^{209}At ε decay 1974Ja26

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. Chen # and F. G. Kondev	NDS 126, 373 (2015)	30-Sep-2013

Parent: ^{209}At: E=0.0; J^{π}=9/2$^-$; $T_{1/2}$=5.42 h *5*; Q(ε)=3483 *5*; %ε+%β^+ decay=95.9 *5*

^{209}At-Q(ε): From 2012Wa38.

The decay scheme is that of 1974Ja26 based on extensive coincidence data.

1974Ja26: ^{209}At sources were produced by the reaction of ^{209}Bi(α,4n) with 47-51 MeV α beams on bismuth metal targets of thicknesses 30-59 mg/cm^2 at the Berkeley lab. γ-ray single spectra were measured by a 35 cm^3 coaxial Ge(Li) detector (FWHM=2.6 keV at 1332 keV), a 10 cm^3 planar Ge(Li) (FWHM=1.5 keV at 122 keV) and a 0.784 cm^2 by 5 mm Si(Li) detector (FWHM=0.8 keV at 60 keV); $\gamma\gamma$-coincidences were measured with two 35 cm^3 coaxial Ge(Li) detectors; conversion electrons were detected with the Si(Li) detector. Measured Eγ, Iγ, $\gamma\gamma$-coin, I_{ce}. Deduced levels, J^{π}, conversion coefficients, γ-multipolarities, decay branchings, log *ft*.

1973Af01: ^{209}At sources were produced from a thorium target bombarded by a 660 MeV proton beam from the synchrocyclotron of the Nuclear Problems Laboratory. γ-rays were detected with Ge(Li) detectors and conversion electrons were detected with two Si(Li) β-spectrometers. Measured Eγ, Iγ, E_{ce}, I_{ce}. Deduced levels, γ-branchings, γ-multipolarities, conversion coefficients.

1971Al31: ^{209}At source was produced from the ISOLDE facility at CERN using ^{232}Th(p,spall) reactions. γ-rays were detected by Ge(Li) detectors and β-particles were detected by a double-focusing magnetic spectrometer (up to 210 keV) and by a 2 mm thick Si(Li) detector (up to 1500 keV). Measured Eγ, Iγ, $\gamma\gamma$-coin, delayed-coin., Eβ, Iβ. Deduced levels, $T_{1/2}$,γ-branchings, γ-multipolarities, conversion coefficients.

1987Si14: ^{209}At were produced by the reaction of ^{209}Bi(^{3}He,Xn) with the ^{3}He beam from the U-200 cyclotron at JINR. γ-rays were detected by two 30 cm^3 coaxial Ge(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma(\theta)$. Deduced levels, J^{π}, mixing ratios.

2011Ma75: ^{209}At nuclei were produced from a 47.6 MeV ^{9}Be beam on a Tl_2CO_3 target and from a 46 MeV ^{7}Li beam on a $PbNO_3$ target. γ-rays were detected with a high-purity germanium detector (FWHM=2.13 keV at 1.33 MeV). Measured production yields, Eγ, Iγ.

Others: 1985BuZQ, 1983Ha51, 1969Go23.

^{209}Po Levels

E(level)†	J^{π}‡	$T_{1/2}$	Comments
0.0	1/2$^-$		
544.98 *8*	5/2$^-$	70 ps *20*	$T_{1/2}$: from (790.2γ)(545.0γ)(Δt) (1971Al31).
854.35 *15*	3/2$^-$		
1175.34 *8*	5/2$^-$		
1213.70? *10*	1/2$^-$,3/2$^-$		
1326.85 *9*	9/2$^-$		
1408.90 *9*	7/2$^-$		
1417.66 *9*	13/2$^-$	24.8 ns *14*	$T_{1/2}$: from (90.8γ-ce(L))(239.190γ)(Δt) (1971Al31).
1521.85 *9*	11/2$^-$	70 ps *20*	$T_{1/2}$: from (790.2γ)(781.9γ)(Δt) (1971Al31).
1715.69 *9*	9/2$^-$		
1761.03 *9*	13/2$^+$		
1990.99 *9*	7/2$^-$		
2312.04 *9*	9/2$^+$		
2654.38 *20*	(5/2$^+$)		
2835.67 *13*	(9/2$^+$,11/2$^-$)		
2864.50 *11*	11/2$^+$		
2902.35 *11*	11/2$^+$		
2908.46 *10*	11/2$^+$		
2978.26 *10*	11/2$^+$		
3072.66 *12*	(9/2$^+$)		
3251.63? *24*			

† From a least-squares fit to γ-ray energies.
‡ From Adopted Levels.

^{209}At ε decay 1974Ja26 (continued)

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I(ε+β^+)†‡	Comments
(231 *5*)	3251.63?		0.112 *21*	7.25 *9*	0.112 *21*	εK=0.631 *7*; εL=0.270 *5*; εM+=0.0996 *20*
(410 *5*)	3072.66		0.304 *12*	7.475 *22*	0.304 *12*	εK=0.7303 *13*; εL=0.1997 *9*; εM+=0.0700 *4*
(505 *5*)	2978.26		5.08 *13*	6.468 *16*	5.08 *13*	εK=0.7484 *8*; εL=0.1869 *6*; εM+=0.06473 *22*
(575 *5*)	2908.46		4.59 *13*	6.643 *16*	4.59 *13*	εK=0.7572 *6*; εL=0.1806 *4*; εM+=0.06217 *16*
(581 *5*)	2902.35		1.30 *5*	7.201 *20*	1.30 *5*	εK=0.7579 *6*; εL=0.1801 *4*; εM+=0.06198 *16*
(619 *5*)	2864.50		8.4 *3*	6.453 *18*	8.4 *3*	εK=0.7616 *5*; εL=0.1775 *4*; εM+=0.06090 *14*
(647 *5*)	2835.67		0.17 *3*	8.19 *8*	0.17 *3*	εK=0.7641 *5*; εL=0.1757 *3*; εM+=0.06018 *12*
(829 *5*)	2654.38		0.084 *6*	8.74 *4*	0.084 *6*	εK=0.7752 *3*; εL=0.1678 *2*; εM+=0.05697 *7*
(1171 *5*)	2312.04		70.9 *19*	6.138 *13*	70.9 *19*	εK=0.7860 *1*; εL=0.16016 *8*; εM+=0.05387 *3*
(1492 *5*)	1990.99		0.17 *7*	8.98 *18*	0.17 *7*	εK=0.7909; εL=0.15632 *5*; εM+=0.05233 *2*
(1961 *5*)	1521.85	0.05 *4*	8 *6*	7.6 *4*	8 *6*	av Eβ=442.8 *22*; εK=0.7906; εL=0.15223 *5*; εM+=0.05075 *2*

† From I(γ+ce) imbalance at each level.
‡ Absolute intensity per 100 decays.

$\gamma(^{209}Po)$

Iγ normalization: Σ (I(γ+ce) to ground state)=100% by assuming no direct feedings to the ground state.

E_γ[†]	I_γ[‡h]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[e]	δ[eg]	α[f]	Comments
90.8 *1*	2.01[@] *20*	1417.66	13/2$^-$	1326.85	9/2$^-$	E2		10.77	α(L)=7.98 *12*; α(M)=2.13 *4* α(N)=0.545 *9*; α(O)=0.1036 *16*; α(P)=0.00924 *14* I_γ: I(γ+ce)=22 *1* in 1971Al31. Mult.: from α(L12)exp/α(L3)exp=1.34 *10* (1974Ja26), α(L)exp=8.7 *11* (1973Af01), α(L2)exp/α(L3)exp=1.25 *6* (1971Al31). Additional information 8.
104.187[a] *3*	2.6[@] *4*	1521.85	11/2$^-$	1417.66	13/2$^-$	M1		9.87	α(K)=8.00 *12*; α(L)=1.429 *20*; α(M)=0.337 *5* α(N)=0.0869 *13*; α(O)=0.0182 *3*; α(P)=0.00235 *4* I_γ: 1.4 *1* from 1971Al31. 1973Af01 propose a doublet at Eγ=113 based on conversion data arguments. The evaluators feel that the data are consistent with a single transition. No doublet is reported by 1974Ja26. Mult.: from α(L1)exp=2.4 *4* from 1971Al31 A_2=+0.4 *4* (1987Si14). Additional information 9.
113.1 *1*	0.20[#] *4*	1521.85	11/2$^-$	1408.90	7/2$^-$	E2		4.29	α(K)=0.429 *6*; α(L)=2.86 *5*; α(M)=0.764 *12* α(N)=0.196 *3*; α(O)=0.0373 *6*; α(P)=0.00335 *5* E_γ: 1973Af01 report two γ-rays at E=112.6 *3* and 113.35 *30* with I(112.6γ)=0.120 *19*, I(113.35γ)=0.144 *16*. 1974Ja26 report no evidence for a doublet. Mult.: from α(K)exp=1.0 *6* (1971Al31), one gets mult=M1+E2 with δ=3.1 *4*. The uncertainty in I(ce(K)) due to the required window absorption correction is not included.
^{x}126.0 *5*	0.051[b] *16*								
^{x}149.5 *5*	0.056[b] *12*								
151.4 *2*	0.089[@] *16*	1326.85	9/2$^-$	1175.34	5/2$^-$	[E2]		1.319	α(K)=0.294 *5*; α(L)=0.761 *12*; α(M)=0.202 *3* α(N)=0.0519 *8*; α(O)=0.00992 *15*; α(P)=0.000910 *14*
^{x}161.2 *4*	0.076[b] *16*								
^{x}191.0 *2*	0.45[b] *5*								
195.0 *1*	25.8 *12*	1521.85	11/2$^-$	1326.85	9/2$^-$	M1+E2	+0.40 *+17−22*	1.51 *13*	α(K)=1.19 *13*; α(L)=0.241 *4*; α(M)=0.0577 *14* α(N)=0.0149 *4*; α(O)=0.00307 *6*; α(P)=0.000381 *11* Mult.: α(K)exp=1.17 *12*, α(L)exp=0.22 *2*, α(M)exp=0.061 *7* from 1974Ja26; α(K)exp=1.18 *10* from 1971Al31; α(K)exp=1.21 *8*, α(L)exp=0.24 *3* from 1973Af01.

^{209}At ε decay 1974Ja26 (continued)

γ(^{209}Po) (continued)

E_γ[†]	I_γ[‡h]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[e]	δ[eg]	α[f]	Comments
									A_2=+0.15 *5* (1987Si14). Additional information 10. δ: +0.090 *6* in γγ(θ) (1985BuZQ) and +0.08 *5* from γ(θ,T) (1987Si14).
233.6 *1*	1.10 *9*	1408.90	7/2⁻	1175.34	5/2⁻	M1(+E2)	−0.30 *+22−30*	0.95 *14*	α(K)=0.76 *13*; α(L)=0.142 *5*; α(M)=0.0337 *7* α(N)=0.00867 *19*; α(O)=0.00180 *6*; α(P)=0.000229 *17* Mult.: α(K)exp=0.76 *5*, α(L)exp=0.136 *10*, α(M)exp=0.028 *10* (tentative) from 1974Ja26; α(K)exp=0.75 *10* from 1971Al31; α(K)exp=0.79 *12*, α(L)exp=0.17 *3* from 1973Af01. A_2=+0.5 *4* (1987Si14). Additional information 6. δ: −0.1 *5* from γ(θ,T) (1987Si14).
239.190[a] *18*	13.8 *5*	1761.03	13/2⁺	1521.85	11/2⁻	E1		0.0533	α(K)=0.0432 *6*; α(L)=0.00769 *11*; α(M)=0.00181 *3* α(N)=0.000462 *7*; α(O)=9.40×10^{-5} *14*; α(P)=1.119×10^{-5} *16* Mult.: α(K)exp=0.037 *4*, α(L)exp=0.005 *1* from 1974Ja26; α(K)exp=0.038 *3* from 1971Al31; α(K)exp=0.041 *7*, α(L)exp=0.0069 *15* from 1973Af01 A_2=+0.28 *8* (1987Si14). Additional information 12. δ: 0.00 *4* from γ(θ,T) (1987Si14).
[x]242.2 *4*	0.24[b] *4*								
321.1 *1*	0.69 *3*	2312.04	9/2⁺	1990.99	7/2⁻	E1		0.0268	α(K)=0.0219 *3*; α(L)=0.00377 *6*; α(M)=0.000885 *13* α(N)=0.000226 *4*; α(O)=4.63×10^{-5} *7*; α(P)=5.62×10^{-6} *8* Mult.: α(K)exp=0.026 *15* (tentative) from 1974Ja26; α(K)exp≈0.027 from 1973Af01.
[x]342.87[a] *8*	0.57 *3*								I_γ: from 1974Ja26. 1973Af01 report a doublet with energies 342.2 *4* and 343.3 *4*, with Iγ=0.45 *7* and 0.29 *5*, respectively. 1974Ja26 report no evidence for a doublet, and do not confirm the placements of 1973Af01. Mult.: from α(K)exp=0.11 *1* (1974Ja26) and α(K)exp=0.087 *22* (1973Af01) using the BrIccMixing program, one obtains mult=E1+M2 with δ=0.33 *2*, or mult=M1+E2 with δ=1.8 *2*.
[x]379.9 *7*	0.18[b] *5*								Mult.: from α(K)exp=0.20 *5* (1973Af01), one obtains mult=E1+M2 with δ=0.64 *12*, or mult=M1(+E2) with δ=0.3 *+5−3*.
388.8 *1*	0.54 *3*	1715.69	9/2⁻	1326.85	9/2⁻	M1(+E2)	≤0.6	0.22 *3*	α(K)=0.182 *22*; α(L)=0.0329 *25*; α(M)=0.0078 *6* α(N)=0.00201 *14*; α(O)=0.00042 *3*; α(P)=5.3×10^{-5} *5* Mult.: α(K)exp=0.19 *2* from 1974Ja26; α(K)exp=0.20 *9* from 1971Al31; α(K)exp=0.19 *4*, α(L)exp=0.028 *7* from 1973Af01.

$^{209}_{84}Po_{125}$-4

$\gamma(^{209}$Po) (continued)

E_γ [†]	I_γ [‡h]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [e]	δ [eg]	α [f]	Comments
415.8 *6*	0.06[&] *2*	3251.63?		2835.67	$(9/2^+,11/2^-)$				
[x]433.8 *3*	0.08[&] *2*								
[x]447.6 *1*	0.29 *2*					M1+E2	0.5 *3*	0.145 *25*	α(K)=0.117 *22*; α(L)=0.021 *3*; α(M)=0.0051 *6* α(N)=0.00131 *15*; α(O)=0.00027 *4*; α(P)=3.5×10^{-5} *5* E_γ: Placed by 1973Af01 from an 1865 level. This level is not confirmed by 1974Ja26. Mult.,δ: α(K)exp=0.13 *2* from 1974Ja26; α(K)exp=0.10 *3* from 1973Af01.
[x]515.1 *3*	0.05[&] *2*								
[x]523.0 *3*	0.04[&] *2*					(M2)		0.320	α(K)=0.249 *4*; α(L)=0.0540 *8*; α(M)=0.01313 *19* α(N)=0.00340 *5*; α(O)=0.000708 *10*; α(P)=9.00×10^{-5} *13* Mult.: α(K)exp=0.32 *8* (tentative) from 1974Ja26.
545.0 *1*	100	544.98	$5/2^-$	0.0	$1/2^-$	E2		0.0262	α(K)=0.0186 *3*; α(L)=0.00575 *8*; α(M)=0.001437 *21* α(N)=0.000369 *6*; α(O)=7.40×10^{-5} *11*; α(P)=8.25×10^{-6} *12* Mult.: α(K)exp=0.019 from 1971Al31; α(K)exp=0.0178 *11*, α(L)exp=0.0054 *5* from 1973Af01 A_2=−0.50 *7* (1987Si14). Additional information 1.
551.0 *1*	5.4 *2*	2312.04	$9/2^+$	1761.03	$13/2^+$	(E2)		0.0256	α(K)=0.0182 *3*; α(L)=0.00557 *8*; α(M)=0.001390 *20* α(N)=0.000357 *5*; α(O)=7.16×10^{-5} *10*; α(P)=7.99×10^{-6} *12* Mult.: α(K)exp=0.0183 from 1974Ja26; α(K)exp=0.018 (tentative) from 1971Al31; α(K)exp=0.024 *4* from 1973Af01. K-conversion electrons of 551.0γ and 552.5γ are not resolved. 1974Ja26 and 1971Al31 assume mult(551γ)=E2. Additional information 13.
552.5 *2*	1.7 *2*	2864.50	$11/2^+$	2312.04	$9/2^+$	M1(+E2)	<0.4	0.093 *6*	α(K)=0.076 *5*; α(L)=0.0132 *6*; α(M)=0.00310 *14* α(N)=0.00080 *4*; α(O)=0.000167 *8*; α(P)=2.15×10^{-5} *11* Mult.: K-conversion electrons of 551.0γ and 552.5γ are not resolved. 1974Ja26 and 1971Al31 assume mult=E2 for the 551γ, as required by the decay scheme, and deduce α(K)(552γ)=0.086 *10* and 0.070 *25*, respectively, giving mult(552γ)=M1(+E2). Additional information 17.
554.6 *2*	0.63 *10*	1408.90	$7/2^-$	854.35	$3/2^-$	E2		0.0252	α(K)=0.0179 *3*; α(L)=0.00546 *8*; α(M)=0.001362 *20* α(N)=0.000350 *5*; α(O)=7.02×10^{-5} *10*; α(P)=7.85×10^{-6} *11* Mult.: α(K)exp≈0.022 from 1973Af01.
596.2[i] *1*	≤0.76[id]	2312.04	$9/2^+$	1715.69	$9/2^-$	(E1+M2)		0.0093 *21*	α(K)=0.0076 *17*; α(L)=0.0013 *4*; α(M)=0.00031 *9* α(N)=7.9×10^{-5} *22*; α(O)=1.6×10^{-5} *5*; α(P)=2.1×10^{-6} *6* Mult.: α(K)exp=0.031 *5* from 1974Ja26 and α(K)exp=0.018 *5* from 1973Af01 for the 596.2γ doublet.
596.2[i] *1*	≤0.76[id]	2908.46	$11/2^+$	2312.04	$9/2^+$	(M1+E2)		0.0800	α(K)=0.0653 *10*; α(L)=0.01121 *16*; α(M)=0.00264 *4* α(N)=0.000678 *10*; α(O)=0.0001421 *20*; α(P)=1.84×10^{-5} *3*

$^{209}_{84}Po_{125}$-5

γ(^{209}Po) (continued)

E_γ[†]	I_γ[‡h]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[e]	δ[eg]	α[f]	Comments
									Mult.: α(K)exp=0.031 *5* from 1974Ja26 and α(K)exp=0.018 *5* from 1973Af01 for the 596.2γ doublet.
630.3 *1*	0.75 *3*	1175.34	5/2$^-$	544.98	5/2$^-$	M1		0.0691	α(K)=0.0564 *8*; α(L)=0.00967 *14*; α(M)=0.00227 *4* α(N)=0.000585 *9*; α(O)=0.0001225 *18*; α(P)=1.587$\times10^{-5}$ *23* Mult.: α(L)exp=0.014 *4* from 1974Ja26; α(K)exp≈0.08, α(L)exp=0.016 *5* from 1973Af01. Additional information 3.
666.1 *1*	2.05 *7*	2978.26	11/2$^+$	2312.04	9/2$^+$	E2(+M1)	>+3.6	0.0183 *16*	α(K)=0.0138 *14*; α(L)=0.00343 *19*; α(M)=0.00084 *5* α(N)=0.000216 *12*; α(O)=4.38$\times10^{-5}$ *24*; α(P)=5.1$\times10^{-6}$ *4* Mult.: α(K)exp=0.013 *2*, α(L)exp=0.0030 *8* from 1974Ja26; α(K)exp=0.0140 *14* from 1973Af01 A_2=−0.54 *26* (1987Si14). Additional information 22. δ: sign from $\gamma(\theta$,T) (δ=+4.7 *+390−18*) (1987Si14).
^{x}719.6 *3*	0.08[&] *1*					(M2)		0.1254	α(K)=0.0990 *14*; α(L)=0.0200 *3*; α(M)=0.00482 *7* α(N)=0.001246 *18*; α(O)=0.000260 *4*; α(P)=3.32$\times10^{-5}$ *5* Mult.: α(K)exp=0.13 *4* (tentative) from 1974Ja26.
^{x}750.9 *2*	0.07[&] *1*								
781.9 *1*	91.6 *26*	1326.85	9/2$^-$	544.98	5/2$^-$	E2		0.01200	α(K)=0.00918 *13*; α(L)=0.00213 *3*; α(M)=0.000519 *8* α(N)=0.0001333 *19*; α(O)=2.71$\times10^{-5}$ *4*; α(P)=3.21$\times10^{-6}$ *5* Mult.: α(K)exp=0.0091 *7*, α(L)exp=0.0019 *2* from 1974Ja26; α(K)exp=0.0100 *8* from 1971Al31; α(K)exp=0.0089 *8*, α(L)exp=0.00184 *21* from 1973Af01 A_2=−0.433 (1987Si14). Additional information 5.
790.2 *1*	69.8 *20*	2312.04	9/2$^+$	1521.85	11/2$^-$	E1(+M2)	−0.02 *+4−3*	0.00422 *21*	α(K)=0.04 *4*; α(L)=0.008 *8*; α(M)=0.0019 *18* α(N)=0.0005 *5*; α(O)=0.00010 *10*; α(P)=1.3$\times10^{-5}$ *12* Mult.: α(K)exp=0.0033 *3*, α(L)exp=0.00050 *7* from 1974Ja26; α(K)exp=0.0040 *4* from 1971Al31; α(K)exp=0.0034 *3*, α(L)exp=0.00056 *14* from 1973Af01 A_2=+0.13 *4* (1987Si14). Additional information 14. δ: from $\gamma(\theta$,T) (1987Si14).
^{x}799.1 *2*	0.11[&] *2*								
^{x}807.4[j] *2*	0.2[c] *1*								
^{x}809.8 *3*	0.036[&] *8*								
815.6 *1*	0.29 *6*	1990.99	7/2$^-$	1175.34	5/2$^-$	M1+E2	0.6 *4*	0.029 *6*	α(K)=0.023 *5*; α(L)=0.0041 *7*; α(M)=0.00097 *17* α(N)=0.00025 *5*; α(O)=5.2$\times10^{-5}$ *9*; α(P)=6.7$\times10^{-6}$ *13* Mult.: α(K)exp=0.029 *8* (tentative) from 1974Ja26; α(K)exp=0.022 *5* from 1973Af01.

$^{209}_{84}$Po$_{125}$-6

^{209}At ε decay 1974Ja26 (continued)

$\gamma(^{209}$Po) (continued)

E_γ[†]	I_γ[‡h]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[e]	δ[eg]	α[f]	Comments
[x]817.6 *2*	0.18 *4*					(M1+E2)	<0.5	0.0326 *25*	α(K)=0.0266 *21*; α(L)=0.0046 *3*; α(M)=0.00108 *7* α(N)=0.000277 *18*; α(O)=5.8×10^{-5} *4*; α(P)=7.5×10^{-6} *6* Mult.,δ: α(K)exp=0.016 *8* (tentative) from 1974Ja26.
[x]826.8 *3*	0.05[&] *1*								
854.4 *2*	0.71 *6*	854.35	3/2$^-$	0.0	1/2$^-$	M1		0.0313	α(K)=0.0256 *4*; α(L)=0.00434 *6*; α(M)=0.001020 *15* α(N)=0.000262 *4*; α(O)=5.49×10^{-5} *8*; α(P)=7.12×10^{-6} *10* Mult.: α(K)exp=0.026 *5* from 1974Ja26, α(L)exp≈0.0034 from 1973Af01, A_2=+0.5 *7* (1987Si14). Additional information 2.
863.9 *1*	2.26 *10*	1408.90	7/2$^-$	544.98	5/2$^-$	M1(+E2)	−0.4 *+3−4*	0.028 *6*	α(K)=0.022 *5*; α(L)=0.0039 *7*; α(M)=0.00091 *15* α(N)=0.00023 *4*; α(O)=4.9×10^{-5} *9*; α(P)=6.3×10^{-6} *11* Mult.: α(K)exp=0.027 *5*, α(L)exp=0.0028 *8* from 1973Af01 A_2=+0.92 *22* (1987Si14). Additional information 7. δ: from $\gamma(\theta$,T) (1987Si14). α(K)exp of 1973Af01 is consistent with pure M1; however, the ce(K) line is not fully resolved from ce(L)(790γ).
[x]895.0[j] *2*	0.21[c] *5*								
903.0 *1*	4.04 *12*	2312.04	9/2$^+$	1408.90	7/2$^-$	E1(+M2)	+0.10 *+6−16*	0.0039 *10*	α(K)=0.0033 *7*; α(L)=0.00055 *13*; α(M)=0.00013 *3* α(N)=3.3×10^{-5} *8*; α(O)=6.8×10^{-6} *16*; α(P)=8.7×10^{-7} *21* Mult.: α(K)exp=0.0033 *4* from 1974Ja26;0.0025 *13* from 1971Al31; α(K)exp=0.0028 *3* from 1973Af01 A_2=+0.18 *13* (1987Si14). Additional information 15. δ: from $\gamma(\theta$,T) (1987Si14).
[x]910.7 *5*	0.077[&] *11*								
[x]922.2 *2*	0.078[#] *10*								
939.5 *3*	0.05[&] *1*	3251.63?		2312.04	9/2$^+$				
985.2 *1*	0.94[@] *10*	2312.04	9/2$^+$	1326.85	9/2$^-$	E1		0.00279	α(K)=0.00232 *4*; α(L)=0.000361 *5*; α(M)=8.37×10^{-5} *12* α(N)=2.14×10^{-5} *3*; α(O)=4.46×10^{-6} *7*; α(P)=5.69×10^{-7} *8* Mult.: α(K)exp=0.003 *1* from 1973Af01, α(K)exp<0.003 from 1971Al31. Additional information 16.
[x]999.6 *2*	0.17[&] *1*								
[x]1008.4 *4*	0.038[&] *9*								
[x]1037.8 *4*	0.030[&] *6*								
[x]1043.45 *20*	0.12[b] *2*								

$^{209}_{84}Po_{125}$-7

γ(^{209}Po) (continued)

E_γ[†]	I_γ[‡h]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[e]	δ[eg]	α[f]	Comments
1074.6 *1*	0.22 *2*	2835.67	(9/2$^+$,11/2$^-$)	1761.03	13/2$^+$				
^{x}1084.0 *4*	0.037[&] *5*								
^{x}1092.8 *4*	0.049[&] *7*								
^{x}1096.0 *2*	0.15[c] *3*								
1103.4 *1*	5.93 *20*	2864.50	11/2$^+$	1761.03	13/2$^+$	M1+E2	1.6 *+8−5*	0.0089 *18*	α(K)=0.0072 *15*; α(L)=0.00130 *23*; α(M)=0.00031 *6* α(N)=7.9×10^{-5} *14*; α(O)=1.6×10^{-5} *3*; α(P)=2.1×10^{-6} *4*; α(IPF)=2.0×10^{-7} *3* Mult.: α(K)exp=0.0090 *9*, α(L)exp=0.0016 *4* from 1974Ja26; α(K)exp=0.0085 *17* from 1971Al31; α(K)exp=0.0059 *10*, α(L)exp=0.00081 *21* from 1973Af01 A_2=+0.83 *12* (1987Si14). Additional information 18. δ: 2.2 *6* from γ(θ,T) (1987Si14).
^{x}1112.9 *6*	0.022[&] *6*								
1136.5 *3*	0.075[&] *10*	2312.04	9/2$^+$	1175.34	5/2$^-$	(M2)		0.0356	α(K)=0.0286 *4*; α(L)=0.00534 *8*; α(M)=0.001273 *18* α(N)=0.000328 *5*; α(O)=6.86×10^{-5} *10*; α(P)=8.83×10^{-6} *13*; α(IPF)=2.24×10^{-7} *4* Mult.: α(K)exp=0.037 *12* (tentative) from 1974Ja26.
1141.3 *1*	0.36 *2*	2902.35	11/2$^+$	1761.03	13/2$^+$	M1+E2	1.2 *+7−4*	0.0094 *19*	α(K)=0.0077 *16*; α(L)=0.00135 *24*; α(M)=0.00032 *6* α(N)=8.2×10^{-5} *14*; α(O)=1.7×10^{-5} *3*; α(P)=2.2×10^{-6} *4*; α(IPF)=9.8×10^{-7} *14* Mult.: α(K)exp=0.019 *6* from 1974Ja26; α(K)exp=0.0069 *15* from 1973Af01.
1147.6 *1*	1.50 *10*	2908.46	11/2$^+$	1761.03	13/2$^+$	E2(+M1)		0.01459	α(K)=0.01195 *17*; α(L)=0.00201 *3*; α(M)=0.000472 *7* α(N)=0.0001215 *17*; α(O)=2.55×10^{-5} *4*; α(P)=3.30×10^{-6} *5*; α(IPF)=1.720×10^{-6} *25* Mult.: α(K)exp=0.005 *1* (tentative) from 1974Ja26; α(K)exp=0.005 *3* from 1971Al31; α(K)exp=0.0038 *7* from 1973Af01. K-conversion electrons of 1147.6γ and 1148.8γ are not resolved. 1974Ja26 assumed mult(1148.8γ)=E1, divided the I(ceK) intensity accordingly, and deduced α(K)(1147.6γ). Additional information 20. I_γ: from 1974Ja26. 2.4 *1* from 1971Al31 and 2.4 *2* from 1973Af01 are for the doublet.
1148.8 *3*	0.86[&] *10*	2864.50	11/2$^+$	1715.69	9/2$^-$	[E1]		0.00213	α(K)=0.001769 *25*; α(L)=0.000272 *4*; α(M)=6.32×10^{-5} *9* α(N)=1.619×10^{-5} *23*; α(O)=3.37×10^{-6} *5*; α(P)=4.32×10^{-7} *6*; α(IPF)=4.04×10^{-6} *7* Mult.: α(K)exp=0.0018 (tentative) from 1974Ja26, K-conversion electrons of 1147.6γ and 1148.8γ are not resolved. 1974Ja26 assumed mult(1148.8γ)=E1 and divided the I(ceK) intensity accordingly.

$^{209}_{84}$Po$_{125}$-8

γ(^{209}Po) (continued)

E_γ [†]	I_γ [‡h]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [e]	δ [eg]	α [f]	Comments
1170.6 *1*	3.3 *1*	1715.69	9/2$^-$	544.98	5/2$^-$	E2		0.00544	α(K)=0.00435 *6*; α(L)=0.000828 *12*; α(M)=0.000197 *3* α(N)=5.07×10^{-5} *7*; α(O)=1.046×10^{-5} *15*; α(P)=1.294×10^{-6} *19*; α(IPF)=1.77×10^{-6} *3* Mult.: α(K)exp=0.0046 *6*, α(L)exp=0.00094 *32* from 1974Ja26; α(K)exp=0.0030 *15* from 1971Al31; α(K)exp=0.0036 *8*, α(L)exp=0.00067 *17* from 1973Af01. Additional information 11.
1175.3 *1*	2.1 *1*	1175.34	5/2$^-$	0.0	1/2$^-$	E2		0.00540	α(K)=0.00432 *6*; α(L)=0.000821 *12*; α(M)=0.000196 *3* α(N)=5.02×10^{-5} *7*; α(O)=1.037×10^{-5} *15*; α(P)=1.283×10^{-6} *18*; α(IPF)=2.02×10^{-6} *3* Mult.: α(K)exp=0.0049 *8* from 1974Ja26; α(K)exp=0.005 *3* from 1971Al31; α(K)exp=0.0047 *10*, α(L)exp=0.00067 *17* from 1973Af01; A_2=−0.314 *1*, A_4=−0.285 *16* from 1983Ha51.
^{x}1183.1 *2*	0.15 [#] *2*								
1192.8 *2*	0.18 *2*	2908.46	11/2$^+$	1715.69	9/2$^-$	[E1]		0.00200	α(K)=0.001657 *24*; α(L)=0.000255 *4*; α(M)=5.90×10^{-5} *9* α(N)=1.513×10^{-5} *22*; α(O)=3.15×10^{-6} *5*; α(P)=4.05×10^{-7} *6*; α(IPF)=1.264×10^{-5} *19*
^{x}1202.3 *4*	0.022 [&] *6*								
^{x}1210.2 *4*	0.047 [&] *10*								
1213.7 [j] *11*	0.48 *4*	1213.70?	1/2$^-$,3/2$^-$	0.0	1/2$^-$				Mult.: α(K)exp=0.0068 *20* (tentative) from 1974Ja26, α(K)exp≈0.0094 from 1973Af01. Additional information 4.
1217.2 *1*	1.22 *8*	2978.26	11/2$^+$	1761.03	13/2$^+$	M1+E2	1.0 +*12*−*6*	0.009 *3*	α(K)=0.0072 *23*; α(L)=0.0012 *4*; α(M)=0.00029 *9* α(N)=7.5×10^{-5} *21*; α(O)=1.6×10^{-5} *5*; α(P)=2.0×10^{-6} *6*; α(IPF)=7.6×10^{-6} *18* Mult.: α(K)exp=0.0071 *20* (tentative) from 1974Ja26, α(K)exp≈0.0036 from 1973Af01, A_2=+0.6 *3* (1987Si14). Additional information 23.
^{x}1243.9 *2*	0.18 *2*								
1262.6 *1*	2.07 *8*	2978.26	11/2$^+$	1715.69	9/2$^-$	E1(+M2)	+0.09 +*12*−*27*	0.0020 *9*	α(K)=0.0019 *5*; α(L)=0.00031 *8*; α(M)=7.2×10^{-5} *19* α(N)=1.9×10^{-5} *5*; α(O)=3.9×10^{-6} *11*; α(P)=5.0×10^{-7} *14*; α(IPF)=3.52×10^{-5} *9* Mult.: α(K)exp=0.0018 *4* from 1974Ja26; α(K)exp=0.00102 *22* from 1973Af01 A_2=+0.2 *2* (1987Si14). Additional information 24. δ: from γ(θ,T) (1987Si14).
^{x}1272.9 *2*	0.24 *2*								

$^{209}_{84}Po_{125}$-9

γ(^{209}Po) (continued)

E_γ [†]	I_γ [‡h]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [e]	δ [eg]	α [f]	Comments
[x]1295.8 4	0.026[&] 6								
[x]1299.0 4	0.022[&] 6								
1311.7 2	0.060 6	3072.66	(9/2$^+$)	1761.03	13/2$^+$				
[x]1333.4 3	0.15[c] 6								
[x]1342.9 3	0.071[&] 6								
1356.9 1	0.18 1	3072.66	(9/2$^+$)	1715.69	9/2$^-$				
[x]1361.7 6	0.009[&] 4								
[x]1409.0 6	0.019[&] 8								
[x]1411.1 4	0.058[&] 8								
[x]1419.4 4	0.042[&] 9								
[x]1421.5 5	0.023[&] 8								
1427.0 3	0.031[&] 6	2835.67	(9/2$^+$,11/2$^-$)	1408.90	7/2$^-$				
1446.1 1	0.59 2	1990.99	7/2$^-$	544.98	5/2$^-$	M1+E2	1.2 +8−4	0.0055 10	α(K)=0.0045 8; α(L)=0.00077 13; α(M)=0.00018 3 α(N)=4.6×10^{-5} 8; α(O)=9.7×10^{-6} 16; α(P)=1.24×10^{-6} 21; α(IPF)=6.3×10^{-5} 9 Mult.: α(K)exp=0.0044 10 (tentative) from 1974Ja26; α(K)exp=0.0044 10 from 1973Af01.
1456.6 2	0.13 1	2978.26	11/2$^+$	1521.85	11/2$^-$				
1478.9 3	0.044[&] 4	2654.38	(5/2$^+$)	1175.34	5/2$^-$				
1484.7 2	0.10 1	2902.35	11/2$^+$	1417.66	13/2$^-$	[E1]		1.52×10^{-3}	α(K)=0.001140 16; α(L)=0.0001735 25; α(M)=4.02×10^{-5} 6 α(N)=1.029×10^{-5} 15; α(O)=2.15×10^{-6} 3; α(P)=2.77×10^{-7} 4; α(IPF)=0.0001566 22
1490.8 1	0.30 2	2908.46	11/2$^+$	1417.66	13/2$^-$	[E1]		1.52×10^{-3}	α(K)=0.001133 16; α(L)=0.0001723 25; α(M)=3.99×10^{-5} 6 α(N)=1.022×10^{-5} 15; α(O)=2.13×10^{-6} 3; α(P)=2.75×10^{-7} 4; α(IPF)=0.0001606 23
[x]1510 1	0.06[b] 2								
[x]1529.4 5	0.016[&] 5								
[x]1533.1 2	0.18 2								
1537.7 1	0.53 4	2864.50	11/2$^+$	1326.85	9/2$^-$				
1575.5 1	0.96 5	2902.35	11/2$^+$	1326.85	9/2$^-$	E1		1.46×10^{-3}	α(K)=0.001033 15; α(L)=0.0001567 22; α(M)=3.63×10^{-5} 5 α(N)=9.29×10^{-6} 13; α(O)=1.94×10^{-6} 3; α(P)=2.50×10^{-7} 4; α(IPF)=0.000218 3 Mult.: α(K)exp≈0.00116 from 1973Af01 A_2=+0.4 4 (1987Si14). Additional information 19.
1581.6 1	1.98 7	2908.46	11/2$^+$	1326.85	9/2$^-$	E1		1.45×10^{-3}	α(K)=0.001026 15; α(L)=0.0001557 22;

$^{209}_{84}$Po$_{125}$-10

γ(^{209}Po) (continued)

E_γ [†]	I_γ [‡h]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [e]	α [f]	Comments
								α(M)=3.60×10^{-5} *5* α(N)=9.23×10^{-6} *13*; α(O)=1.93×10^{-6} *3*; α(P)=2.49×10^{-7} *4*; α(IPF)=0.000223 *4* Mult.: α(K)exp=0.00087 *40* (tentative) from 1974Ja26, α(K)exp≈0.00076 from 1973Af01, A_2=+0.36 *20* (1987Si14). Additional information 21. δ: 0.0 *2* from γ(θ,T) (1987Si14).
[x]1622.4 *1*	0.19 *1*							
1651.3 *3*	0.045[@] *4*	2978.26	11/2$^+$	1326.85	9/2$^-$			
[x]1687.3 *1*	0.41 *2*					(E2)	0.00289	α(K)=0.00225 *4*; α(L)=0.000387 *6*; α(M)=9.11×10^{-5} *13* α(N)=2.34×10^{-5} *4*; α(O)=4.86×10^{-6} *7*; α(P)=6.17×10^{-7} *9*; α(IPF)=0.0001283 *18* α(K)exp≈0.00167 from 1973Af01.
[x]1706.1 *7*	0.006[&] *3*							
1730.0 *4*	0.013[&] *2*	3251.63?		1521.85	11/2$^-$			
1745.9 *2*	0.091 *5*	3072.66	(9/2$^+$)	1326.85	9/2$^-$			
1767.0 *1*	0.56 *3*	2312.04	9/2$^+$	544.98	5/2$^-$	M2	0.01151	α(K)=0.00925 *13*; α(L)=0.001634 *23*; α(M)=0.000386 *6* α(N)=9.95×10^{-5} *14*; α(O)=2.08×10^{-5} *3*; α(P)=2.69×10^{-6} *4*; α(IPF)=0.0001172 *17* Mult.: α(K)exp=0.0096 *20* from 1974Ja26, α(K)exp≈0.0045 from 1973Af01.
[x]1786.5 *1*	0.13 *1*							
[x]1804.1 *1*	0.062 *6*							
[x]1810.0 *2*	0.047[@] *5*							
[x]1861.4 *5*	0.008[&] *2*							
[x]1947.7 *4*	0.015[&] *2*							
[x]2102.0 *4*	0.008[&] *3*							
[x]2105 *1*	0.04[c] *1*							
2109.5 *3*	0.045[@] *4*	2654.38	(5/2$^+$)	544.98	5/2$^-$			E_γ: from 1974Ja26. 1973Af01 report 2108.2 *6*, 1971Al31 report 2111 *1*.
[x]2204 *1*	0.04[c] *1*							
[x]2245.8 *6*	0.007[&] *1*							
[x]2292.3 *5*	0.020[@] *7*							
2319.6 *4*	0.008[&] *2*	2864.50	11/2$^+$	544.98	5/2$^-$			
[x]2342.9 *4*	0.021[&] *5*							
2357.7 *6*	0.006[&] *2*	2902.35	11/2$^+$	544.98	5/2$^-$			
2363.7 *4*	0.015[&] *2*	2908.46	11/2$^+$	544.98	5/2$^-$			
[x]2368.3 *4*	0.012[&] *2*							
2433.44 *20*	0.015[&] *2*	2978.26	11/2$^+$	544.98	5/2$^-$			
[x]2448 *1*	0.02[c] *1*							
2528.1 *6*	0.003[&] *1*	3072.66	(9/2$^+$)	544.98	5/2$^-$			

γ(^{209}Po) (continued)

E_γ [†]	I_γ [‡h]	E_i(level)	J^π_i	E_f	J^π_f
[x]2555.4 *4*	0.002[&] *1*				
[x]2588.9 *4*	0.021[&] *3*				
[x]2645.6 *3*	0.012[@] *3*				
2654.4 *4*	0.003[&] *1*	2654.38	(5/2$^+$)	0.0	1/2$^-$

[†] Weighted average of values from 1974Ja26, 1973Af01, 1972Ch09, 1971Al31.

[‡] Weighted average of values from 1974Ja26, 1973Af01 and 1971Al31, unless otherwise noted. Normalized to I(545γ)=100. Others:1972Ch09,

[#] Weighted average of values from 1974Ja26 and 1971Al31.

[@] Weighted average of values from 1974Ja26 and 1973Af01.

[&] Reported only by 1974Ja26.

[a] From 1974Ja26.

[b] Reported only by 1973Af01.

[c] Reported only by 1971Al31. Not seen by 1974Ja26.

[d] 1974Ja26 report Eγ=596.4 with Iγ=0.72 *4* doubly placed from the from the 2312 and 2908 levels. α(K) for the doublet is consistent with mult=E1+M2 with $\delta\approx$0.33 or mult=M1+E2 with $\delta\approx$1.5. From $\gamma\gamma$, the authors favor placement from the 2312 level, requiring $\Delta\pi$=yes; however, the M2 component is rather large.

[e] From Adopted Gammas, unless otherwise noted. Conversion coefficients are obtained in 1974Ja26, 1973Af01 and 1971Al31, based on relative I(γ) and I(ce(K)) data normalized to α(K)(545γ)=0.0187 (E2); other: 1972Ch09. Mixing ratios obtained in 1987Si14 are from $\gamma(\theta$,T) measured with a low-temperature, polarized source.

[f] Additional information 25.

[g] Additional information 26.

[h] For absolute intensity per 100 decays, multiply by 0.909 *5*.

[i] Multiply placed with undivided intensity.

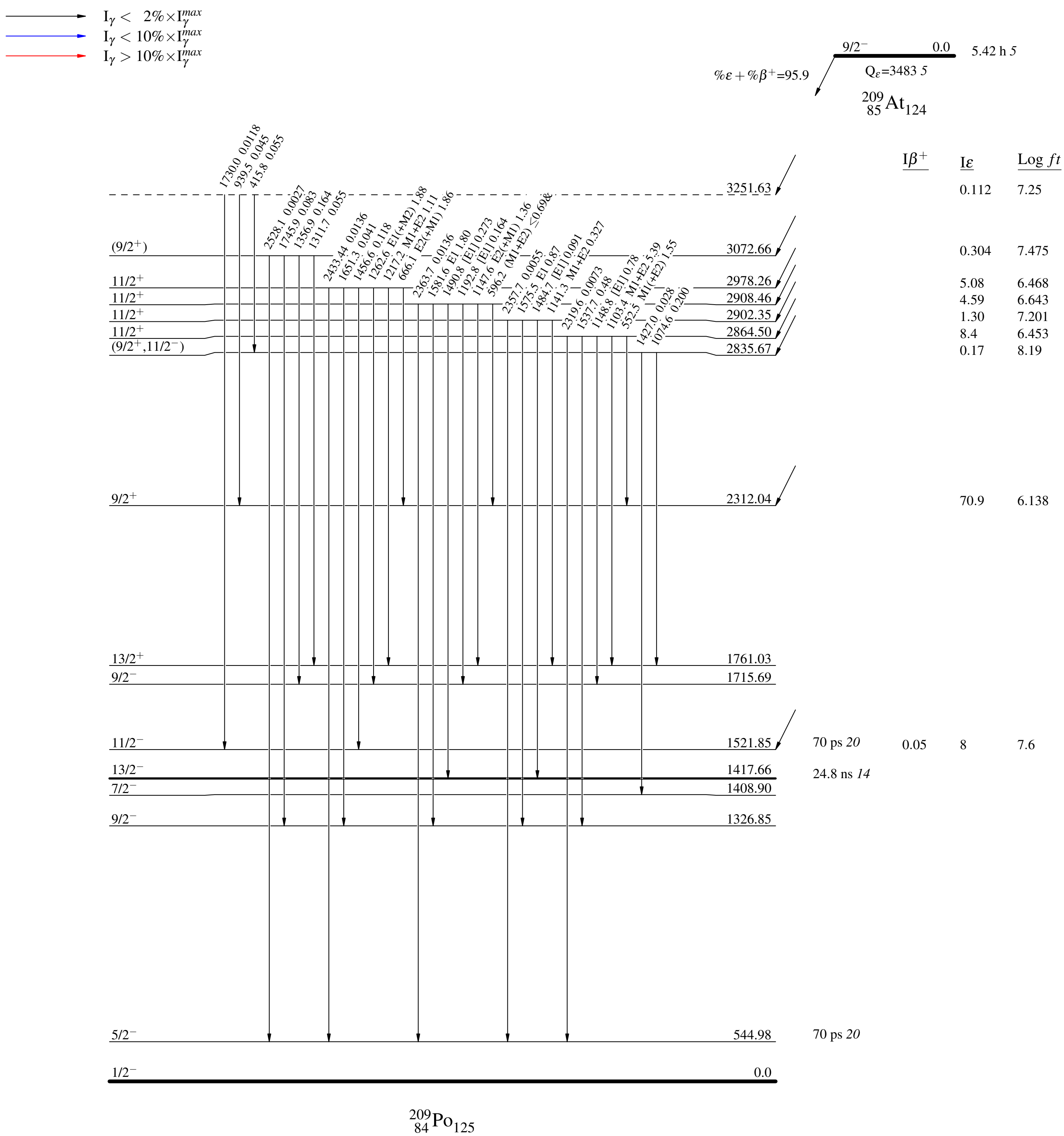
[j] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

^{209}At ε decay 1974Ja26

Decay Scheme

Intensities: I_γ per 100 parent decays
& Multiply placed: undivided intensity given



^{209}At ε decay 1974Ja26

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays
& Multiply placed: undivided intensity given