^{221}Fr α decay 1999Gr33,1995Sh01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev, S. Kumar	NDS 147, 382 (2018)	1-Dec-2017

Parent: ^{221}Fr: E=0.0; J^π=5/2$^-$; $T_{1/2}$=4.801 min *6*; Q(α)=6457.7 *14*; %α decay=99.995 *2*

^{221}Fr-%α is deduced using the rounded off value of %β^-=0.0048 *15* in 1997Ch53. Other: %β^-=0.011 *5* in the earlier work of 1995Ch74.

^{221}Fr-J^π: Directly measured from 1978Ek02 and 1985Co24. π from μ. J^π=5/2$^-$ member of the 1/2[541] band (prolate deformation).

^{221}Fr-$T_{1/2}$: Weighted average of 4.806 m *6* (2013Su13), 4.768 m *13* (2010Wa42) and 4.790 m *20* (2007Je07).

^{221}Fr-Q(α) from 2017Wa10.

1999Gr33: ^{221}Fr was produced from ^{225}Ac by the isotope generator technique, using ^{229}Th material that was isolated from ^{233}U and purified over five years. In one set of experiments, the source was placed in vacuum facing α detector. In the second set, recoiling nuclei from ^{225}Ac decay were collected on Al support and every 15 min transfered to the α detector. Detectors: 100-mm^2 Si(Au) with energy resolution of 20-25 keV and 84-cm^3 HPGe detector with energy resolution of 1.0 keV at an energy of 150 keV. Measured: singles α- and γ-ray spectra, and $\alpha\gamma$ coin.

1995Sh01: ^{221}Fr was produced from ^{225}Ac by the isotope generator technique, using a 3μCi ^{229}Th material. Recoiling nuclei from ^{225}Ac decay were collected on a moving tape that brought the ^{221}Fr activity in front of detectors. Detectors: 200-mm^2 Si wafer, 100 μm-thick with 16 keV energy resolution; a single coaxial Ge detector with a 0.5 mm Al window; 700-mm^2, 16-mm thick Si(Li) detector inside an axially increasing magnetic field for ce detection. Measured: Singles α, γ and ce, and $\alpha\gamma$ coin.

Others: 1955St04, 1962Wa28, 1964Va20, 1968Le07, 1969LeZW, 1969Dz06, 1970Al17, 1972Dz14, 1981Di14, 1994NiZZ, 1994Ar23, 1992Li26, 1999Sc17, 1995Bu17 (same as 1999Gr33), 2002Gr36 (same as 2002GrZY).

^{217}At Levels

E(level)[†]	J^π[‡]	$T_{1/2}$	Comments
0.0[#]	9/2$^-$	32.6 ms *3*	$T_{1/2}$: From Adopted Levels.
100.13[@] *8*	7/2$^-$	<0.5 ns	$T_{1/2}$: From α-100γ(t) in 1970Al17.
217.97[#] *9*	5/2$^-$	0.27 ns *2*	$T_{1/2}$: From α-218γ(t) in 1970Al17.
271.75[@] *10*	3/2$^-$		
310.10[&] *20*	(13/2$^+$)		
367.99[#] *13*	3/2$^-$		
381.42[@] *17*	(7/2)$^-$		
410.40[#] *20*	13/2$^-$		
424.13[@] *22*	(5/2,7/2,9/2)$^-$		
537.8 *5*	(7/2,9/2)		
568.7[@] *3*	(7/2,9/2)		
576.90[#] *19*	7/2$^-$		
652.0 *20*			
663.3[@] *3*	(5/2$^-$,7/2,9/2$^-$)		
809.30 *20*			
891.9 *3*			

[†] From a least-squares fit to Eγ.

[‡] From Adopted Levels. For excited states J^π follow from the proposed decay scheme of 1995Sh01, based on measured γ-ray transition multipolarities.

[#] Seq.(A): Dominant $\pi(h_{9/2})^3\nu(g_{9/2})^6$.

[@] Seq.(B): Dominant $\pi(f^1_{7/2},h^2_{9/2})\nu(g_{9/2})^6$.

[&] Probable $\pi(i^1_{13/2},h^2_{9/2})\nu(g_{9/2})^6$.

^{221}Fr α decay 1999Gr33,1995Sh01 (continued)

α radiations

Eα[†]	E(level)	Iα[†#]	HF[‡]	Comments
5500 *40*	891.9	3.3×10^{-4} *9*	61 *17*	Eα,Iα: From 2002Gr36.
5530 *25*	809.30	9.0×10^{-4} *20*	60 *14*	Eα,Iα: From 2002Gr36.
5688 *3*	663.3	0.002 *1*	146 *73*	
5696 *4*	652.0	≈0.001	≈332	Eα: Given uncertain in 1968Le07, but confirmed in 1999Gr33 (Eα=5697 keV).
5775 *3*	576.90	0.065 *5*	11.8 *10*	Eα: Other: 5776 keV *10* (1964Va20). Iα: Unweighted average of 0.07 *3* (1964Va20) and 0.06 *1* (1968Le07,1969LeZW).
5782 *4*	568.7	0.005 *2*	168 *68*	
5812.5 *25*	537.8	0.004 *2*	2.9×10^{2} *15*	
5924.5 *25*	424.13	0.04 *1*	100 *26*	Eα: Other: 5930 keV *7* (1967Dz02). Iα: Weighted average of 0.05 *1* (1967Dz02) and 0.03 *1* (1968Le07,1969LeZW), and the smallest experimental uncertainty.
5938 *2*	410.40	0.17 *2*	27 *4*	Eα: Others: 5938 keV *10* (1964Va20) and 5940 keV *6* (1967Dz02). Iα: Unweighted average of 0.2 *1* (1964Va20), 0.13 *1* (1967Dz02) and 0.17 *3* (1968Le07,1969LeZW).
5965.0 *25*	381.42	0.10 *2*	63 *13*	Eα: Other: 5966 keV *6* (1967Dz02). Iα: Unweighted average of 0.12 *1* (1967Dz02) and 0.08 *1* (1968Le07,1969LeZW).
5979 *2*	367.99	0.48 *3*	15.1 *10*	Eα: Others: 5980 keV *10* (1964Va20) and 5980 keV *6* (1967Dz02). Iα: Weighted average of 0.5 *1* (1964Va20), 0.46 *5* (1967Dz02) and 0.49 *3* (1968Le07,1969LeZW).
6036 *3*	310.10	0.003 *2*	4.4×10^{3} *30*	Eα: Others: 6037 keV *10* (1964Va20) and 6041 keV *6* (1967Dz02). Iα: Others: 0.02 (1964Va20) and 0.03 *1* (1967Dz02).
6075 *2*	271.75	0.14 *2*	140 *20*	Eα: Others: 6070 keV *10* (1964Va20) and 6075 keV *5* (1967Dz02). Iα: Weighted average of 0.2 *1* (1964Va20), 0.13 *2* (1967Dz02) and 0.15 *3* (1968Le07,1969LeZW), and the smallest experimental uncertainty.
6126.3 *15*	217.97	15.1 *2*	2.24 *4*	Eα: Recommended by 1991Ry01. Measured Eα are: 6124 keV *3* (1962Wa28), 6126 keV *5* (1964Va20), 6125 keV *5* (1967Dz02) and 6125.5 keV *20* (1968Le07,1969LeZW). Iα: Recommended by 1991Ry01. Weighted average of 15 *2* (1964Va20), 14.5 *7* (1967Dz02) and 15.1 *2* (1968Le07,1969LeZW). (6126α)(θ) from oriented ^{221}Fr: A_2=− 0.375 *14*, A_4=− 0.10 *5* (1999Sc17) corresponds to 95.1% l_α=2 and 4.9% l_α=2 transitions (from J^π=5/2$^-$ parent) (1999Sc17). Alpha anisotropy also measured in 1992Li26.
6241.8 *20*	100.13	1.36 *6*	80 *5*	Eα: Others: 6243 keV *5* (1964Va20) and 6241 keV *6* (1967Dz02). Iα: Weighted average of 1.6 *3* (1964Va20), 1.35 *7* (1967Dz02) and 1.34 *10* (1968Le07,1969LeZW).
6341.0 *13*	0.0	83.3 *7*	3.43 *4*	Eα: Recommended by 1991Ry01. Measured Eα are: 6332 keV *10* (1955St04), 6336 keV *6* (1960Vo05), 6340 keV *2* (1962Wa28), 6340 keV *5* (1964Va20), 6338 keV *5* (1967Dz02) and 6339.8 keV *20* (1968Le07,1969LeZW). Iα: Recommended by 1991Ry01. Weighted average of 82 *3* (1964Va20), 83.2 *20* (1967Dz02) and 83.4 *8* (1968Le07,1969LeZW). (6341α)(θ) from oriented ^{221}Fr: A_2=− 0.389 *10*, A_4=− 0.06 *6* (1999Sc17) corresponds to ≥99.5% l_α=2 transition (from J^π=5/2$^-$ parent) (1999Sc17). Alpha anisotropy also measured in 1992Li26.

[†] From 1968Le07, unless otherwise stated.
[‡] $r_0(^{217}At)$= 1.5501 *10*, average of $r_0(^{216}Po)$=1.5555 *2* and $r_0(^{217}Rn)$=1.5446 *19* (1998Ak04).
[#] For absolute intensity per 100 decays, multiply by 0.99995 *2*.

γ(^{217}At)

Iγ normalization: Weighted average of I_γ(218γ)=11.57% *15* (1986He06) and 11.25% *18*, the later deduced from Iα(6126.3α)=15.1% 2 and the decay scheme adopted here. Others: 13.44% *7* (1981Di14), 12.5% *4* (1968Le07,1969LeZW), 11.3% *10* (1995Sh01), 11.18% *15* (1999Gr33) and 11.6% *4* (1994Ar23).
I(Kα x ray)=2.23% *20* (1995Sh01). I(Kα_1 x ray)/I(Kα_2 x ray)= 0.61 *6* (1972Dz14).

E_γ [†]	I_γ [&]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	δ [‡]	α [@]	Comments
53.8 *1*	1.25 *23*	271.75	3/2⁻	217.97	5/2⁻	M1		14.17	α(L)=10.79 *17*; α(M)=2.56 *4* α(N)=0.663 *10*; α(O)=0.1419 *22*; α(P)=0.0196 *3* E_γ: From 1995Sh01. Others: 53.54 *18* (1995Bu17) and 53.81 *3* (1999Gr33). I_γ: Weighted average of 1.16 *27* (1999Gr33) and 1.50 *44* (1995Sh01). Other: 0.41 *5* (1995Bu17). Mult.: α(L)exp=8 *4* (1995Sh01).
[x]68.11 *15*	0.45 *18*								E_γ,I_γ: From 1995Bu17, but not reported in any other work.
96.3 *3*	0.63 *27*	367.99	3/2⁻	271.75	3/2⁻	(E2+M1)		5.8 *32*	E_γ: From 1995Sh01 and 1999Gr33. Other: 96.12 *18* (1995Bu17). I_γ: From 1999Gr33. Others: <0.88 (1995Sh01) and 1.3 *4* (1995Bu17). Mult.: α(L)exp>2.5 (1995Sh01) would imply a sizable E2 component (α(L,M1)=1.98, α(L,E2)=6.6). Note, that α(exp)=25 *15* (1999Gr33) is not consistent with either M1 or E2 (α(M1)=2.6, α(E2)=8.9).
100.2 *1*	12.3 *17*	100.13	7/2⁻	0.0	9/2⁻	M1		11.98	α(K)=9.67 *14*; α(L)=1.76 *3*; α(M)=0.417 *6* α(N)=0.1081 *16*; α(O)=0.0231 *4*; α(P)=0.00320 *5* E_γ: From 1995Sh01. Others: 100.63 *2* (1994Ar23), 99.52 *6* (1995Bu17) and 100.25 *2* (1999Gr33). I_γ: Unweighted average of 14.7 *9* (1994Ar23), 8.9 *27* (1999Gr33) and 13.3 *18* (1995Sh01). Other: 10.1 *5* (1995Bu17). Mult.: α(L)exp=1.2 *6* (1995Sh01).
117.8 *2*	2.0 *12*	217.97	5/2⁻	100.13	7/2⁻	M1(+E2)	<2.1	6.1 *16*	α(K)=3.8 *24*; α(L)=1.70 *60*; α(M)=0.44 *18* α(N)=0.113 *45*; α(O)=0.0228 *84*; α(P)=0.0026 *7* E_γ: From 1995Sh01. Others: 118.0 *2* (1968Le07,1969LeZW), 117.67 *5* (1994Ar23), 118.18 *9* (1995Bu17) and 117.82 *3* (1999Gr33). I_γ: From 1999Gr33. Others: 3.28 *17* (1994Ar23), 0.44 *18* (1995Sh01) and 2.16 *27* (1995Bu17). Mult.,δ: From α(L)exp=1.5 *8* (1969Dz06). Note that α(exp)=13.5 *86* (1999Gr33) is not consistent with either M1 or E2 (α(M1)=7.6, α(E2)=3.9).
150.0 *1*	3.92 *17*	367.99	3/2⁻	217.97	5/2⁻	M1+E2	0.54 *24*	3.3 *4*	α(K)=2.5 *5*; α(L)=0.62 *5*; α(M)=0.153 *16* α(N)=0.040 *4*; α(O)=0.0083 *7*; α(P)=0.00105 *4* E_γ: From 1995Sh01. Others: 150.21 *3* (1999Gr33), 150.04 *4* (1995Bu17), 150.43 *5* (1994Ar23). I_γ: Weighted average of 4.20 *18* (1999Gr33), 5.31 *88* (1995Sh01) and 3.62 *17* (1994Ar23). Other: 5.32 *9* (1995Bu17). Mult.,δ: From α(K)exp=2.6 *5* (1995Sh01) and 2.2 *7* (1969Dz06). Other: α(exp)=3.5 *9* (1999Gr33).

$^{217}_{85}At_{132}$-3

^{221}Fr α decay 1999Gr33,1995Sh01 (continued)

$\gamma(^{217}At)$ (continued)

E_γ [†]	I_γ [&]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [@]	Comments
171.6 *1*	6.77 *18*	271.75	3/2$^-$	100.13	7/2$^-$	E2	0.867	α(K)=0.227 *4*; α(L)=0.474 *7*; α(M)=0.1264 *18* α(N)=0.0327 *5*; α(O)=0.00645 *10*; α(P)=0.000670 *10* E_γ: From 1995Sh01. Others: 171.83 *3* (1999Gr33), 171.68 *4* (1995Bu17), 172.05 *5* (1994Ar23). I_γ: Weighted average of 6.80 *18* (1999Gr33) and 5.8 *11* (1995Sh01). Others: 5.17 *17* (1994Ar23) and 7.12 *27* (1995Bu17). Mult.: α(K)exp=0.3 *1* (1995Sh01); α(exp)=0.84 *2* (1999Gr33).
[x]201.4 *6*	0.10 *1*							E_γ,I_γ: From 1999Gr33. Other: Eγ=201.44 *50* and Iγ=0.05 *3* (1995Bu17).
208.3 *6*	0.45 *9*	576.90	7/2$^-$	367.99	3/2$^-$	[E2]	0.430 *8*	α(K)=0.1519 *24*; α(L)=0.206 *4*; α(M)=0.0547 *11* α(N)=0.0141 *3*; α(O)=0.00281 *6*; α(P)=0.000296 *6* E_γ: From 1999Gr33. Other: 208.3 *5* (1995Bu17). I_γ: From 1999Gr33. Other: 0.41 *7* (1995Bu17).
218.0 *1*	1000	217.97	5/2$^-$	0.0	9/2$^-$	E2	0.368	α(K)=0.1377 *20*; α(L)=0.1705 *24*; α(M)=0.0452 *7* α(N)=0.01168 *17*; α(O)=0.00232 *4*; α(P)=0.000246 *4* E_γ: From 1995Sh01. Others: 218.0 *4* (1968Le07,1969LeZW), 218.30 *2* (1994Ar23), 218.14 *3* (1995Bu17) and 218.12 *2* (1999Gr33). I_γ: 1000 *9* (1995Sh01), 1000 *34* (1994Ar23), 1000 *13* (1999Gr33) and 1000 *27* (1995Bu17). Mult.: From K:(L1+L2):L3=1.50 *7*:1.40 *15*:0.53 *5* in 1969Dz06. α(exp)=0.14 used as a normalization in 1995Sh01. γ anisotropy in 1992Li26 is also consistent with Mult=E2.
[x]250.7[#] *2*	0.30 *7*							E_γ,I_γ: From 1994Ar23, but Iγ<0.1 in 1999Gr33.
[x]253.15[#] *15*	0.59 *8*							E_γ,I_γ: From 1994Ar23, but Iγ<0.1 in 1999Gr33.
[x]263.39[#] *14*	0.19 *5*							E_γ,I_γ: From 1995Bu17, but Iγ<0.1 in 1999Gr33.
[x]271.91[#] *5*	0.31 *9*							E_γ,I_γ: From 1994Ar23, but Iγ<0.1 in 1999Gr33.
281.8 *3*		663.3	(5/2$^-$,7/2,9/2$^-$)	381.42	(7/2)$^-$			E_γ: Doublet from 1995Sh01.
281.9 *3*	0.060 *6*	381.42	(7/2)$^-$	100.13	7/2$^-$	[M1]	0.653	α(K)=0.530 *8*; α(L)=0.0938 *14*; α(M)=0.0222 *4* α(N)=0.00575 *9*; α(O)=0.001231 *18*; α(P)=0.0001700 *25* E_γ: From 1995Sh01. Others: 282.12 *9* (1999Gr33), 282.36 *15* (1995Bu17), 282.25 *5* (1994Ar23). I_γ: Weighted average of 0.63 *9* (1999Gr33), 0.71 *27* (1995Sh01) and 0.56 *9* (1994Ar23). Other: 0.11 *4* (1995Bu17).
[x]297.11[#] *40*	0.77 *7*							E_γ,I_γ: From 1995Bu17, but Iγ<0.1 in 1999Gr33.
[x]299.59[#] *14*	1.3 *6*							E_γ,I_γ: From 1995Bu17, but Iγ<0.1 in 1999Gr33.
310.1 *2*	<0.09	310.10	(13/2$^+$)	0.0	9/2$^-$	[M2]	1.79	α(K)=1.331 *19*; α(L)=0.343 *5*; α(M)=0.0856 *13* α(N)=0.0224 *4*; α(O)=0.00476 *7*; α(P)=0.000641 *9* E_γ: Rounded off from 1995Bu17. Other: 314.20 *5* (1994Ar23). I_γ: From 1999Gr33. Others: 0.58 *10* (1994Ar23) and 0.41 *7* (1995Bu17), but those were found in 1999Gr33 to be significantly affected by coincidence summing.
[x]314.11[#] *17*	0.22 *5*							E_γ,I_γ: From 1995Bu17, but Iγ<0.1 in 1999Gr33.

$^{217}_{85}At_{132}$-4

^{221}Fr α decay 1999Gr33,1995Sh01 (continued)

γ(^{217}At) (continued)

E_γ †	I_γ &	E_i(level)	J_i^π	E_f	J_f^π	Mult. ‡	δ ‡	α @	Comments
324.0 *2*	1.52 *6*	424.13	(5/2,7/2,9/2)$^-$	100.13	7/2$^-$	M1(+E2)	<1.1	0.353 *94*	α(K)=0.279 *84*; α(L)=0.056 *8*; α(M)=0.0135 *17* α(N)=0.0035 *5*; α(O)=0.00074 *10*; α(P)=9.9×10^{-5} *17* E_γ: From 1995Sh01. Others: 324.10 *6* (1999Gr33), 323.99 *6* (1995Bu17), 323.99 *3* (1994Ar23). I_γ: Weighted average of 1.70 *9* (1999Gr33), 1.06 *27* (1995Sh01) and 1.38 *9* (1994Ar23). Other: 1.7 *7* (1995Bu17). Mult.,δ: From α(K)exp=0.4 *2* (1995Sh01).
359.0 *2*	3.37 *12*	576.90	7/2$^-$	217.97	5/2$^-$	M1(+E2)	<0.5	0.31 *3*	α(K)=0.251 *23*; α(L)=0.0459 *25*; α(M)=0.0109 *6* α(N)=0.00282 *14*; α(O)=0.00060 *4*; α(P)=8.2×10^{-5} *6* E_γ: From 1995Sh01. Others: 359.86 *4* (1999Gr33) and 359.92 *6* (1995Bu17). I_γ: Weighted average of 3.58 *18* (1999Gr33), 3.19 *88* (1995Sh01) and 3.19 *17* (1994Ar23). Other: 3.5 *11* (1995Bu17). Mult.,δ: From α(K)exp=0.4 *1* (1995Sh01).
^{x}368.18# *10*	0.48 *5*								E_γ,I_γ: From 1995Bu17, but Iγ<0.1 in 1999Gr33. Other: Eγ=368.17 *2* and Iγ=7.33 *9* (1994Ar23).
381.1 *2*	2.98 *12*	381.42	(7/2)$^-$	0.0	9/2$^-$	M1(+E2)	<0.9	0.24 *5*	α(K)=0.19 *5*; α(L)=0.036 *5*; α(M)=0.0087 *11* α(N)=0.0022 *3*; α(O)=0.00048 *6*; α(P)=6.4×10^{-5} *10* E_γ: From 1995Sh01. Others: 382.34 *4* (1999Gr33), 381.81 *4* (1995Bu17), 382.36 *2* (1994Ar23). I_γ: Weighted average of 2.95 *18* (1999Gr33), 2.74 *88* (1995Sh01) and 3.02 *17* (1994Ar23). Other: 2.97 *18* (1995Bu17). Mult.,δ: From α(K)exp=0.25 *10* (1995Sh01).
410.4 *2*	10.53 *18*	410.40	13/2$^-$	0.0	9/2$^-$	E2		0.0549	α(K)=0.0344 *5*; α(L)=0.01531 *22*; α(M)=0.00392 *6* α(N)=0.001015 *15*; α(O)=0.000206 *3*; α(P)=2.39×10^{-5} *4* E_γ: From 1995Sh01. Others: 410.64 *5* (1999Gr33), 409.93 *7* (1995Bu17), 410.73 *2* (1994Ar23). I_γ: Weighted average of 10.55 *18* (1999Gr33), 9.7 *18* (1995Sh01) and 10.3 *9* (1994Ar23). Other: 11.17 *18* (1995Bu17). Mult.: α(K)exp=0.03 *1* (1995Sh01).
437.8 *5*	0.093 *11*	537.8	(7/2,9/2)	100.13	7/2$^-$				E_γ: From 1995Sh01. Others: 437.00 *5* (1999Gr33) and 435.68 *10* (1994Ar23). I_γ: From 1999Gr33. Others: 0.09 (1995Sh01) and 0.34 *6* (1994Ar23).
446.3 *8*	0.15 *4*	663.3	(5/2$^-$,7/2,9/2$^-$)	217.97	5/2$^-$				E_γ: From 1995Sh01. Others: 446.30 *8* (1999Gr33) and 445.07 *20* (1995Bu17). I_γ: From 1999Gr33. Others: 0.09 (1995Sh01) and 0.08 *4* (1995Bu17).
469.0 *5*	0.14 *3*	568.7	(7/2,9/2)	100.13	7/2$^-$				E_γ: From 1995Sh01. Others: 468.3 *7* (1999Gr33) and 469.6 *2*

$^{217}_{85}At_{132}$-5

^{221}Fr α decay 1999Gr33,1995Sh01 (continued)

$\gamma(^{217}At)$ (continued)

E_γ †	I_γ &	E_i(level)	J_i^π	E_f	J_f^π	Mult. ‡	α @	Comments
								(1995Bu17). I_γ: Weighted average of 0.13 *3* (1999Gr33) and 0.18 *9* (1995Sh01). Other: 0.26 *4* (1995Bu17).
x496.2 *10*	≈0.09							E_γ,I_γ: From 1995Sh01. Other: $I\gamma$<0.04 (1999Gr33).
537.5 *8*	0.40 *3*	537.8	(7/2,9/2)	0.0	9/2$^-$			E_γ: From 1995Sh01. Others: 537.8 *8* (1999Gr33), 537.0 *2* (1995Bu17) and 538.02 *10* (1994Ar23). I_γ: Weighted average of 0.45 *4* (1999Gr33), 0.18 *9* (1995Sh01) and 0.34 *10* (1994Ar23). Other: 0.27 *4* (1995Bu17).
562.3 *12*	≈0.05	663.3	(5/2$^-$,7/2,9/2$^-$)	100.13	7/2$^-$			E_γ,I_γ: From 1995Sh01.
568.5 *3*	0.11 *4*	568.7	(7/2,9/2)	0.0	9/2$^-$			E_γ: From 1999Gr33 (same in 1995Bu17). Other: 568.4 *10* (1995Sh01). I_γ: From 1999Gr33. Others: 0.09 (1995Sh01) and 0.14 *4* (1995Bu17).
576.9 *4*	0.31 *3*	576.90	7/2$^-$	0.0	9/2$^-$	[M1]	0.0948	α(K)=0.0772 *11*; α(L)=0.01342 *19*; α(M)=0.00317 *5* α(N)=0.000820 *12*; α(O)=0.0001756 *25*; α(P)=2.43×10^{-5} *4* E_γ: From 1999Gr33 (same in 1995Bu17). Other: 577.0 *8* (1995Sh01) and 577.76 *6* (1994Ar23). I_γ: Weighted average of 0.26 *4* (1999Gr33), 0.35 *9* (1995Sh01) and 0.41 *6* (1994Ar23). Other: 0.33 *5* (1995Bu17).
652 *2*	≈0.04	652.0		0.0	9/2$^-$			E_γ,I_γ: From 1999Gr33.
x658 *2*	≈0.06							E_γ,I_γ: From 1999Gr33.
665 *2*	≈0.08	663.3	(5/2$^-$,7/2,9/2$^-$)	0.0	9/2$^-$			E_γ,I_γ: From 1999Gr33.
809.3 *2*	0.080 *17*	809.30		0.0	9/2$^-$			E_γ,I_γ: From 2002Gr36.
891.9 *3*	0.029 *8*	891.9		0.0	9/2$^-$			E_γ,I_γ: From 2002Gr36.

† From 1995Sh01, unless otherwise stated. Uncertainties quoted for many Eγ in 1999Gr33, 1995Bu17 and 1994Ar23 are unrealistically small, given the large-size Ge detectors used in these measurements and the absence of information regarding the calibration procedure.

‡ From ce measurements of 1969Dz06 and 1995Sh01 and α(T) in 1999Gr33. Mixing ratios, δ, were determined using the BrIccmixing program.

Reported in 1999Gr33 to have a significant γ-ray coincidence summing contributions.

@ Additional information 2.

& For absolute intensity per 100 decays, multiply by 0.01144 *12*.

x γ ray not placed in level scheme.

$^{217}_{85}At_{132}$-6

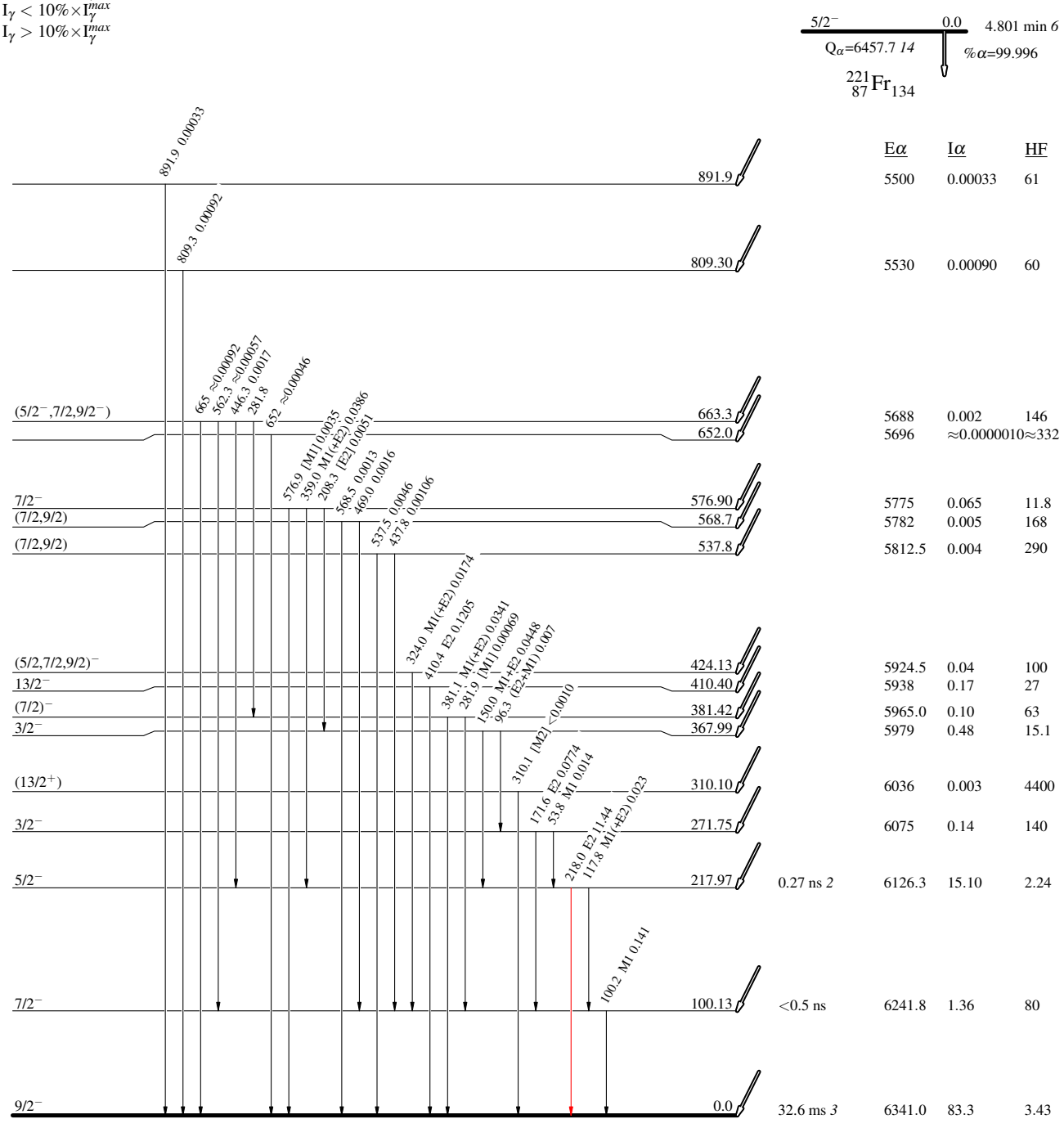
^{221}Fr α decay 1999Gr33,1995Sh01

Decay Scheme

Intensities: I_γ per 100 parent decays

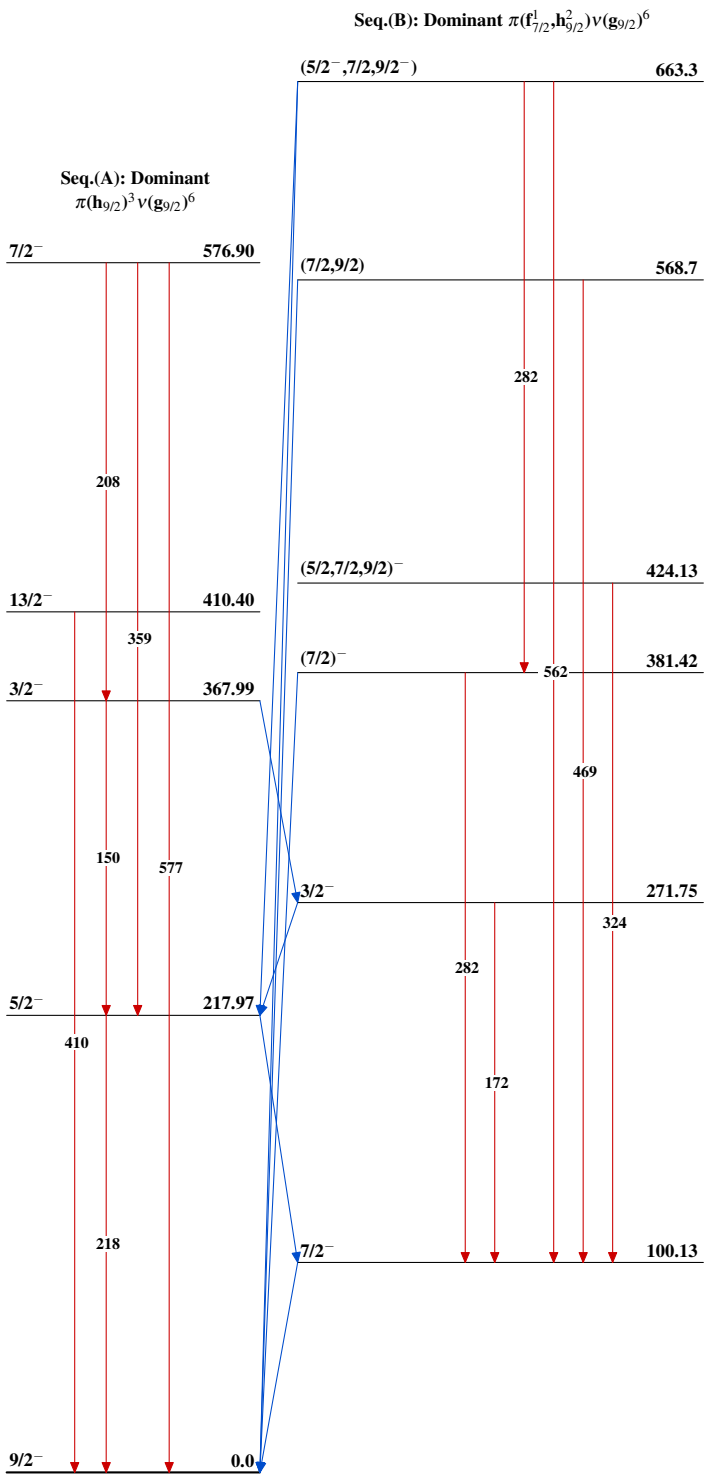
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{217}_{85}At_{132}$

^{221}Fr α decay 1999Gr33,1995Sh01



$^{217}_{85}At_{132}$