^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04

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

Includes ^{204}Hg(^{15}N,4nγ),E≈78 MeV; ^{207}Pb(^{11}B,3n).

1984Sc25: target: >99% enriched ^{208}Pb, E(^{11}B)=66 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\alpha\gamma$ coin, $\gamma\gamma$(t), $\alpha\gamma$(t), $\gamma(\theta)$ for θ=90°, 115°, 127°, 138°, and 149°. Measured level half-lives, α decay from g.s. and excited levels. Deduced γ-ray multipolarities. Detectors: Ge(Li), high-purity germanium, Si surface barrier.

1984De16: ^{208}Pb(^{11}B,4n), target: 98% enriched ^{208}Pb, E(^{11}B)=58, 62 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, $\alpha\gamma$ coin, ce-ce coin, $\gamma\gamma$(t), $\alpha\gamma$(t), differential perturbed angular distribution (DPAD) of α particles, α decay from g.s. and excited levels, level half-lives. The ^{207}Pb(^{11}B,3n) reaction was used to confirm the assignment of measured α particles to ^{215}Fr.

1984De16: ^{204}Hg(^{15}N,4nγ), target: 98% enriched ^{204}Hg cooled to −30° C, E(^{15}N)≈78 MeV. Measured differential perturbed angular distribution (DPAD) for γ rays. Deduced γ-ray multipolarities, g-factors, half-lives.

1985Dr04: target: enriched ^{208}Pb, E(^{11}B)=45-66 MeV. Measured Eγ, Iγ, $\gamma\gamma$, γ(x ray) coin, $\gamma(\theta)$(θ=0° to 90° in 15° increments), γ-ray excitation functions, and γ(lin pol). Deduced level scheme, multipolarities, spins and parities.

1982GoZU, 1983GoZX: ^{213}Tl(^{13}C,3nγ), E=65 MeV; measured Eγ, Iγ, Eα, $\gamma(\theta)$, $\alpha\gamma$ coin, $\gamma\gamma$ coin; deduced levels, level half-life. Gamma cascade 201.6-290.2-450.5-670.2 from a 1612.5 level of 9.8 ns *14* half-life discovered in this work. For the first time, excited states in ^{215}Fr were identified at 670.2, (13/2$^-$); 1120.7, (17/2$^-$); 1410.9, (21/2$^-$); and isomer at 1612.5 keV. The α decays were observed from g.s., 1410 and 1612 levels.

^{215}Fr Levels

First level scheme of ^{215}Fr with four excited states was reported in 1982GoZU (also 1983GoZX). 1984De16 extended the level scheme up to 3068 level with 20 gamma rays. A contemporary study by 1984Sc25 produced a level scheme up to 3462 level with 26 gamma rays; the level scheme up to 3068 level almost the same as in 1984De16. 1985Dr04 measured polarization asymmetries for several of the gamma rays, establishing definite multipolarities. They reported 21 gamma rays and essentially confirmed the earlier level schemes of 1984De16 and 1984Sc25. In the opinion of the evaluators, further work is needed to define the ordering of the cascades above the 2251 level.

E(level)†	J$^\pi$#	T$_{1/2}$	Comments
0.0	9/2$^-$	86 ns *5*	%α=100 T$_{1/2}$: from Adopted Levels. Measured Eα=9365 (1982GoZU), 9630 (1984Sc25), 9369 (1984De16).
670.34 *13*	(13/2)$^-$		
699.97 *13*	(11/2)$^-$		
835.43 *14*	(13/2)$^+$		%α=4.3 *15* %α: deduced by evaluators from Iα(10160)/Iα(total)= 3.8% *15* (1984Sc25), and renormalizing g.s. α branch from 87.7% to 100%. It is assumed by the evaluators that 1984Sc25 have corrected for 78% detection of the ground state α branch in $\alpha\gamma$-coin spectrum. Measured Eα=10160 *30* (1984Sc25).
1121.51 *17*	(17/2)$^-$		%α=0.9 *1* %α: for 1121 and/or 1149 levels; deduced by evaluators from Iα(10460)/Iα(total)=0.8% *1* (1984Sc25), and renormalizing g.s. α branch from 87.7% to 100%. It is assumed by the evaluators that 1984Sc25 have corrected for 78% detection of the ground state α branch in $\alpha\gamma$-coin spectrum. Measured Eα=10460 *30* (1984Sc25), 10493 (1984De16) from 1121+1149 levels.
1149.04 *14*	(15/2)$^-$		%α=0.9 *1* %α: for 1121 and/or 1149 levels; deduced by evaluators from Iα(10460)/Iα(total)=0.8% *1* (1984Sc25), and renormalizing g.s. α branch from 87.7% to 100%. It is assumed by the evaluators that 1984Sc25 have corrected for 78% detection of the ground state α branch in $\alpha\gamma$-coin spectrum. Measured Eα=10460 *30* (1984Sc25), 10493 (1984De16) from 1121+1149 levels.
1440.02 *18*	(19/2)$^-$	4 ns *2*	%α=4.7 *4*

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^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

^{215}Fr Levels (continued)

E(level)[†]	J$^{\pi}$[#]	T$_{1/2}$	Comments
			g=0.33 *10* (1984De16) g: DPAD of γ rays (1984De16), value is for 1440 and/or 1573 level. %α: deduced by evaluators from Iα(10740)/Iα(total)=4.1% *3* (1984Sc25), and renormalizing g.s. α branch from 87.7% to 100%. It is assumed by the evaluators that 1984Sc25 have corrected for 78% detection of the ground state α branch in $\alpha\gamma$-coin spectrum. T$_{1/2}$: $\gamma\gamma$(t) (1984De16), value is for 1440 and/or 1573 level. Measured Eα=10760 (1982GoZU), 10740 *30* (1984Sc25), 10789 (1984De16).
1457.36 *21*	(21/2)$^-$		
1573.10 *21*	(23/2)$^-$	3.5 ns *14*	%α=4.1 *4* g=−0.33 *10* (1984Sc25) g: from DPAD, g factor=0.33 10 (1984De16) for 1440 and/or 1573 level. %α: deduced by evaluators from Iα(10890)/Iα(total)=3.6% *3* (1984Sc25), and renormalizing g.s. α branch from 87.7% to 100%. It is assumed by the evaluators that 1984Sc25 have corrected for 78% detection of the ground state α branch in $\alpha\gamma$-coin spectrum. T$_{1/2}$: $\gamma\gamma$(t) centroid shift method (1984Sc25). Other value: 4 ns *2*, $\gamma\gamma$(t) centroid shift method (1984De16) for 1440 and/or 1573 level. Measured Eα=10909 (1982GoZU), 10890 *30* (1984Sc25), 10919 (1984De16).
1680.6?[‡] *3*	(25/2)$^-$		
1813.62 *25*	(27/2)$^-$	2.1 ns *14*	T$_{1/2}$: $\gamma\gamma$(t), $\alpha\gamma$(t) centroid shift method (1984Sc25).
2015.9 *3*	(29/2)$^+$	4.7 ns *14*	g=0.47 *20* (1984De16) g: DPAD of γ rays (1984De16). T$_{1/2}$: $\gamma\gamma$(t) and/or $\alpha\gamma$(t) with centroid-shift method. Weighted average of 5.5 ns *14* (1984Sc25), and 3 ns *2* (1984De16). Other: 9.8 ns *14* (1982GoZU) tentatively assigned to a 1612 level decaying by 202γ, but this γ now deexcites a level at 2016 keV; also this half-life may have contribution from higher-lying isomers at 3068 and 3462 keV with half-lives of 14.6 ns and 22.9 ns, respectively.
2251.3 *4*	(33/2)$^+$	5.3 ns *14*	g=0.47 *10* (1984De16) g: DPAD of γ rays (1984De16). T$_{1/2}$: $\gamma\gamma$(t) and/or $\alpha\gamma$(t) with centroid-shift method. Weighted average of 5.5 ns *14* (1984Sc25), and 5 ns *2* (1984De16).
2806.8?[‡] *4*	(35/2)$^-$		
2900.4?[‡] *4*	(35/2$^-$)		J$^{\pi}$: from 1984Sc25. 33/2$^{(+)}$ proposed in 1985Dr04.
3014.0?[‡] *5*	(37/2$^-$)		
3068.9 *4*	(39/2)$^-$	14.6 ns *14*	g=0.47 *2* (1984De16) g: from DPAD of γ rays (1984De16, corrected for diamagnetism and Knight shift). Other: 0.48 *2*, DPAD of α particles (1984De16). T$_{1/2}$: $\gamma\gamma$(t) (262γ-555γ time curves fitted to a two-level decay formula) (1984Sc25). Other: 33 ns *5* or 30 ns *5* (1984De16), which may correspond to the half-life of the isomer at 3462 keV.
3207.5 *5*	(41/2$^-$)		
3409.1 *4*	(41/2)		
3417.1?[‡] *5*	(45/2$^-$)		
3419.4? *5*			Tentative level in 1985Dr04 not included in Adopted Levels.
3462.3 *6*	(47/2$^+$)	22.9 ns *21*	T$_{1/2}$: $\gamma\gamma$(t) (262γ-555γ time curves fitted to a two-level decay formula), and from 210γ time spectrum (1984Sc25). Other: 33 ns *5*, $\gamma\gamma$(t) for all γ rays; 30 ns *5*, time spectrum of g.s. α transition fitted to a two-component decay (1984De16); where this half-life is assigned to 3068 level.

[†] From a least-squares fit of γ-ray energies.

[‡] The orderings of 133-107 cascade from 1813 level; 262-55 cascade from 3069 level; 194-114-649 cascade from 3207 level; and 45-210 cascade from 3462 level are not established. The level energies for the intermediate levels can be different for alternate orderings.

[#] As proposed in 1985Dr04, 1984Sc25 and 1984De16 based on $\gamma(\theta)$, γ(lin pol), ce, and transition probabilities.

^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

$\gamma(^{215}Fr)$

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[d]	δ	α[f]	Comments
(27.5[@] *2*)	[@]	1149.04	(15/2)$^-$	1121.51	(17/2)$^-$	(M1)		124 *4*	E_γ: from level-energy difference. Mult.: not E1 since this line is not observed in γ spectrum.
45.2[@c] *3*	17[@&] *2*	3462.3	(47/2$^+$)	3417.1?	(45/2$^-$)	(E1)		0.894 *21*	α(L)=0.676 *16*; α(M)=0.165 *4*; α(N)=0.0423 *10*; α(O)=0.00869 *20*; α(P)=0.001128 *25* α(Q)=3.15×10^{-5} *7* Mult.: from intensity balance at 3417 level.
107.4[c] *3*	8[&] *1*	1680.6?	(25/2)$^-$	1573.10	(23/2)$^-$	M1(+E2)		11.66 *19*	α(K)=9.37 *15*; α(L)=1.74 *3*; α(M)=0.415 *7*; α(N)=0.1089 *18*; α(O)=0.0243 *4*; α(P)=0.00390 *7* α(Q)=0.000218 *4* Mult.: from 1984De16, based on K and L lines. α: for M1. Additional information 13.
[x]112[#]									
113.7[@c] *3*	0.4[@&] *1*	3014.0?	(37/2$^-$)	2900.4?	(35/2$^-$)	[M1]		9.94 *16*	α(K)=7.99 *13*; α(L)=1.478 *24*; α(M)=0.352 *6*; α(N)=0.0924 *15*; α(O)=0.0206 *4* α(P)=0.00331 *6*; α(Q)=0.000185 *3*
115.8 *2*	1.7[&] *2*	1573.10	(23/2)$^-$	1457.36	(21/2)$^-$	[M1]		9.43	α(K)=7.59 *12*; α(L)=1.402 *21*; α(M)=0.334 *5*; α(N)=0.0876 *13*; α(O)=0.0196 *3* α(P)=0.00314 *5*; α(Q)=0.000175 *3* Additional information 11.
133.05[g] *15*	32[ga] *3*	1573.10	(23/2)$^-$	1440.02	(19/2)$^-$	E2		2.67	α(K)=0.315 *5*; α(L)=1.734 *25*; α(M)=0.469 *7*; α(N)=0.1230 *18*; α(O)=0.0256 *4* α(P)=0.00332 *5*; α(Q)=1.310×10^{-5} *19* Additional information 12. A_2=+0.23 *4*, A_4=−0.07 *7* (1985Dr04). A_2=+0.24 *5*, A_4=−0.06 *5* for doublet (1984Sc25).
133.05[gc] *15*	11[ga] *3*	1813.62	(27/2)$^-$	1680.6?	(25/2)$^-$	M1+E2	+0.50 *+13−18*	5.6 *4*	α(K)=4.2 *5*; α(L)=1.10 *8*; α(M)=0.273 *24*; α(N)=0.072 *7*; α(O)=0.0156 *13*; α(P)=0.00235 *13* α(Q)=9.7×10^{-5} *11* Additional information 14. δ: from $\gamma(\theta)$ (1984De16).
135.41 *15*	7.1 *3*	835.43	(13/2)$^+$	699.97	(11/2)$^-$	(E1)		0.227	α(K)=0.179 *3*; α(L)=0.0366 *6*; α(M)=0.00876 *13*; α(N)=0.00227 *4*; α(O)=0.000488 *7* α(P)=7.12×10^{-5} *10*; α(Q)=2.80×10^{-6} *4* Additional information 3. A_2=−0.09 *4*, A_4=−0.01 *7* (1985Dr04). Non-observation in ce spectrum of 1984De16 suggests E1.
138.5[@] *3*	2.6[@&] *5*	3207.5	(41/2$^-$)	3068.9	(39/2)$^-$	[M1]		5.67	α(K)=4.56 *7*; α(L)=0.838 *13*; α(M)=0.200 *3*; α(N)=0.0524 *8*; α(O)=0.01171 *18* α(P)=0.00188 *3*; α(Q)=0.0001049 *16*

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^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

$\gamma(^{215}Fr)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[d]	α[f]	Comments
164.96[b] *15*	4.03 *23*	835.43	$(13/2)^+$	670.34	$(13/2)^-$	(E1)	0.1402	α(K)=0.1113 *16*; α(L)=0.0219 *3*; α(M)=0.00523 *8*; α(N)=0.001357 *20*; α(O)=0.000293 *5* α(P)=4.34×10^{-5} *7*; α(Q)=1.79×10^{-6} *3* A_2=+0.37 *5*, A_4=−0.04 *7* (1985Dr04); ΔJ=0 transition. I_γ: from Iγ(165)/Iγ(135)=0.568 *32* (1985Dr04).
193.6[@c] *2*	5[@] *1*	3207.5	$(41/2^-)$	3014.0?	$(37/2^-)$	(E2)	0.622	α(K)=0.1740 *25*; α(L)=0.330 *5*; α(M)=0.0887 *13*; α(N)=0.0233 *4*; α(O)=0.00486 *8* α(P)=0.000643 *10*; α(Q)=4.81×10^{-6} *7* A_2=+0.37 *9*, A_4=0.00 *10* (1984Sc25).
202.32 *15*	101 *3*	2015.9	$(29/2)^+$	1813.62	$(27/2)^-$	E1	0.0858	α(K)=0.0686 *10*; α(L)=0.01305 *19*; α(M)=0.00311 *5*; α(N)=0.000807 *12* α(O)=0.0001754 *25*; α(P)=2.63×10^{-5} *4*; α(Q)=1.136×10^{-6} *16* Additional information 16. A_2=−0.26 *4*, A_4=−0.03 *6*, POL=+0.53 *17* (1985Dr04). A_2=−0.11 *5*, A_4=+0.02 *5* (1984Sc25). A_2=−0.19 *2*, Iγ(prompt)/Iγ(delayed)=0.23 *4* (1984De16). K/L ratio overlaps E1 or M1 (1984De16).
209.6[@c] *2*	26[@] *1*	3417.1?	$(45/2^-)$	3207.5	$(41/2^-)$	E2	0.468	α(K)=0.1485 *21*; α(L)=0.236 *4*; α(M)=0.0632 *10*; α(N)=0.01657 *25*; α(O)=0.00347 *5* α(P)=0.000461 *7*; α(Q)=3.95×10^{-6} *6* A_2=+0.27 *5*, A_4=−0.07 *5* (1984Sc25).
[x]229[#]								
235.39 *15*	79 *3*	2251.3	$(33/2)^+$	2015.9	$(29/2)^+$	E2	0.314	α(K)=0.1168 *17*; α(L)=0.1454 *21*; α(M)=0.0388 *6*; α(N)=0.01019 *15*; α(O)=0.00214 *3* α(P)=0.000286 *4*; α(Q)=2.98×10^{-6} *5* Additional information 17. A_2=+0.23 *4*, A_4=−0.09 *6* (1985Dr04). A_2=+0.39 *6*, A_4=−0.06 *5* (1984Sc25). A_2=+0.24 *3*, Iγ(prompt)/Iγ(delayed)=0.22 *4* (1984De16).
[x]239[#]								
240.53 *15*	27 *1*	1813.62	$(27/2)^-$	1573.10	$(23/2)^-$	E2[e]	0.292	α(K)=0.1117 *16*; α(L)=0.1332 *19*; α(M)=0.0355 *5*; α(N)=0.00932 *14*; α(O)=0.00196 *3* α(P)=0.000263 *4*; α(Q)=2.83×10^{-6} *4* Additional information 15. A_2=+0.29 *4*, A_4=−0.10 *7* (1985Dr04). A_2=+0.35 *6*, A_4=−0.05 *5* (1984Sc25). A_2=+0.20 *5*, Iγ(prompt)/Iγ(delayed)=0.30 *5* (1984De16).
262.01[c] *15*	38 *1*	3068.9	$(39/2)^-$	2806.8?	$(35/2)^-$	E2[e]	0.220	α(K)=0.0931 *13*; α(L)=0.0941 *14*; α(M)=0.0250 *4*; α(N)=0.00656 *10*; α(O)=0.001380 *20* α(P)=0.000187 *3*; α(Q)=2.31×10^{-6} *4* Additional information 20. A_2=+0.35 *4*, A_4=−0.12 *7*, POL=+0.46 *37* (1985Dr04). A_2=+0.35 *6*, A_4=−0.05 *5* (1984Sc25). A_2=+0.25 *5*, Iγ(prompt)/Iγ(delayed)=0.15 *4* (1984De16).

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^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

$\gamma(^{215}Fr)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [d]	δ	α [f]	Comments
290.93 *15*	97 *3*	1440.02	$(19/2)^-$	1149.04	$(15/2)^-$	E2 [e]		0.1590	α(K)=0.0746 *11*; α(L)=0.0625 *9*; α(M)=0.01653 *24*; α(N)=0.00434 *6*; α(O)=0.000914 *13* α(P)=0.0001248 *18*; α(Q)=1.81×10^{-6} *3* Additional information 8. A_2=+0.32 *4*, A_4=−0.11 *6*, POL=+0.55 *9* (1985Dr04). A_2=+0.36 *5*, A_4=−0.05 *5* (1984Sc25). A_2=+0.26 *5*, Iγ(prompt)/Iγ(delayed)=0.35 *6* (1984De16).
313.41 *15*	7.0 *3*	1149.04	$(15/2)^-$	835.43	$(13/2)^+$	E1		0.031	α(K)=0.0251 *4*; α(L)=0.00450 *7*; α(M)=0.001067 *15*; α(N)=0.000277 *4*; α(O)=6.08×10^{-5} *9* α(P)=9.31×10^{-6} *13*; α(Q)=4.38×10^{-7} *7* Additional information 5. A_2=−0.03 *4*, A_4=−0.06 *6*, POL=+0.30 *18* (1985Dr04). A_2=−0.11 *8*, A_4=−0.03 *10* (1984Sc25). Non-observation in ce spectrum of 1984De16 suggests E1.
318.52 *15*	19 *1*	1440.02	$(19/2)^-$	1121.51	$(17/2)^-$	M1+E2	+10 *+6−2*	0.125 *4*	α(K)=0.0654 *25*; α(L)=0.0446 *7*; α(M)=0.01171 *17*; α(N)=0.00307 *5*; α(O)=0.000650 *10* α(P)=8.97×10^{-5} *14*; α(Q)=1.56×10^{-6} *6* Additional information 9. A_2=−0.22 *4*, A_4=+0.22 *6*, POL=+0.49 *21* (1985Dr04). A_2=−0.18 *5*, A_4=+0.14 *7* (1984Sc25). K/L ratio overlaps E2 and E3 (1984De16). δ: from $\gamma(\theta)$ (1985Dr04). Dominant E2 with <10% M1 admixture from ce data in 1984De16.
335.88 *15*	19 *1*	1457.36	$(21/2)^-$	1121.51	$(17/2)^-$	E2 [e]		0.1039	α(K)=0.0550 *8*; α(L)=0.0363 *5*; α(M)=0.00952 *14*; α(N)=0.00250 *4*; α(O)=0.000529 *8* α(P)=7.31×10^{-5} *11*; α(Q)=1.309×10^{-6} *19* Additional information 10. A_2=+0.31 *4*, A_4=−0.09 *7* (1985Dr04). A_2=+0.27 *6*, A_4=−0.12 *5* (1984Sc25). Iγ(prompt)/Iγ(delayed)=0.23 *8* (1984De16).
340.25 *15*		3409.1	(41/2)	3068.9	$(39/2)^-$	D			A_2=−0.14 *7*, A_4=+0.01 *7* (1985Dr04). E_γ: from 1985Dr04. This γ ray was observed by 1984Sc25 in $\alpha\gamma$ coin, but not placed in the level scheme. I_γ: 7.6 *3* (1985Dr04) relative to 100 for 670γ.
449.11 *15*	42 *1*	1149.04	$(15/2)^-$	699.97	$(11/2)^-$	E2 [e]		0.0479	α(K)=0.0302 *5*; α(L)=0.01314 *19*; α(M)=0.00338 *5*; α(N)=0.000887 *13*; α(O)=0.000190 *3* α(P)=2.71×10^{-5} *4*; α(Q)=6.95×10^{-7} *10* Additional information 6. A_2=+0.31 *4*, A_4=−0.09 *7*, POL=+0.50 *14* (1985Dr04). POL for 451+449. A_2=+0.41 *6*, A_4=−0.05 *5* (1984Sc25). A_2=+0.30 *10*, Iγ(prompt)/Iγ(delayed)=0.46 *5* (1984De16).
451.23 *15*	57 *2*	1121.51	$(17/2)^-$	670.34	$(13/2)^-$	E2 [e]		0.0473	α(K)=0.0300 *5*; α(L)=0.01294 *19*; α(M)=0.00333 *5*; α(N)=0.000873

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^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

$\gamma(^{215}Fr)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[d]	δ	α[f]	Comments
									13; α(O)=0.000187 *3* α(P)=2.67×10^{-5} *4*; α(Q)=6.88×10^{-7} *10* Additional information 4. A_2=+0.30 *4*, A_4=−0.09 *7*, POL=+0.50 *14* (1985Dr04). POL for 451+449.
478.80 *15*	32 *2*	1149.04	(15/2)$^-$	670.34	(13/2)$^-$	M1+E2	−3.8 *+5−4*	0.050 *3*	A_2=+0.33 *6*, A_4=−0.03 *5* (1984Sc25). A_2=+0.21 *5*, Iγ(prompt)/Iγ(delayed)=0.45 *5* (1984De16). α(K)=0.0345 *24*; α(L)=0.0117 *4*; α(M)=0.00297 *8*; α(N)=0.000778 *22*; α(O)=0.000168 *5* α(P)=2.45×10^{-5} *8*; α(Q)=7.8×10^{-7} *6* Additional information 7. A_2=−0.42 *4*, A_4=+0.13 *4*, POL=+0.42 *9* (1985Dr04). A_2=−0.31 *5*, A_4=+0.11 *7* (1984Sc25). A_2=−0.21 *5*, Iγ(prompt)/Iγ(delayed)=0.36 *6* (1984De16). δ: from $\gamma(\theta)$; weighted average of −3.75 *+50−40* (1985Dr04) and −6 *+3−4* (1984De16).
519.0[bh] *3*		3419.4?		2900.4?	(35/2$^-$)				
555.48[c] *15*	42 *2*	2806.8?	(35/2)$^-$	2251.3	(33/2)$^+$	E1		0.00922 *13*	α(K)=0.00755 *11*; α(L)=0.001270 *18*; α(M)=0.000299 *5*; α(N)=7.80×10^{-5} *11* α(O)=1.724×10^{-5} *25*; α(P)=2.70×10^{-6} *4*; α(Q)=1.383×10^{-7} *20* Additional information 18. A_2=−0.25 *4*, A_4=+0.02 *6*, POL=+0.58 *16* (1985Dr04). A_2=−0.21 *5*, A_4=−0.04 *5* (1984Sc25). A_2=−0.20 *6*, Iγ(prompt)/Iγ(delayed)=0.13 *5* (1984De16).
649.09[c] *15*	6 *1*	2900.4?	(35/2$^-$)	2251.3	(33/2)$^+$	D+Q			Additional information 19. A_2=−0.11 *5*, A_4=−0.26 *6* (1985Dr04). A_2=−0.36 *11*, A_4=−0.21 *14* (1984Sc25). Mult.,δ: from $\gamma(\theta)$ data. δ(E2/M1)=−1.27 $^{18-12}$ (1985Dr04), but (E1) in 1984Sc25. Negative A_4 is inconsistent with pure E1.
670.35 *15*	98 *4*	670.34	(13/2)$^-$	0.0	9/2$^-$	E2[e]		0.0191	α(K)=0.01387 *20*; α(L)=0.00394 *6*; α(M)=0.000984 *14*; α(N)=0.000258 *4*; α(O)=5.60×10^{-5} *8* α(P)=8.34×10^{-6} *12*; α(Q)=3.06×10^{-7} *5* Additional information 1. A_2=+0.27 *4*, A_4=−0.08 *7*, POL=+0.42 *5* (1985Dr04). A_2=+0.31 *5*, A_4=−0.04 *5* (1984Sc25). A_2=+0.20 *5*, Iγ(prompt)/Iγ(delayed)=0.60 *6* (1984De16).
699.95 *15*	44 *2*	699.97	(11/2)$^-$	0.0	9/2$^-$	M1+E2	−3.8 *5*	0.0206 *10*	α(K)=0.0155 *9*; α(L)=0.00390 *13*; α(M)=0.00096 *3*; α(N)=0.000252 *8*; α(O)=5.51×10^{-5} *18* α(P)=8.3×10^{-6} *3*; α(Q)=3.41×10^{-7} *19* Additional information 2.

$^{215}_{87}Fr_{128}$-6

^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04 (continued)

$\gamma(^{215}Fr)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [d]	α [f]	Comments
								A_2=−0.34 *4*, A_4=+0.16 *6*, POL=+0.39 *6* (1985Dr04). A_2=−0.30 *4*, A_4=−0.11 *5* (1984Sc25). A_2=−0.16 *8*, Iγ(prompt)/Iγ(delayed)=0.65 *6* (1984De16). K/L ratio overlaps E2 and E3 (1984De16). δ: from $\gamma(\theta)$; weighted average of −3.75 *+55−40* (1985Dr04) and −7 *+3−13* (1984De16).
817.53 *15*	13 *1*	3068.9	(39/2)$^-$	2251.3	(33/2)$^+$	(E3)	0.0331	α(K)=0.0217 *3*; α(L)=0.00846 *12*; α(M)=0.00217 *3*; α(N)=0.000572 *8*; α(O)=0.0001238 *18* α(P)=1.83×10^{-5} *3*; α(Q)=5.92×10^{-7} *9* Additional information 21. A_2=+0.50 *6*, A_4=+0.08 *7* (1985Dr04). A_2=+0.57 *6*, A_4=+0.12 *7* (1984Sc25). K/L ratio agrees better with E3 but also not far from E2 (1984De16).

† Weighted average from 1984Sc25 and 1985Dr04. Values in 1984De16 given to nearest keV with a general uncertainty of 0.5 keV are in agreement with the adopted values here.

‡ From 1984Sc25 at E(^{11}B)=66 MeV, unless otherwise specified. Corresponding values from 1984De16 at E(^{11}B)=58 MeV, and from 1985Dr04 at E(^{11}B)=58 MeV are listed under document records. For branching ratios in Adopted dataset, all values are considered. Note that intensities in 1985Dr04 are relative to 100 for 670γ; relative to 101 for 202γ in 1964Sc25, and relative to 100 for 202γ in 1984De16.

Seen by 1984Sc25 only in $\alpha\gamma$ coin spectrum but not placed in level scheme.

@ γ from 1984Sc25 only.

& From delayed γ (1984Sc25).

a From $\gamma\gamma$ coin spectrum (1984Sc25).

b γ from 1985Dr04 only.

c The orderings of 133-107 cascade from 1813 level; 262-55 cascade from 3069 level; 194-114-649 cascade from 3207 level; and 45-210 cascade from 3462 level are not established.

d From $\gamma(\theta)$, γ(lin pol), K/L ratios, transition intensity balances, and RUL (for E2 and M2). The data are from 1984De16, 1984Sc25, and and 1985Dr04, as listed under comments.

e E2 from measured K/L ratios with comparison to theoretical values shown in figure 8 of 1984De16. Numerical K/L values are not given explicitly.

f Additional information 22.

g Multiply placed with intensity suitably divided.

h Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.

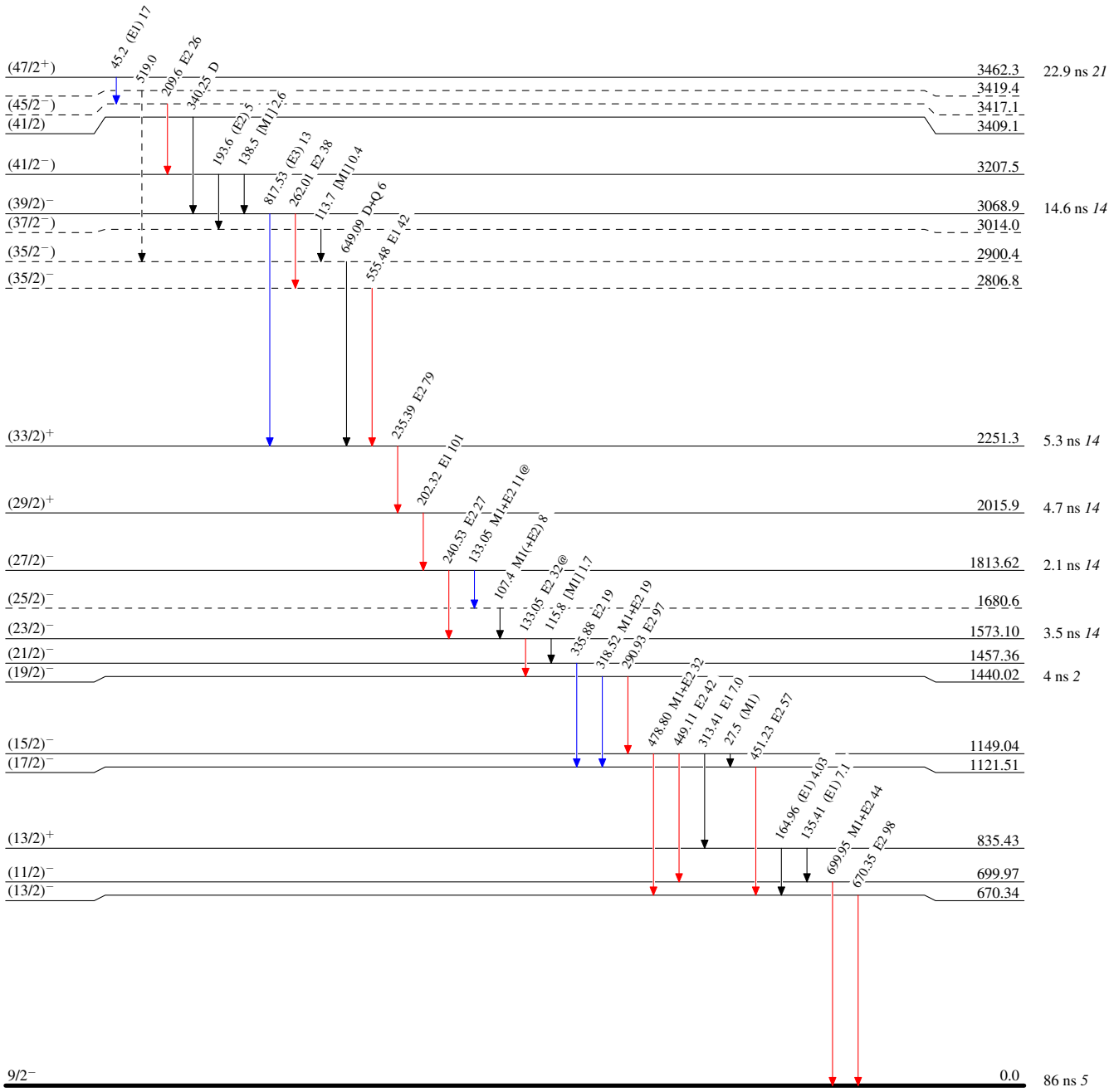
$^{215}_{87}Fr_{128}$-7

^{208}Pb(^{11}B,4nγ) 1984Sc25,1984De16,1985Dr04

Level Scheme

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



$^{215}_{87}Fr_{128}$