0(10)	81(5)			
99.53(3) <sup>c</sup>	$\langle 3^- \rangle$		01Br31		67(13)	$\approx 32$	1.5(3)		
100.999(24) <sup>c</sup>	$\langle 5^- \rangle$		01Br31		60(4)	$\approx 40$	$\approx 0.33$		
134.48(4) <sup>d</sup>	$\langle 3^+ \rangle$		01Br31		17(2)	35(2)	43(7)		1.1(6)



(continued)

 **$^{223}_{87}\text{Fr}$** 

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.	Branching ratios in percentage					
				$E^*_f$ : $2J^\pi_f$ :	0.0 $3^{(-)}$	12.882 $\langle 5^- \rangle$	54.98 $1^{(-)}$	82.129 $\langle 7^- \rangle$	99.53 $\langle 3^- \rangle$
160.43(3) <sup>b</sup>	$\langle 3^+ \rangle$		01Br31		66(3)	32.8(13)			0.6(2)
171.963(25) <sup>b</sup>	$\langle 5^+ \rangle$		01Br31		55.1	31.4(12)		9.6(8)	3.7(7)
187.07(3) <sup>g</sup>	$\langle 5^- \rangle$		01Br31			20.3(8)		29(2)	
188.92(3) <sup>c</sup>	$\langle 7^- \rangle$		01Br31			20.8(8)		65(4)	
219.53(3) <sup>d</sup>	$\langle 7^+ \rangle$		01Br31			68(3)		29.4(12)	
222.98(4) <sup>b</sup>	$\langle 7^+ \rangle$		01Br31					99(4)	
242.45(4)	$\langle 5 \rangle$				29(2)	38(2)			
243.57(4)	$\langle 5 \rangle$				60(3)			36.4(14)	
244.674(25) <sup>g</sup>	$\langle 7^- \rangle$		01Br31			7.6(5)		58(2)	
298.7(3) <sup>g</sup>	$\langle 9^- \rangle$		01Br31					100	
365.65(5)								50(2)	
371(4)									
379(7)									
449(5)									
503(7)									
515.20(22) <sup>f</sup>	$3^-$		01Br31				50(12)		50(12)
540.53(3) <sup>e</sup>	$\langle 5^+ \rangle$		01Br31		35(14)	13.8(8)			27(1)
605.40(3) <sup>f</sup>	$\langle 5^- \rangle$		01Br31		0.87(5)	53(3)		6.9(3)	2.40(13)
647.58(3)	$\langle 5^-, 7^- \rangle$				2.6(2)	18(2)		22(1)	
649.66(3)	$\langle 5^- \rangle$				51(2)	20.7(11)		7.1(4)	5.4(3)
684.80(6) <sup>e</sup>	$\langle 7^+ \rangle$		01Br31						
698.62(7)					8.5(10)				
736.88(4) <sup>f</sup>	$\langle 7^- \rangle$		01Br31		2.24(9)	16.1(7)		29(1)	
763.21(4)						3.2(5)			
782.66(4)	$\langle 3^+, 5^+ \rangle$				3.1(3)				
834.54(5)						5.6(4)		51(5)	
839.30(5)									
892.68(4)					4.6(5)			2.7(5)	
921.63(11)									
987.73(11)									
995.61(7)					8(2)	14(2)			
999.12(6)							25.8(14)		
1001.94(7)									
1035.28(6)									
1042.28(10)									
1070.11(5)									
1102.81(5)					3.6(5)	11(1)			
1120.24(6)						3.8(4)		9.9(7)	
1221.10(7)						36(3)			
1322.17(5)						5.5(9)		45(3)	
1359.12(5)					2.6(4)			4.5(5)	
1398.29(9)						30(4)		29(4)	
1399.17(6)									
1512.40(10)									
1540.74(6)					10.5(8)				

(continued)

**<sup>223</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$T_{1/2}$ or Ref. $\Gamma_{\text{cm}}$	Branching ratios in percentage					
			$E_f^*$ : $2J_f^\pi$ :	0.0 $3^{(-)}$	12.882 $\langle 5^- \rangle$	54.98 $1^{(-)}$	82.129 $\langle 7^- \rangle$	99.53 $\langle 3^- \rangle$
1552.11(6)								
1566.56(18)				11(2)				
1573.78(10)							37(4)	
1590.49(10)								
1595.05(8)							11(1)	
1629.30(10)							15.8(15)	
1695.43(21)								

Additional data on this isotope can be found in [95Sh03, 92Ku03].

Six bands (A-G marked here a-g) were given in [01Br31].

Energy levels and branching ratios [01Br31]. Part 2

**<sup>223</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage								
		$E_f^*$ : $2J_f^\pi$ :	100.999 $\langle 5^- \rangle$	134.48 $\langle 3^+ \rangle$	160.43 $\langle 3^+ \rangle$	171.963 $\langle 5^+ \rangle$	187.07 $\langle 5^- \rangle$	188.92 $\langle 7^- \rangle$	219.53 $\langle 7^+ \rangle$	222.98 $\langle 7^+ \rangle$
134.48(4) <sup>d</sup>	$\langle 3^+ \rangle$		4(1)							
160.43(3) <sup>b</sup>	$\langle 3^+ \rangle$		0.6(2)	$\approx 0.008$						
171.963(25) <sup>b</sup>	$\langle 5^+ \rangle$			$\approx 0.15$						
187.07(3) <sup>g</sup>	$\langle 5^- \rangle$		39(4)	$\approx 12$						
188.92(3) <sup>c</sup>	$\langle 7^- \rangle$		14(2)							
219.53(3) <sup>d</sup>	$\langle 7^+ \rangle$		2.2(5)	$\approx 0.8$						
222.98(4) <sup>b</sup>	$\langle 7^+ \rangle$			$\approx 0.47$	$\approx 0.14$					
242.45(4)	$\langle 5 \rangle$			4(1)	16(2)		$\approx 13$			
243.57(4)	$\langle 5 \rangle$				$\approx 4$					
244.674(25) <sup>g</sup>	$\langle 7^- \rangle$		27.3(11)				3.3(5)	4.0(5)		
365.65(5)									8(3)	42(2)
540.53(3) <sup>e</sup>	$\langle 5^+ \rangle$		17(1)					8(3)		
605.40(3) <sup>f</sup>	$\langle 5^- \rangle$		0.25(2)					34(2)		0.19(6)
647.58(3)	$\langle 5^-, 7^- \rangle$		33(1)					16.2(6)		1.1(2)
649.66(3)	$\langle 5^- \rangle$		9.8(8)			1.2(3)		4.1(2)		
684.80(6) <sup>e</sup>	$\langle 7^+ \rangle$									88(4)
698.62(7)					34(2)			57(3)		
736.88(4) <sup>f</sup>	$\langle 7^- \rangle$		37(1)					1.4(4)	0.5(1)	0.3(1)
763.21(4)						11(5)	44(3)		6.4(5)	14(5)
782.66(4)	$\langle 3^+, 5^+ \rangle$			3.0(8)	69(3)	15.5(7)			4.3(3)	
834.54(5)					6.0(8)					
839.30(5)						41(2)			32(2)	
892.68(4)			3.9(5)				8.2(7)		51(3)	29.8(12)
921.63(11)							100			
995.61(7)			58(2)		19(2)					
999.12(6)						8.0(11)				
1001.94(7)				29(3)	48(2)	22(2)				

(continued)

 **$^{223}_{87}\text{Fr}$** 

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage								
		$E^*_f:$ $2J^\pi_f:$	100.999 $\langle 5^- \rangle$	134.48 $\langle 3^+ \rangle$	160.43 $\langle 3^+ \rangle$	171.963 $\langle 5^+ \rangle$	187.07 $\langle 5^- \rangle$	188.92 $\langle 7^- \rangle$	219.53 $\langle 7^+ \rangle$	222.98 $\langle 7^+ \rangle$
1035.28(6)				27(3)		26(3)			37(3)	9(2)
1042.28(10)					68(5)					
1070.11(5)						24(1)	28(5)		10.4(7)	28(1)
1102.81(5)			17(1)		27(1)		13(1)	14(1)	7(2)	
1120.24(6)					15.4(7)	61(3)		9.9(9)		
1221.10(7)										51(3)
1322.17(5)			7.4(9)							12.6(9)
1359.12(5)			5.5(5)			9.0(5)		5.2(5)	4.6(5)	
1398.29(9)										41(4)
1399.17(6)			37(2)					17(1)		
1540.74(6)			13(1)			7(2)				39(2)
1552.11(6)			9(1)			8(1)			29(1)	26(1)
1566.56(18)					73(5)	16(5)				
1573.78(10)			18(4)							45(4)
1590.49(10)							65(4)	18(3)		17(6)
1595.05(8)						45(4)			26(3)	18(2)
1629.30(10)									84(5)	
1695.43(21)					100					

Energy levels and branching ratios [01Br31]. Part 3

 **$^{223}_{87}\text{Fr}$** 

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage								
		$E^*_f:$ $2J^\pi_f:$	242.45 $\langle 5 \rangle$	243.57 $\langle 5 \rangle$	244.674 $\langle 7^- \rangle$	365.65 $\langle 5^+ \rangle$	540.53 $\langle 5^+ \rangle$	605.40 $\langle 5^- \rangle$	684.80 $\langle 7^+ \rangle$	782.66 $\langle 3^+, 5^+ \rangle$
605.40(3) <sup>f</sup>	$\langle 5^- \rangle$				3.09(13)					
647.58(3)	$\langle 5^-, 7^- \rangle$				7.6(4)					
649.66(3)	$\langle 5^- \rangle$				1.1(4)					
684.80(6) <sup>e</sup>	$\langle 7^+ \rangle$					$\approx 12$				
736.88(4) <sup>f</sup>	$\langle 7^- \rangle$			$\approx 1$	12.8(4)					
763.21(4)			15.1(9)			$\approx 7$				
782.66(4)	$\langle 3^+, 5^+ \rangle$		4.8(16)							
834.54(5)				$\approx 21$	16(4)					
839.30(5)				26(3)						
987.73(11)				100						
999.12(6)										66(3)
1042.28(10)			32(4)							
1070.11(5)									9.9(5)	
1102.81(5)					8(1)					
1221.10(7)				13(2)						
1322.17(5)					11.3(9)		18(1)			
1359.12(5)							47(2)	21.2(10)		
1399.17(6)			17(1)		21(1)			8.3(8)		

(continued)

**<sup>223</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	Branching ratios in percentage								
		$E_f^*:$ $2J_f^\pi:$	242.45 $\langle 5 \rangle$	243.57 $\langle 5 \rangle$	244.674 $\langle 7^- \rangle$	365.65	540.53 $\langle 5^+ \rangle$	605.40 $\langle 5^- \rangle$	684.80 $\langle 7^+ \rangle$	782.66 $\langle 3^+, 5^+ \rangle$
1512.40(10)				100						
1540.74(6)					31(2)					
1552.11(6)					28(2)					

Energy levels [90Ak03, 97Bu03].

**<sup>225</sup>Fr<sub>87</sub>**

$E^*$ [keV]	$2J^\pi$	$\sigma$ (t, $\alpha$ ) $\mu\text{b/sr}$	$T_{1/2}$ or $\Gamma_{\text{cm}}$	Ref.
0.0	$3^-$	$\approx 1.5$	4.0(2) m	97Bu03
28.51(5)	$5^-$	14		97Bu03
82.55(5)	$7^-$	20		97Bu03
128.00	$9^-$	$\approx 45$		97Bu03
142.58(5)	$3^+$	$\approx 23$		97Bu03
151.62(5)	$5^+$			
181.66	$9^+$	120		97Bu03
198.25	$7^+$			
203.35	$\langle 9^- \rangle$	103		97Bu03
207.19(5)	$5^-$	incl		
228.30	$7^-, 9^-$			
241.35(5)	$5^+$	32		97Bu03
293.18	$7^+$	$\approx 3.1$		97Bu03
303.17	$7^+, 9^+$			
330.1(1)	$5^-, 7^-$	$\approx 3.8$		97Bu03
346.08	$7^+, 9^+$			
409.1(1)	$5^+, 7^+$	80		97Bu03
424.9(1)	$\langle 5^-, 7^- \rangle$			
480.0	$7^+$	$\approx 2.4$		97Bu03
502.8(1)	$5^-$	9		97Bu03
559.7	$7^-$			
571.6	$7^-$	$\approx 6$		97Bu03
618.6		75		97Bu03
635.6(1)		$\approx 8$		97Bu03
655		29		97Bu03
665.15	$7^+$	$\approx 13$		97Bu03
721.1(1)	$5^-$			
744.2	$5^+, 7^+$	2.6		97Bu03
754.1				
778.7(1)	$7^-$	4.4		97Bu03
832.3	$5^+ - 9^+$			
839.2(2)	$7^+ - 11^+$	6.7		97Bu03
866.0(2)	$7^-$			

(continued)

**<sup>225</sup>Fr<sub>87</sub>**

$E^*$	$2J^\pi$	$\sigma$ (t, $\alpha$ )	$T_{1/2}$ or	Ref.
[keV]		$\mu\text{b/sr}$	$\Gamma_{\text{cm}}$	
885.9(1)	$5^+$	2.9		97Bu03
979.6(2)	$\langle 5^+ \rangle$	8.8		97Bu03
1028		3.4		97Bu03
1047.3(1)		5.6		97Bu03
1063.0				
1101.9				
1127		70		97Bu03
1225.9		$\approx 23$		97Bu03
1247		$\approx 23$		97Bu03
1321		13		97Bu03
1351		13		97Bu03
1392.0(2)	$5,7^-$	13		97Bu03
1479.6	$7^-$	18		97Bu03
1519.5		$\approx 23$		
1528.3		$\approx 31$		
1577.9				
1614.1				
1655.3				
1749.8				
		97Bu03		Ref.

$\sigma$  (t, $\alpha$ ) were measured with  $E_t=18$  MeV at  $60^\circ$  [97Bu03].