$^{221}_{87}\mathrm{Fr}_{134}$

1 Decay Scheme

Fr-221 disintegrates 99.9952(15)% by alpha emission to levels in At-217 and 0.0048(15)% by beta minus emission to levels in Ra-221. The beta minus decay scheme of Fr-221 has not been studied.
Le francium 221 se désintègre par transitions alpha vers des niveaux excités d'astate 217. Un faible branchement bêta moins n'est pas inclus ici.

2 Nuclear Data

$T_{1/2}(^{221}\mathrm{Fr})$	:	4,79	(2)	min
$T_{1/2}(^{221}\mathrm{Ra})$	:	28	(2)	s
$T_{1/2}(^{217}\mathrm{At})$	:	32,3	(4)	10^{-3} s
$Q^{-}(^{221}\mathrm{Fr})$	:	314	(6)	keV
$Q^{\alpha}(^{221}\mathrm{Fr})$	:	6457,8	(14)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,14}$	5601 (40)	0,000038 (10)	61
$\alpha_{0,13}$	5632 (25)	0,00010 (2)	60
$\alpha_{0,12}$	5794 (3)	0,0025 (5)	111
$\alpha_{0,11}$	5802 (4)	0,0003	828
$\alpha_{0,10}$	5882 (3)	0,064 (4)	11,7
$\alpha_{0,9}$	5890 (4)	0,0031 (6)	290
$\alpha_{0,8}$	5920 (3)	0,006 (1)	197
$\alpha_{0,7}$	6034 (3)	0,0285 (24)	143
$\alpha_{0,6}$	6048,4 (20)	0,128 (3)	36,4
$\alpha_{0,5}$	6075,9 (25)	0,064 (16)	117
$\alpha_{0,4}$	6090,1 (20)	0,39 (7)	27
$\alpha_{0,3}$	6187,9 (20)	0,15 (3)	65

	Energy keV	Probability × 100	F
$\alpha_{0,2}$	6239,2 (15)	15,1 (2)	2,2
$\alpha_{0,1}$	6358 (2)	1,34 (7)	120
$\alpha_{0,0}$	6458,0 (13)	82,8 (2)	3,44

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{3,2}$(At)	53,81 (3)	0,220 (38)	M1		10,79 (15)	2,56 (4)	14,17 (20)
$\gamma_{4,3}$(At)	96,3 (3)	0,046 (26)	M1+E2		4,1 (18)	1,1 (5)	5,6 (24)
$\gamma_{1,0}$(At)	100,25 (2)	2,02 (17)	M1	9,66 (14)	1,758 (25)	0,416 (6)	11,97 (17)
$\gamma_{2,1}$(At)	117,82 (3)	0,19 (14)	M1	6,13 (9)	1,104 (16)	0,261 (4)	7,58 (11)
$\gamma_{4,2}$(At)	150,21 (3)	0,216 (12)	M1	3,08 (5)	0,550 (8)	0,1303 (19)	3,80 (5)
$\gamma_{3,1}$(At)	171,83 (3)	0,129 (17)	E2	0,226 (4)	0,471 (7)	0,1257 (18)	0,863 (12)
$\gamma_{10,4}$(At)	208,3 (6)	0,0073 (14)	[E2]	0,1519 (24)	0,206 (4)	0,0547 (11)	0,430 (8)
$\gamma_{2,0}$(At)	218,12 (2)	15,61 (21)	E2	0,1375 (20)	0,1701 (24)	0,0451 (7)	0,367 (5)
$\gamma_{12,5}$(At)	282,12 (9)						
$\gamma_{5,1}$(At)	282,12 (9)	0,0097 (20)	[M1,E2]	0,30 (23)	0,077 (17)	0,019 (4)	0,41 (25)
$\gamma_{7,1}$(At)	324,10 (6)	0,0252 (17)	M1	0,362 (5)	0,0639 (9)	0,01510 (22)	0,446 (6)
$\gamma_{10,2}$(At)	359,86 (4)	0,0514 (20)	M1	0,272 (4)	0,0479 (7)	0,01133 (16)	0,335 (5)
$\gamma_{5,0}$(At)	382,34 (4)	0,0437 (18)	M1	0,231 (4)	0,0406 (6)	0,00960 (14)	0,284 (4)
$\gamma_{6,0}$(At)	410,64 (5)	0,1270 (26)	E2	0,0344 (5)	0,01528 (22)	0,00392 (6)	0,0548 (8)
$\gamma_{8,1}$(At)	437,00 (5)	0,0010 (1)					
$\gamma_{12,2}$(At)	446,30 (8)	0,0017 (4)	E1 + M2				
$\gamma_{9,1}$(At)	468,3 (7)	0,0018 (3)					
$\gamma_{8,0}$(At)	537,8 (8)	0,0045 (8)					
$\gamma_{12,1}$(At)	562,3 (12)	0,005 (5)					
$\gamma_{9,0}$(At)	568,5 (3)	0,0012 (4)					
$\gamma_{10,0}$(At)	576,9 (4)	0,0033 (7)	[M1]	0,0772 (11)	0,01342 (19)	0,00317 (5)	0,0948 (13)
$\gamma_{11,0}$(At)	652 (2)	0,0004 (4)					
$\gamma_{12,0}$(At)	665 (2)	0,0009 (9)					
$\gamma_{13,0}$(At)	809,3 (2)	0,00010 (2)					
$\gamma_{14,0}$(At)	891,9 (3)	0,000038 (10)					

3 Atomic Data

3.1 At

ω_K : 0,966 (4)
$\bar{\omega}_L$: 0,416 (17)
n_{KL} : 0,805 (5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	78,94		60,33
	$K\alpha_1$	81,51		100
	$K\beta_3$	91,73	}	
	$K\beta_1$	92,315	}	
	$K\beta_5''$	92,883	}	34,63
	$K\beta_2$	94,846	}	
	$K\beta_4$	95,211	}	10,9
	$KO_{2,3}$	95,595	}	
X_L				
	$L\ell$	9,8964		
	$L\gamma$	– 16,7291		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	60,489 – 67,031	100
KLX	73,811 – 81,516	56,8
KXY	87,10 – 95,72	8,07
Auger L	5,6 – 17,4	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,14}$	5500 (40)	0,000038 (10)
$\alpha_{0,13}$	5530 (25)	0,00010 (2)
$\alpha_{0,12}$	5689 (3)	0,0025 (5)
$\alpha_{0,11}$	5697 (4)	0,0003
$\alpha_{0,10}$	5776 (3)	0,064 (4)
$\alpha_{0,9}$	5783 (4)	0,0031 (6)
$\alpha_{0,8}$	5813 (3)	0,006 (1)
$\alpha_{0,7}$	5925 (3)	0,0285 (24)
$\alpha_{0,6}$	5938,9 (20)	0,128 (3)
$\alpha_{0,5}$	5965,9 (25)	0,064 (16)
$\alpha_{0,4}$	5979,9 (20)	0,39 (7)
$\alpha_{0,3}$	6075,9 (20)	0,15 (3)
$\alpha_{0,2}$	6126,3 (15)	15,1 (2)
$\alpha_{0,1}$	6243 (2)	1,34 (7)
$\alpha_{0,0}$	6341,0 (13)	82,8 (2)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(At)	5,6 - 17,4	3,05 (10)
e_{AK}	(At)		0,114 (6)
	KLL	60,489 - 67,031	}
	KLX	73,811 - 81,516	}
	KXY	87,10 - 95,72	}
$ec_{1,0\ K}$	(At)	4,53 (2)	1,51 (13)
$ec_{2,1\ K}$	(At)	22,10 (3)	0,13 (10)
$ec_{3,2\ L}$	(At)	36,33 - 39,60	0,156 (27)
$ec_{4,2\ K}$	(At)	54,49 (3)	0,138 (8)
$ec_{1,0\ L}$	(At)	82,77 - 86,04	0,274 (23)
$ec_{1,0\ M}$	(At)	95,94 - 97,47	0,065 (5)
$ec_{2,0\ T}$	(At)	122,40 - 218,08	4,19 (8)
$ec_{2,0\ K}$	(At)	122,40 (2)	1,570 (31)
$ec_{2,0\ L}$	(At)	200,64 - 203,91	1,943 (37)
$ec_{2,0\ M}$	(At)	213,81 - 215,34	0,515 (10)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(At)	9,8964 — 16,7291	2,18 (7)	
XKα_2	(At)	78,94	0,96 (5)	} Kα
XKα_1	(At)	81,51	1,59 (9)	}
XKβ_3	(At)	91,73	}	
XKβ_1	(At)	92,315	} 0,55 (6)	K$'\beta_1$
XKβ''_5	(At)	92,883	}	
XKβ_2	(At)	94,846	}	
XKβ_4	(At)	95,211	} 0,18 (2)	K$'\beta_2$
XKO$_{2,3}$	(At)	95,595	}	

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{3,2}$(At)	53,81 (3)	0,0145 (25)
$\gamma_{4,3}$(At)	96,3 (3)	0,007 (3)
$\gamma_{1,0}$(At)	100,25 (2)	0,156 (13)
$\gamma_{2,1}$(At)	117,82 (3)	0,022 (16)
$\gamma_{4,2}$(At)	150,21 (3)	0,0449 (25)
$\gamma_{3,1}$(At)	171,83 (3)	0,069 (9)
$\gamma_{10,4}$(At)	208,3 (6)	0,0051 (10)
$\gamma_{2,0}$(At)	218,12 (2)	11,42 (15)
$\gamma_{5,1}$(At)	282,12 (9)	0,0069 (7)
$\gamma_{7,1}$(At)	324,10 (6)	0,0174 (12)
$\gamma_{10,2}$(At)	359,86 (4)	0,0385 (15)
$\gamma_{5,0}$(At)	382,34 (4)	0,0340 (14)
$\gamma_{6,0}$(At)	410,64 (5)	0,1204 (25)
$\gamma_{8,1}$(At)	437,00 (5)	0,0010 (1)
$\gamma_{12,2}$(At)	446,30 (8)	0,0017 (4)
$\gamma_{9,1}$(At)	468,3 (7)	0,0018 (3)
$\gamma_{8,0}$(At)	537,8 (8)	0,0045 (8)
$\gamma_{12,1}$(At)	562,3 (12)	0,005 (5)
$\gamma_{9,0}$(At)	568,5 (3)	0,0012 (4)
$\gamma_{10,0}$(At)	576,9 (4)	0,0030 (6)
$\gamma_{11,0}$(At)	652 (2)	0,0004 (4)
$\gamma_{12,0}$(At)	665 (2)	0,0009 (9)
$\gamma_{13,0}$(At)	809,3 (2)	0,00010 (2)
$\gamma_{14,0}$(At)	891,9 (3)	0,000038 (10)

7 Main Production Modes

Descendant Th – 229

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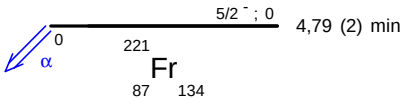
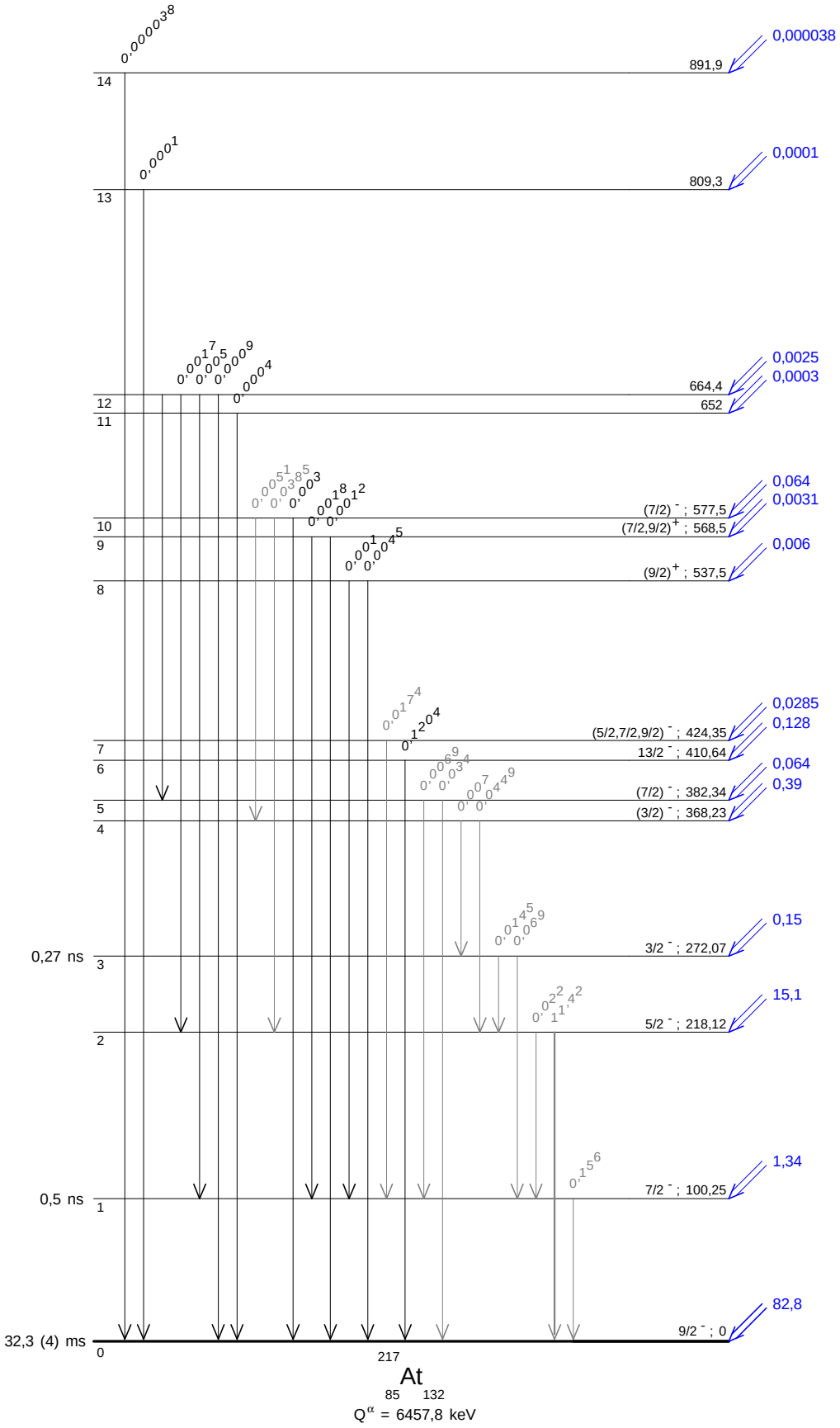
$^{221}_{87}Fr_{134}$



γ Emission intensities per 100 disintegrations



Q^{α} = 6457,8 keV

% α = 99,9952