^{231}Ra β^- decay (103.9 s) 2008Bo29

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jagdish K. Tuli, and Edgardo Browne	NDS 185, 560 (2022)	31-Aug-2022

Parent: ^{231}Ra: E=0.0; J$^\pi$=(5/2$^+$); $T_{1/2}$=103.9 s *14*; Q(β^-)=2454 *17*; %β^- decay=100.0

^{231}Ra-J$^\pi$,$T_{1/2}$: From ^{231}Ra Adopted Levels. Level is interpreted as ν5/2[622] (2001Fr05).

^{231}Ra-Q(β^-): From 2021Wa16.

2008Bo29 (also 2007Bo48, 2006Bo33): ^{231}Ra source was produced in spallation reaction: A=231 isobars from bombardment of a UC_2-C target with a 1 GeV proton beam from CERN PS-Booster. The source of ^{231}Ra was also obtained from the decay of ^{231}Fr, which was produced in the proton-induced fission of uranium, and the ions were accelerated to 60 keV then recorded on a magnetic tape after mass separation. Measured Eγ, Iγ, ce, $\gamma\gamma$-, (ce)γ- and $\beta\gamma$-coin, level half-lives by $\beta\gamma\gamma$(t) fast timing technique, and half-life of ^{231}Ra decay. Conversion electrons were detected using a mini-orange spectrometer.

Note: compilers of the XUNDL dataset found some differences in values given in Table 1 and corresponding ones in Fig. 5 of 2008Bo29. According to e-mail reply of Nov 25, 2008 from M.J.G. Borge, the numbers listed in Table 1 of their paper are deemed as correct, when there are inconsistencies between Table 1 and Fig. 5.

1985Hi02: ^{231}Ra from decay of ^{231}Fr, the latter from mass separation of spallation products from 600-MeV protons on ^{238}U. Measured Eγ, Iγ, $\beta\gamma$-coin. Six γ rays reported but with no decay scheme proposed.

Overall the decay scheme of ^{231}Ra is poorly known, with little definite information about the multipolarities of γ transitions and limited data for intensities of low-energy transitions.

^{231}Ac Levels

E(level)†	J$^\pi$‡	$T_{1/2}$@	Comments
0.0	1/2$^+$		Configuration=π1/2[400] (2008Bo29).
5.25 *7*	(1/2$^+$,3/2$^+$,5/2$^+$)		
18.35 *7*	(3/2$^-$)		Configuration=π1/2[530] (2008Bo29).
37.96 *6*	(3/2)$^+$		3/2$^+$ member of configuration=π1/2[400] (2008Bo29).
61.70 *7*	(3/2$^+$)		Configuration=π3/2[651] (2008Bo29).
68.50 *6*	(5/2$^+$)		5/2$^+$ member of configuration=π3/2[651] (2008Bo29).
74.70 *6*	(5/2$^+$)		5/2$^+$ member of configuration=π1/2[400] (2008Bo29). J$^\pi$: 3/2$^+$,5/2$^+$ in 2008Bo29.
96.07? *5*	(1/2,3/2)		J$^\pi$: possible dipole γ to 1/2$^+$.
115.97 *6*	(3/2$^-$)	14.3 ns *11*	Configuration=π3/2[532] (2008Bo29).
160.63 *7*	(5/2$^-$)	<900 ps	5/2$^-$ member of configuration=π3/2[532] (2008Bo29).
237.90 *6*	(3/2$^+$)	57 ps *11*	Configuration=π3/2[402] (2008Bo29).
245.73? *9*	(1/2$^-$,3/2$^-$,5/2$^-$)		
266.68 *6*	(3/2$^-$)	90 ps *20*	$T_{1/2}$: from Tables 3 and 4 in 2008Bo29.
372.28 *7*	1/2$^-$,3/2$^-$		
415.24 *7*	(3/2$^-$,5/2$^-$)		
449.48 *8*	(3/2$^-$,5/2$^-$)		381.16γ and 444.32γ shown in Fig. 5 of 2008Bo29 are incorrect.
456.48? *10*	(3/2$^+$,5/2$^+$)		
471.58 *8*	(5/2$^-$)	<54 ps	Configuration=π5/2[532] (2008Bo29).
473.24? *11*	(1/2$^-$,3/2$^-$)		
478.17 *10*	1/2$^+$,3/2$^+$		
485.69 *7*	(3/2$^+$,5/2$^+$)		
498.05 *9*	1/2$^+$,3/2$^+$		J$^\pi$: 3/2$^+$ in 2008Bo29.
512.96 *9*	1/2$^+$,3/2$^+$		J$^\pi$: 3/2$^+$ in 2008Bo29.
530.93? *9*	(5/2$^+$)		Configuration=π5/2[642] (2008Bo29).
595.14? *16*	(3/2$^-$)		
670.76? *13*	#		
680.77 *9*	#		
824.85? *20*	#		
847.2? *3*	#		
848.95 *14*	#		

Continued on next page (footnotes at end of table)

^{231}Ra β^- decay (103.9 s) 2008Bo29 (continued)

^{231}Ac Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
870.1 *5*	#	1100.24? *20*	#	1155.21? *23*	#
912.1? *3*	#	1114.91? *24*	#	1248.4? *3*	#
931.41? *12*	#	1137.9 *4*	#	1354.2? *5*	#

† From least-squares fit to γ-ray energies. All the tentatively placed transitions were included in the fitting procedure. Uncertainties for Eγ for the following poorly-fitted gamma-rays were doubled to a maximum of 0.2 keV: 106.48γ and 260.82γ from 267 level, and 417.55γ from 486 level.

‡ From the Adopted Levels, based on assignments in 2008Bo29 from multipolarity assignments, and from tentative configuration assignments in authors′ Fig. 7, showing band structures.

Possible β feeding from (5/2$^+$) parent state suggests (3/2,5/2,7/2). In a few cases spin is further restricted to (3/2,5/2$^+$) from possible γ to 1/2$^+$ level in ^{231}Ac.

@ From $\beta\gamma\gamma$(t) fast-timing technique (2008Bo29,2007Bo48).

β^- radiations

E(decay)	E(level)	Comments
(1100 *17*)	1354.2?	Iβ=0.7 *2*, log *ft*=6.5 (2008Bo29).
(1206 *17*)	1248.4?	Iβ=0.24 *9*, log *ft*=7.1 (2008Bo29).
(1299 *17*)	1155.21?	Iβ=1.0 *3*, log *ft*=6.6 (2008Bo29).
(1316 *17*)	1137.9	Iβ=0.7 *2*, log *ft*=6.8 (2008Bo29).
(1339 *17*)	1114.91?	Iβ=0.8 *3*, log *ft*=6.8 (2008Bo29).
(1354 *17*)	1100.24?	Iβ=0.8 *3*, log *ft*=6.8 (2008Bo29).
(1523 *17*)	931.41?	Iβ=0.7 *2*, log *ft*=7.1 (2008Bo29).
(1542 *17*)	912.1?	Iβ=1.5 *5*, log *ft*=6.7 (2008Bo29).
(1584 *17*)	870.1	Iβ=0.3 *1*, log *ft*=7.5 (2008Bo29).
(1605 *17*)	848.95	Iβ=1.5 *5*, log *ft*=6.8 (2008Bo29).
(1607 *17*)	847.2?	Iβ=0.5 *2*, log *ft*=7.3 (2008Bo29).
(1629 *17*)	824.85?	Iβ=0.5 *2*, log *ft*=7.3 (2008Bo29).
(1773 *17*)	680.77	Iβ=1.8 *6*, log *ft*=6.9 (2008Bo29).
(1783 *17*)	670.76?	Iβ=0.30 *12*, log *ft*=7.7 (2008Bo29).
(1859 *17*)	595.14?	Iβ=2.1 *7*, log *ft*=6.9 (2008Bo29).
(1923 *17*)	530.93?	Iβ=24 *8*, log *ft*=5.9 (2008Bo29).
(1941 *17*)	512.96	Iβ=11 *4* (2008Bo29).
(1956 *17*)	498.05	Iβ=3.9 *13*, log *ft*=6.7 (2008Bo29).
(1968 *17*)	485.69	Iβ=4.5 *15*, log *ft*=6.7 (2008Bo29).
(1976 *17*)	478.17	Iβ=1.7 *6*, log *ft*=7.1 (2008Bo29).
(1981 *17*)	473.24?	Iβ=2.2 *8*, log *ft*=7.0 (2008Bo29).
(1982 *17*)	471.58	Iβ=27 *10*, log *ft*=5.9 (2008Bo29).
(1998 *17*)	456.48?	Iβ=2.5 *8*, log *ft*=6.9 (2008Bo29).
(2039 *17*)	415.24	Iβ=5 *2*, log *ft*=6.7 (2008Bo29).
(2082 *17*)	372.28	Iβ=4.2 *14* (2008Bo29).
(2216 *17*)	237.90	Iβ=1.2 *7*, log *ft*=7.5 (2008Bo29).

γ(^{231}Ac)

Measured E(Ac K[x-rays)=87.66 *5*, I(Ac $K_{\alpha2}$ x-rays)=90 *11* (2008Bo29), relative to 100 *11* for 54.29γ, or to 73 *16* for 205.00γ.

Measured E(Ac K) x-rays)=90.86 *5*, I(Ac $K_{\alpha2}$ x-rays)=141 *17* (2008Bo29), relative to 100 *11* for 54.29γ, or to 73 *16* for 205.00γ.

Measured I(Ac K x-rays)=285 *15* (1985Hi02), relative to 100 *6* for the 204.98γ.

Using the RADLST code, evaluators deduced x-ray intensities of 626 *94* for 87.66 *5* ($K_{\alpha2}$) and 1018 *152* for 90.86 *6* ($K_{\alpha1}$), which significantly disagree with the experimental values of 903 *106* for 87.66 *5* ($K_{\alpha2}$) and 1411 *165* for 90.86 *6* ($K_{\alpha1}$) given in 2008Bo29. This discrepancy suggests incorrect γ-ray multipolarities and therefore does not warrant either deducing a decay-scheme normalization factor or β^- intensities from γ-ray transition intensity balances.

The γ-normalization factor of 0.0758 *19* from 2008Bo29 is difficult to reproduce, thus omitted here, since several low-energy transitions have unknown multipolarities and mixing ratios, and placements of several transitions are uncertain.

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[@]	$I_{(\gamma+ce)}$	Comments
18.44 *10*	≈9.0	18.35	(3/2$^-$)	0.0	1/2$^+$	[E1]	6.29 *13*		α(L)=3.73 *8*; α(M)=1.95 *4* α(N)=0.497 *10*; α(O)=0.0996 *20*; α(P)=0.01300 *25*; α(Q)=0.000362 *7*
19.64 *10*	≈6.0	37.96	(3/2)$^+$	18.35	(3/2$^-$)	[E1]	5.29 *11*		α(L)=3.12 *7*; α(M)=1.65 *4* α(N)=0.420 *9*; α(O)=0.0848 *17*; α(P)=0.01124 *21*; α(Q)=0.000322 *6*
21.0[b] *4*	<0.006	266.68	(3/2$^-$)	245.73?	(1/2$^-$,3/2$^-$,5/2$^-$)	[M1]	3.3×10^2 *22*	<0.7	Evaluators assume that Iγ<7, relative to 1000 for 54.29γ quoted in 2008Bo29 is the transition intensity, not the photon intensity, as otherwise, with large conversion coefficient for the 21.0 transition, there will be intensity balance problems at the 245.7 level.
26.40 *8*	>0.9	498.05	1/2$^+$,3/2$^+$	471.58	(5/2$^-$)	[E1]	3.90 *7*		α(L)=2.92 *5*; α(M)=0.743 *12* α(N)=0.191 *3*; α(O)=0.0396 *7*; α(P)=0.00561 *9*; α(Q)=0.000184 *3* I_γ: >0.9 *2* in 2008Bo29. Contribution of the 26-keV γ from Th is subtracted.
36.74 *5*	1.1 *1*	74.70	(5/2$^+$)	37.96	(3/2)$^+$	[M1]	64.3 *9*		α(L)=48.6 *7*; α(M)=11.69 *17* α(N)=3.10 *5*; α(O)=0.721 *11*; α(P)=0.1334 *20*; α(Q)=0.01188 *18*
37.8 *4*	0.9 *3*	37.96	(3/2)$^+$	0.0	1/2$^+$	[M1]	59.1 *21*		α(L)=44.7 *16*; α(M)=10.7 *4* α(N)=2.85 *10*; α(O)=0.663 *24*; α(P)=0.123 *5*; α(Q)=0.0109 *4* E_γ: seen only in coincidence spectrum (namely with 78.0-keV).
40.30[b] *5*	0.7 *3*	1155.21?		1114.91?		[D]	25 *24*		
41.27 *5*	9.7 *19*	115.97	(3/2$^-$)	74.70	(5/2$^+$)	[E1]	1.197 *17*		B(E1)↓=1.8×10^{-7} *4*; B(E1)(W.u.)=7.4×10^{-6} *16* (2008Bo29)

$^{231}_{89}$Ac$_{142}$-3

$\gamma(^{231}$Ac) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[#]	α[@]	Comments
									α(L)=0.902 *13*; α(M)=0.223 *4* α(N)=0.0578 *9*; α(O)=0.01238 *18*; α(P)=0.00189 *3*; α(Q)=7.50×10^{-5} *11*
44.6 *1*	3.0 *4*	160.63	(5/2$^-$)	115.97	(3/2$^-$)	M1		36.3 *5*	α(L1)exp+α(L2)exp=24 *6* B(M1)↓>0.015 *5*; B(M1)(W.u.)>0.008 *3* (2008Bo29) α(L)=27.5 *5*; α(M)=6.60 *11* α(N)=1.75 *3*; α(O)=0.407 *7*; α(P)=0.0753 *12*; α(Q)=0.00671 *11* δ(E2/M1)<0.04 from α(L1+L2)exp.
47.45 *5*	3.8 *5*	115.97	(3/2$^-$)	68.50	(5/2$^+$)	[E1]		0.826 *12*	B(E1)↓=4.6×10^{-8} *8*; B(E1)(W.u.)=1.9×10^{-6} *3* (2008Bo29) α(L)=0.623 *9*; α(M)=0.1534 *22* α(N)=0.0398 *6*; α(O)=0.00859 *13*; α(P)=0.001336 *19*; α(Q)=5.61×10^{-5} *8*
54.29 *5*	100 *11*	115.97	(3/2$^-$)	61.70	(3/2$^+$)	E1		0.577 *8*	α(L1)exp+α(L2)exp≤0.11 B(E1)↓=8.2×10^{-7} *7*; B(E1)(W.u.)=3.4×10^{-5} *3* (2008Bo29) α(L)=0.436 *7*; α(M)=0.1068 *16* α(N)=0.0277 *4*; α(O)=0.00603 *9*; α(P)=0.000954 *14*; α(Q)=4.22×10^{-5} *6* Eγ=55 *1*, Iγ=47 *10* (1985Hi02).
56.50 *5*	0.8 *1*	61.70	(3/2$^+$)	5.25	(1/2$^+$,3/2$^+$,5/2$^+$)	E2(+M1)	>2.0	143 *14*	α(L1)exp+α(L2)exp=58 *17*; α(M)exp=31 *9*; α(N)exp=12 *4* α(L)=105 *11*; α(M)=29 *3* α(N)=7.6 *8*; α(O)=1.65 *17*; α(P)=0.257 *25*; α(Q)=9.9×10^{-4} *27* δ(E2/M1)=1.6 *5* from α(L1+L2)exp, 2.0 *9* from α(M)exp and >2.0 from α(N)exp. All experimental conversion coefficients deduced from (ce)γ and $\gamma\gamma$ coin with 54.29γ.
63.23[b] *5*	0.8 *1*	68.50	(5/2$^+$)	5.25	(1/2$^+$,3/2$^+$,5/2$^+$)	[M1,E2]		52 *40*	α(L)=38 *29*; α(M)=10.3 *80* α(N)=2.7 *22*; α(O)=0.60 *46*; α(P)=0.096 *69*; α(Q)=0.00143 *98*
70.44 *5*	0.8 *1*	485.69	(3/2$^+$,5/2$^+$)	415.24	(3/2$^-$,5/2$^-$)	[E1]		0.288 *4*	α(L)=0.218 *3*; α(M)=0.0531 *8* α(N)=0.01383 *20*; α(O)=0.00304 *5*; α(P)=0.000495 *7*; α(Q)=2.41×10^{-5} *4*
77.17 *7*	1.5 *3*	237.90	(3/2$^+$)	160.63	(5/2$^-$)	E1		0.226 *3*	α(L1)exp+α(L2)exp≤0.15 B(E1)↓=4.4×10^{-6} *12*; B(E1)(W.u.)=1.8×10^{-4} *5* (2008Bo29) α(L)=0.1711 *25*; α(M)=0.0416 *6* α(N)=0.01084 *16*; α(O)=0.00239 *4*; α(P)=0.000392 *6*; α(Q)=1.98×10^{-5} *3*
77.97 *6*	37.8 *44*	115.97	(3/2$^-$)	37.96	(3/2)$^+$	E1		0.220 *3*	α(L1)exp+α(L2)exp≤0.15

^{231}Ra β^- decay (103.9 s) 2008Bo29 (continued)

$\gamma(^{231}$Ac) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[@]	Comments
								B(E1)↓=1.05×10^{-7} *15*; B(E1)(W.u.)=4.3×10^{-6} *6* (2008Bo29) α(L)=0.1664 *24*; α(M)=0.0405 *6* α(N)=0.01055 *15*; α(O)=0.00233 *4*; α(P)=0.000382 *6*; α(Q)=1.93×10^{-5} *3*
81.48 *9*	6.1 *8*	530.93?	(5/2$^+$)	449.48	(3/2$^-$,5/2$^-$)	[E1]	0.196 *3*	α(L)=0.1481 *22*; α(M)=0.0360 *6* α(N)=0.00938 *14*; α(O)=0.00207 *3*; α(P)=0.000342 *5*; α(Q)=1.753×10^{-5} *25* I_γ: contribution from At x ray is subtracted.
96.01[b] *6*	3.0 *7*	96.07?	(1/2,3/2)	0.0	1/2$^+$	[D]	2.0 *19*	α(L)=1.5 *14*; α(M)=0.4 *4* α(N)=0.10 *9*; α(O)=0.022 *21*; α(P)=0.004 *4*; α(Q)=0.0004 *4* From transition intensity balance at 96.1 level, 96.1γ cannot be E2 or M2.
106.48[b] *9*	5.0 *8*	266.68	(3/2$^-$)	160.63	(5/2$^-$)	[M1]	2.86 *4*	B(M1)↓=6.4×10^{-4} *18*; B(M1)(W.u.)=3.6×10^{-4} *10* (2008Bo29) α(L)=2.17 *3*; α(M)=0.520 *8* α(N)=0.1380 *20*; α(O)=0.0321 *5*; α(P)=0.00593 *9*; α(Q)=0.000527 *8* E_γ: somewhat poor fit, level-energy difference=106.05. I_γ: contribution from Ac x ray is subtracted.
113.40 *8*	1.1 *1*	485.69	(3/2$^+$,5/2$^+$)	372.28	1/2$^-$,3/2$^-$	[E1]	0.358 *5*	α(K)=0.276 *4*; α(L)=0.0619 *9*; α(M)=0.01496 *22* α(N)=0.00391 *6*; α(O)=0.000874 *13*; α(P)=0.0001478 *21*; α(Q)=8.42×10^{-6} *12*
^{x}120.20 *7*	1.1 *1*							(ce)γ coin with 204.8 transition.
121.96 *8*	2.8 *3*	237.90	(3/2$^+$)	115.97	(3/2$^-$)	[E1]	0.302 *4*	B(E1)↓=2.1×10^{-6} *5*; B(E1)(W.u.)=9×10^{-5} *2* (2008Bo29) α(K)=0.234 *4*; α(L)=0.0512 *8*; α(M)=0.01235 *18* α(N)=0.00323 *5*; α(O)=0.000724 *11*; α(P)=0.0001230 *18*; α(Q)=7.16×10^{-6} *10*
129.76 *7*	5.9 *7*	245.73?	(1/2$^-$,3/2$^-$,5/2$^-$)	115.97	(3/2$^-$)	M1+E2	5.8 *24*	α(L1)exp+α(L2)exp=1.31 *40* α(K)=3.4 *31*; α(L)=1.76 *53*; α(M)=0.46 *17* α(N)=0.122 *44*; α(O)=0.0272 *91*; α(P)=0.0045 *12*; α(Q)=1.7×10^{-4} *14* Experimental conversion coefficient deduced from (ce)γ and $\gamma\gamma$ coin with 54.29γ gives mult=M1 or E2.
134.38[b] *10*	0.9 *2*	372.28	1/2$^-$,3/2$^-$	237.90	(3/2$^+$)	[E1]	0.239 *4*	α(K)=0.187 *3*; α(L)=0.0397 *6*; α(M)=0.00958 *14* α(N)=0.00251 *4*; α(O)=0.000563 *8*; α(P)=9.63×10^{-5} *14*; α(Q)=5.77×10^{-6} *9*
141.88[b] *10*	≤1.8	237.90	(3/2$^+$)	96.07?	(1/2,3/2)	[D]	3.3 *31*	B(E1)↓≤7.6×10^{-7} *19*; B(E1)(W.u.)≤3.1×10^{-5} *8* (2008Bo29) I_γ: ≤1.6 *2*. It may be also be contributed by sum line of 54.29γ and 87.66 Ac x ray.
150.75 *10*	0.8 *1*	266.68	(3/2$^-$)	115.97	(3/2$^-$)	[M1]	5.30 *8*	B(M1)↓=3.6×10^{-5} *10*; B(M1)(W.u.)=2.0×10^{-5} *6* (2008Bo29) α(K)=4.25 *6*; α(L)=0.799 *12*; α(M)=0.192 *3* α(N)=0.0508 *8*; α(O)=0.01182 *17*; α(P)=0.00219 *3*; α(Q)=0.000194 *3*
170.41[b] *10*	1.4 *2*	266.68	(3/2$^-$)	96.07?	(1/2,3/2)	[D]	1.9 *18*	α(K)=1.6 *15*; α(L)=0.3 *3*; α(M)=0.07 *7* α(N)=0.019 *18*; α(O)=0.004 *4*; α(P)=0.0008 *8*; α(Q)=7.E−5 *7* B(M1)↓=4.4×10^{-5} *12*; B(M1)(W.u.)=2.4×10^{-5} *7* (2008Bo29)

$^{231}_{89}Ac_{142}$-5

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[@]	Comments
177.39 *8*	1.9 *3*	415.24	(3/2⁻,5/2⁻)	237.90	(3/2⁺)	[E1]	0.1228 *17*	α(K)=0.0971 *14*; α(L)=0.0195 *3*; α(M)=0.00468 *7* α(N)=0.001229 *18*; α(O)=0.000278 *4*; α(P)=4.82×10^{-5} *7*; α(Q)=3.10×10^{-6} *5*
[x]178.45 *10*	1.5 *2*							$\gamma\gamma$ coin with 54.3, 78.0, 232.7 transitions.
192.00 *8*	15.3 *17*	266.68	(3/2⁻)	74.70	(5/2⁺)	[E1]	0.1017 *14*	B(E1)↓=3.7×10^{-7} *9*; B(E1)(W.u.)=1.5×10^{-5} *4* (2008Bo29) α(K)=0.0806 *12*; α(L)=0.01595 *23*; α(M)=0.00383 *6* α(N)=0.001006 *15*; α(O)=0.000228 *4*; α(P)=3.97×10^{-5} *6*; α(Q)=2.60×10^{-6} *4*
195.09 *10*	8.1 *9*	680.77		485.69	(3/2⁺,5/2⁺)	[D,E2]	1.4 *13*	
198.18 *8*	62.2 *63*	266.68	(3/2⁻)	68.50	(5/2⁺)	E1	0.0943 *13*	α(K)exp=0.06 *2*; α(L1)exp+α(L2)exp=0.07 *5* B(E1)↓=1.4×10^{-6} *3*; B(E1)(W.u.)=5.6×10^{-5} *14* (2008Bo29) α(K)=0.0749 *11*; α(L)=0.01474 *21*; α(M)=0.00354 *5* α(N)=0.000929 *13*; α(O)=0.000210 *3*; α(P)=3.67×10^{-5} *6*; α(Q)=2.43×10^{-6} *4*
204.79 *10*	48 *16*	471.58	(5/2⁻)	266.68	(3/2⁻)	M1	2.23 *3*	α(K)exp=1.77 *24* B(M1)↓>0.013 *2*; B(M1)(W.u.)>7.4×10^{-3} *13* (2008Bo29) α(K)=1.79 *3*; α(L)=0.335 *5*; α(M)=0.0803 *12* α(N)=0.0213 *3*; α(O)=0.00495 *7*; α(P)=0.000916 *13*; α(Q)=8.12×10^{-5} *12* δ(E2/M1)=0.0 *+5−0* from ce data. α(K)exp: from $\gamma\gamma$ coin.
205.00 *10*	73 *16*	266.68	(3/2⁻)	61.70	(3/2⁺)	E1	0.0871 *12*	α(K)exp≤0.23; α(L1)exp+α(L2)exp≤0.12 B(E1)↓=1.4×10^{-6} *3*; B(E1)(W.u.)=5.9×10^{-5} *16* (2008Bo29) α(K)=0.0692 *10*; α(L)=0.01354 *19*; α(M)=0.00325 *5* α(N)=0.000854 *12*; α(O)=0.000193 *3*; α(P)=3.38×10^{-5} *5*; α(Q)=2.25×10^{-6} *4* Eγ=204.98 *3*, Iγ=100 *6* (1985Hi02). For experimental conversion coefficients, contribution from ce(K) and ce(L1+L2) of 204.79γ subtracted.
211.50[a] *10*	1.3[a] *4*	449.48	(3/2⁻,5/2⁻)	237.90	(3/2⁺)	[E1]	0.0809 *11*	α(K)=0.0643 *9*; α(L)=0.01253 *18*; α(M)=0.00301 *5* α(N)=0.000790 *11*; α(O)=0.000179 *3*; α(P)=3.13×10^{-5} *5*; α(Q)=2.11×10^{-6} *3* I_γ: note that total intensity of the doublet=2.3 is shown in Fig. 5 of 2008Bo29.
211.50[a] *10*	1.0[a] *4*	478.17	1/2⁺,3/2⁺	266.68	(3/2⁻)	[E1]	0.0809 *11*	α(K)=0.0643 *9*; α(L)=0.01253 *18*; α(M)=0.00301 *5* α(N)=0.000790 *11*; α(O)=0.000179 *3*; α(P)=3.13×10^{-5} *5*; α(Q)=2.11×10^{-6} *3*
219.69 *15*	9.1 *12*	237.90	(3/2⁺)	18.35	(3/2⁻)	[E1]	0.0740 *10*	B(E1)↓=1.2×10^{-6} *3*; B(E1)(W.u.)=4.8×10^{-5} *12* (2008Bo29) α(K)=0.0589 *9*; α(L)=0.01141 *16*; α(M)=0.00274 *4* α(N)=0.000719 *11*; α(O)=0.0001631 *23*; α(P)=2.86×10^{-5} *4*; α(Q)=1.94×10^{-6} *3*
[x]226.89 *15*	2.5 *9*							

$^{231}_{89}Ac_{142}$-6

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ#	α@	Comments
228.73 *10*	17.5 *17*	266.68	(3/2$^-$)	37.96	(3/2)$^+$	[E1]		0.0673 *10*	B(E1)↓=2.5×10^{-7} *6*; B(E1)(W.u.)=1.0×10^{-5} *3* (2008Bo29) α(K)=0.0537 *8*; α(L)=0.01033 *15*; α(M)=0.00248 *4* α(N)=0.000651 *10*; α(O)=0.0001477 *21*; α(P)=2.59×10^{-5} *4*; α(Q)=1.775×10^{-6} *25*
232.71 *9*	23.9 *21*	237.90	(3/2$^+$)	5.25	(1/2$^+$,3/2$^+$,5/2$^+$)	(E2(+M1))	>4	0.40 *4*	α(K)exp=0.12 *6* α(K)=0.15 *4*; α(L)=0.181 *3*; α(M)=0.0486 *8* α(N)=0.01292 *20*; α(O)=0.00285 *5*; α(P)=0.000460 *9*; α(Q)=8.2×10^{-6} *15* Mult.: E1 is not ruled out within the uncertainty for α(K)exp.
237.86 *15*	2.6 *3*	237.90	(3/2$^+$)	0.0	1/2$^+$	[M1]		1.470 *21*	B(M1)↓=0.0025 *4*; B(M1)(W.u.)=0.0014 *2* (2008Bo29) α(K)=1.180 *17*; α(L)=0.220 *4*; α(M)=0.0527 *8* α(N)=0.01398 *20*; α(O)=0.00325 *5*; α(P)=0.000601 *9*; α(Q)=5.33×10^{-5} *8*
247.65 *15*	12.5† *13*	485.69	(3/2$^+$,5/2$^+$)	237.90	(3/2$^+$)	M1(+E2)	<0.8	0.9 *4*	α(K)exp=0.87 *22*; α(L1)exp+α(L2)exp=0.31 *14* α(K)=0.7 *4*; α(L)=0.174 *23*; α(M)=0.043 *4* α(N)=0.0115 *10*; α(O)=0.0026 *3*; α(P)=0.00047 *8*; α(Q)=3.1×10^{-5} *17* δ(E2/M1) from BriccMixing for a maximum of reduced χ^2=2.
^{x}249.49 *10*	2.7 *4*								
254.57 *10*	16.5 *16*	415.24	(3/2$^-$,5/2$^-$)	160.63	(5/2$^-$)	M1		1.217 *17*	α(K)exp=1.07 *26*; α(L1)exp+α(L2)exp=0.34 *14* α(K)=0.977 *14*; α(L)=0.182 *3*; α(M)=0.0436 *7* α(N)=0.01157 *17*; α(O)=0.00269 *4*; α(P)=0.000497 *7*; α(Q)=4.41×10^{-5} *7* δ(E2/M1)=0.0 +*5*−*0* from ce data.
^{x}256.79 *15*	2.2 *3*								Placement from 372 level shown in Fig. 5 of 2008Bo29 is incorrect.
260.82 *10*	15.8 *15*	266.68	(3/2$^-$)	5.25	(1/2$^+$,3/2$^+$,5/2$^+$)	[E1]		0.0497 *7*	B(E1)↓=1.5×10^{-7} *4*; B(E1)(W.u.)=6.2×10^{-6} *16* (2008Bo29) α(K)=0.0398 *6*; α(L)=0.00751 *11*; α(M)=0.00180 *3* α(N)=0.000472 *7*; α(O)=0.0001075 *15*; α(P)=1.90×10^{-5} *3*; α(Q)=1.336×10^{-6} *19* E_γ: poor fit. Level-energy difference=261.43.
275.38 *10*	1.6 *6*	1100.24?		824.85?		[D,E2]		0.51 *47*	
288.94 *10*	3.0 *4*	449.48	(3/2$^-$,5/2$^-$)	160.63	(5/2$^-$)	M1		0.857 *12*	α(K)exp=0.87 *26* α(K)=0.688 *10*; α(L)=0.1280 *18*; α(M)=0.0306 *5* α(N)=0.00813 *12*; α(O)=0.00189 *3*; α(P)=0.000350 *5*; α(Q)=3.10×10^{-5} *5* δ(E2/M1)=0.0 +*6*−*0* from ce data.

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α@	Comments
								Experimental conversion coefficient deduced from (ce)γ- and $\gamma\gamma$-coin with 54.29γ.
295.74 *15*	1.9 *5*	456.48?	(3/2$^+$,5/2$^+$)	160.63	(5/2$^-$)	[E1]	0.0373 *5*	α(K)=0.0300 *5*; α(L)=0.00557 *8*; α(M)=0.001330 *19* α(N)=0.000350 *5*; α(O)=7.98×10^{-5} *12*; α(P)=1.417×10^{-5} *20*; α(Q)=1.023×10^{-6} *15*
299.10 *15*	6.6 *7*	415.24	(3/2$^-$,5/2$^-$)	115.97	(3/2$^-$)	M1	0.780 *11*	α(K)exp=1.01 *35* α(K)=0.626 *9*; α(L)=0.1163 *17*; α(M)=0.0278 *4* α(N)=0.00739 *11*; α(O)=0.001717 *25*; α(P)=0.000318 *5*; α(Q)=2.81×10^{-5} *4* δ(E2/M1)=0.0 +*6*−*0* from ce data.
^{x}313.50 *10*	1.6 *3*							
325.12 *15*	2.5 *3*	485.69	(3/2$^+$,5/2$^+$)	160.63	(5/2$^-$)	[E1]	0.0303 *4*	α(K)=0.0244 *4*; α(L)=0.00446 *7*; α(M)=0.001066 *15* α(N)=0.000280 *4*; α(O)=6.41×10^{-5} *9*; α(P)=1.141×10^{-5} *16*; α(Q)=8.39×10^{-7} *12*
355.66 *20*	4.0 *7*	471.58	(5/2$^-$)	115.97	(3/2$^-$)	M1	0.485 *7*	α(K)exp=0.60 *20* B(M1)↓>2.1×10^{-4} *5*; B(M1)(W.u.)>1.2×10^{-4} *3* (2008Bo29) α(K)=0.390 *6*; α(L)=0.0721 *11*; α(M)=0.01727 *25* α(N)=0.00458 *7*; α(O)=0.001065 *15*; α(P)=0.000197 *3*; α(Q)=1.745×10^{-5} *25* δ(E2/M1)=0.0 +*6*−*0* from ce data.
357.26 *10*	19.3 *18*	473.24?	(1/2$^-$,3/2$^-$)	115.97	(3/2$^-$)	M1	0.479 *7*	α(K)exp=0.60 *20* α(K)=0.385 *6*; α(L)=0.0713 *10*; α(M)=0.01705 *24* α(N)=0.00452 *7*; α(O)=0.001052 *15*; α(P)=0.000195 *3*; α(Q)=1.724×10^{-5} *25* δ(E2/M1)=0.0 +*6*−*0* from ce data.
369.52 *30*	14.8† *26*	485.69	(3/2$^+$,5/2$^+$)	115.97	(3/2$^-$)	[E1]	0.0229 *3*	α(K)=0.0185 *3*; α(L)=0.00333 *5*; α(M)=0.000795 *12* α(N)=0.000209 *3*; α(O)=4.79×10^{-5} *7*; α(P)=8.57×10^{-6} *12*; α(Q)=6.45×10^{-7} *9*
372.27 *10*	45.5† *43*	372.28	1/2$^-$,3/2$^-$	0.0	1/2$^+$	E1	0.0225 *3*	α(K)exp=0.021 *12* α(K)=0.0182 *3*; α(L)=0.00328 *5*; α(M)=0.000781 *11* α(N)=0.000206 *3*; α(O)=4.71×10^{-5} *7*; α(P)=8.43×10^{-6} *12*; α(Q)=6.35×10^{-7} *9*
375.72^b *10*	6.8 *9*	848.95		473.24?	(1/2$^-$,3/2$^-$)	[D,E2]	0.25 *23*	
381.16^b *30*	1.1 *1*	912.1?		530.93?	(5/2$^+$)	[D,E2]	0.21 *19*	Eγ=381.76, Iγ=3.0 in Fig. 5 of 2008Bo29 is incorrect. In Fig. 5 of 2008Bo29, this γ is also shown from 449 level.
381.76^b *15*	3.0 *5*	456.48?	(3/2$^+$,5/2$^+$)	74.70	(5/2$^+$)	[M1]	0.400 *6*	α(K)=0.321 *5*; α(L)=0.0594 *9*; α(M)=0.01422 *20* α(N)=0.00377 *6*; α(O)=0.000877 *13*; α(P)=0.0001622 *23*; α(Q)=1.437×10^{-5} *21*
387.99^b *15*	4.5 *12*	456.48?	(3/2$^+$,5/2$^+$)	68.50	(5/2$^+$)	[M1]	0.383 *6*	α(K)=0.308 *5*; α(L)=0.0568 *8*; α(M)=0.01360 *19* α(N)=0.00361 *5*; α(O)=0.000839 *12*; α(P)=0.0001552 *22*; α(Q)=1.375×10^{-5} *20* Iγ: doublet, contribution from Th subtracted.

$^{231}_{89}$Ac$_{142}$-8

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
394.90 *15*	12.7 *13*	456.48?	(3/2$^+$,5/2$^+$)	61.70	(3/2$^+$)	M1	0.365 *5*	α(K)exp=0.25 *15* α(K)=0.293 *5*; α(L)=0.0542 *8*; α(M)=0.01296 *19* α(N)=0.00344 *5*; α(O)=0.000799 *12*; α(P)=0.0001478 *21*; α(Q)=1.310×10^{-5} *19* δ(E2/M1)=0.5 +*14*−*5* from ce data.
396.92[&] *15*	5.7 *18*	415.24	(3/2$^-$,5/2$^-$)	18.35	(3/2$^-$)	M1	0.360 *5*	α(K)exp=0.25 *15* α(K)=0.289 *4*; α(L)=0.0534 *8*; α(M)=0.01278 *18* α(N)=0.00339 *5*; α(O)=0.000788 *11*; α(P)=0.0001458 *21*; α(Q)=1.292×10^{-5} *19* δ(E2/M1)=0.4 +*14*−*4* from ce data. I_γ: contributions from a 397.3-keV γ in Ra decay and 396.9-keV γ from Th subtracted. 2008Bo29 placed 396.92γ from the 415 level only in Tables 1 and 2, but in Fig. 1 and Table 4, placement was also shown from 471 level. The latter placement appears incorrect, as implied multipolarity of E1 for this placement is inconsistent with M1 from α(K) exp data in authors′ Table 2. However, possibility of a small component of the 396.9 γ ray from the 471.6 level is not precluded. Evaluators assign the intensity given in 2008Bo29 to the placement from 415 level only.
396.92[&b] *15*		471.58	(5/2$^-$)	74.70	(5/2$^+$)			
403.03 *15*	30.1 *29*	471.58	(5/2$^-$)	68.50	(5/2$^+$)	[E1]	0.0190 *3*	B(E1)↓>1.2×10^{-7} *4*; B(E1)(W.u.)>5.0×10^{-6} *10* (2008Bo29) α(K)=0.01540 *22*; α(L)=0.00275 *4*; α(M)=0.000654 *10* α(N)=0.0001723 *25*; α(O)=3.95×10^{-5} *6*; α(P)=7.08×10^{-6} *10*; α(Q)=5.41×10^{-7} *8*
409.89 *10*	108 *10*	471.58	(5/2$^-$)	61.70	(3/2$^+$)	E1	0.0184 *3*	α(K)exp<0.035 B(E1)↓>4.1×10^{-7} *8*; B(E1)(W.u.)=1.7×10^{-5} *3* (2008Bo29) α(K)=0.01487 *21*; α(L)=0.00265 *4*; α(M)=0.000630 *9* α(N)=0.0001660 *24*; α(O)=3.80×10^{-5} *6*; α(P)=6.83×10^{-6} *10*; α(Q)=5.23×10^{-7} *8* E2 is not ruled out from α(K)exp. Eγ=409.92 *9*, Iγ=108 *12* (1985Hi02).
417.55[b] *10*	1.4 *2*	485.69	(3/2$^+$,5/2$^+$)	68.50	(5/2$^+$)	[M1]	0.314 *5*	α(K)=0.252 *4*; α(L)=0.0465 *7*; α(M)=0.01113 *16* α(N)=0.00295 *5*; α(O)=0.000686 *10*; α(P)=0.0001270 *18*; α(Q)=1.125×10^{-5} *16* E_γ: somewhat poor fit, level-energy difference=417.19.
425.02 *10*	2.3 *5*	670.76?		245.73?	(1/2$^-$,3/2$^-$,5/2$^-$)	[D,E2]	0.16 *14*	
429.62 *15*	11.0 *14*	498.05	1/2$^+$,3/2$^+$	68.50	(5/2$^+$)	[M1]	0.290 *4*	α(K)=0.234 *4*; α(L)=0.0431 *6*; α(M)=0.01030 *15* α(N)=0.00273 *4*; α(O)=0.000635 *9*; α(P)=0.0001175 *17*; α(Q)=1.041×10^{-5} *15*
432.00[b] *30*	3.6 *5*	847.2?		415.24	(3/2$^-$,5/2$^-$)	[D,E2]	0.15 *14*	
434.50 *15*	14.3 *13*	595.14?	(3/2$^-$)	160.63	(5/2$^-$)	M1	0.282 *4*	α(K)exp=0.28 *9*

$^{231}_{89}Ac_{142}$-9

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
								α(K)=0.227 *4*; α(L)=0.0418 *6*; α(M)=0.00999 *14* α(N)=0.00265 *4*; α(O)=0.000616 *9*; α(P)=0.0001139 *16*; α(Q)=1.010×10^{-5} *15* δ(E2/M1)=0.0 *+6−0* from ce data.
442.90 *10*	4.3 *6*	680.77		237.90	(3/2$^+$)	[D,E2]	0.15 *12*	
444.32[b] *10*	3.2 *6*	512.96	1/2$^+$,3/2$^+$	68.50	(5/2$^+$)	[M1]	0.265 *4*	α(K)=0.213 *3*; α(L)=0.0393 *6*; α(M)=0.00940 *14* α(N)=0.00249 *4*; α(O)=0.000579 *9*; α(P)=0.0001072 *15*; α(Q)=9.50×10^{-6} *14* In Fig. 5 of 2008Bo29, this γ is also shown from 449 level.
445.74 *10*	4.8 *6*	931.41?		485.69	(3/2$^+$,5/2$^+$)	[D,E2]	0.15 *12*	
456.19 *15*	67.6 *61*	530.93?	(5/2$^+$)	74.70	(5/2$^+$)	M1	0.247 *4*	α(K)exp=0.28 *6*; α(L1)exp+α(L2)exp=0.04 *2* α(K)=0.199 *3*; α(L)=0.0366 *6*; α(M)=0.00875 *13* α(N)=0.00232 *4*; α(O)=0.000539 *8*; α(P)=9.98×10^{-5} *14*; α(Q)=8.85×10^{-6} *13* δ(E2/M1)=0.0 *+4−0* from ce data. Eγ=456.2 *2*, Iγ=64 *7* (1985Hi02).
462.38 *15*	53.4 *48*	530.93?	(5/2$^+$)	68.50	(5/2$^+$)	M1	0.238 *4*	α(K)exp=0.21 *5*; α(L1)exp+α(L2)exp=0.06 *3* α(K)=0.192 *3*; α(L)=0.0353 *5*; α(M)=0.00843 *12* α(N)=0.00224 *4*; α(O)=0.000520 *8*; α(P)=9.62×10^{-5} *14*; α(Q)=8.53×10^{-6} *12* Eγ=462.4 *2*, Iγ=46 *6* (1985Hi02). δ(E2/M1)=0.0 *+5−0* from ce data.
467.39 *15*	13.6 *20*	485.69	(3/2$^+$,5/2$^+$)	18.35	(3/2$^-$)	[E1]	0.01399 *20*	α(K)=0.01136 *16*; α(L)=0.00199 *3*; α(M)=0.000473 *7* α(N)=0.0001247 *18*; α(O)=2.86×10^{-5} *4*; α(P)=5.16×10^{-6} *8*; α(Q)=4.04×10^{-7} *6*
469.23 *15*	90.9 *85*	530.93?	(5/2$^+$)	61.70	(3/2$^+$)	M1	0.229 *3*	α(K)exp=0.21 *5*; α(L1)exp+α(L2)exp=0.04 *2* α(K)=0.184 *3*; α(L)=0.0339 *5*; α(M)=0.00810 *12* α(N)=0.00215 *3*; α(O)=0.000500 *7*; α(P)=9.24×10^{-5} *13*; α(Q)=8.20×10^{-6} *12* δ(E2/M1)=0.0 *+5−0* from ce data. Eγ=469.3 *2*, Iγ=81 *6* (1985Hi02).
473.40[b] *30*	2.8 *6*	473.24?	(1/2$^-$,3/2$^-$)	0.0	1/2$^+$	[E1]	0.01363 *19*	α(K)=0.01108 *16*; α(L)=0.00194 *3*; α(M)=0.000460 *7* α(N)=0.0001213 *17*; α(O)=2.79×10^{-5} *4*; α(P)=5.02×10^{-6} *7*; α(Q)=3.94×10^{-7} *6*
475.29 *15*	32.3 *31*	512.96	1/2$^+$,3/2$^+$	37.96	(3/2)$^+$	M1	0.221 *3*	α(K)exp=0.21 *6* α(K)=0.1780 *25*; α(L)=0.0327 *5*; α(M)=0.00783 *11* α(N)=0.00207 *3*; α(O)=0.000483 *7*; α(P)=8.93×10^{-5} *13*; α(Q)=7.92×10^{-6} *12* δ(E2/M1)=0.0 *+6−0* from ce data.
478.15 *15*	14.8 *21*	478.17	1/2$^+$,3/2$^+$	0.0	1/2$^+$	M1	0.218 *3*	α(K)exp=0.15 *6* α(K)=0.1751 *25*; α(L)=0.0322 *5*; α(M)=0.00770 *11* α(N)=0.00204 *3*; α(O)=0.000475 *7*; α(P)=8.78×10^{-5} *13*;

From ENSDF

γ(^{231}Ac) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	α@	Comments
								α(Q)=7.79×10^{-6} *11* δ(E2/M1)=0.5 +*8*−*5* from ce data. I_γ: doublet. Contribution from Ra is subtracted.
481.74[b] *30*	2.5 *5*	931.41?		449.48	(3/2$^-$,5/2$^-$)	[D,E2]	0.11 *10*	
494.57 *30*	2.8 *6*	512.96	1/2$^+$,3/2$^+$	18.35	(3/2$^-$)	[E1]	0.01247 *18*	α(K)=0.01015 *15*; α(L)=0.001767 *25*; α(M)=0.000419 *6* α(N)=0.0001105 *16*; α(O)=2.54×10^{-5} *4*; α(P)=4.59×10^{-6} *7*; α(Q)=3.62×10^{-7} *5*
498.20 *15*	22.7 *21*	498.05	1/2$^+$,3/2$^+$	0.0	1/2$^+$	M1	0.195 *3*	α(K)exp=0.17 *7* α(K)=0.1569 *22*; α(L)=0.0288 *4*; α(M)=0.00689 *10* α(N)=0.00183 *3*; α(O)=0.000425 *6*; α(P)=7.86×10^{-5} *11*; α(Q)=6.97×10^{-6} *10* δ(E2/M1)=0.0 +*9*−*0* from ce data.
513.00 *15*	65.9† *86*	512.96	1/2$^+$,3/2$^+$	0.0	1/2$^+$	M1	0.180 *3*	α(K)exp=0.14 *4* α(K)=0.1451 *21*; α(L)=0.0266 *4*; α(M)=0.00637 *9* α(N)=0.001688 *24*; α(O)=0.000392 *6*; α(P)=7.26×10^{-5} *11*; α(Q)=6.44×10^{-6} *9* δ(E2/M1)=0.2 +*6*−*2* from ce data.
569.4 *5*	5.1 *7*	1100.24?		530.93?	(5/2$^+$)	[D,E2]	0.07 *6*	
577.7[b] *3*	1.9 *6*	1248.4?		670.76?		[D,E2]	0.07 *6*	
586.8 *6*	3.0 *6*	824.85?		237.90	(3/2$^+$)	[D,E2]	0.07 *6*	
595.3 *5*	5.1 *7*	595.14?	(3/2$^-$)	0.0	1/2$^+$	[E1]	0.00865 *12*	α(K)=0.00706 *10*; α(L)=0.001205 *17*; α(M)=0.000285 *4* α(N)=7.53×10^{-5} *11*; α(O)=1.733×10^{-5} *25*; α(P)=3.14×10^{-6} *5*; α(Q)=2.55×10^{-7} *4*
[x]607.6 *5*	1.0 *1*							
609.3[b] *5*	2.8 *3*	670.76?		61.70	(3/2$^+$)	[D,E2]	0.06 *5*	
612.5[b] *5*	1.0 *1*	680.77		68.50	(5/2$^+$)	[D,E2]	0.06 *5*	
614.6[b] *3*	1.5 *2*	1100.24?		485.69	(3/2$^+$,5/2$^+$)	[D,E2]	0.06 *5*	
662.0 *3*	5.2 *5*	680.77		18.35	(3/2$^-$)	[D,E2]	0.05 *4*	
666.3[b] *4*	1.7 *3*	1137.9		471.58	(5/2$^-$)	[D,E2]	0.05 *4*	
732.6 *5*	8.0 *24*	848.95		115.97	(3/2$^-$)	[D,E2]	0.038 *32*	
754.1 *5*	3.1 *5*	870.1		115.97	(3/2$^-$)	[D,E2]	0.034 *29*	
763.1 *3*	4.5 *12*	824.85?		61.70	(3/2$^+$)	[D,E2]	0.034 *29*	
842.0 *5*	1.8 *6*	847.2?		5.25	(1/2$^+$,3/2$^+$,5/2$^+$)	[D,E2]	0.026 *21*	
[x]844.2 *5*	1.8 *3*							
849.1 *5*	1.3 *5*	848.95		0.0	1/2$^+$			
[x]857.8 *6*	3.5 *6*							
868.4[b] *6*	6.9 *11*	1354.2?		485.69	(3/2$^+$,5/2$^+$)	[D,E2]	0.024 *20*	I_γ: 3.1 in Fig. 5 of 2008Bo29 is incorrect.
871.1 *6*	6.0 *6*	1137.9		266.68	(3/2$^-$)	[D,E2]	0.024 *20*	
912.1 *6*	15.0 *26*	912.1?		0.0	1/2$^+$	[D,E2]	0.022 *18*	
[x]937.7 *5*	3.2 *9*							
[x]986.9 *4*	3.1 *9*							

$^{231}_{89}Ac_{142}$-11

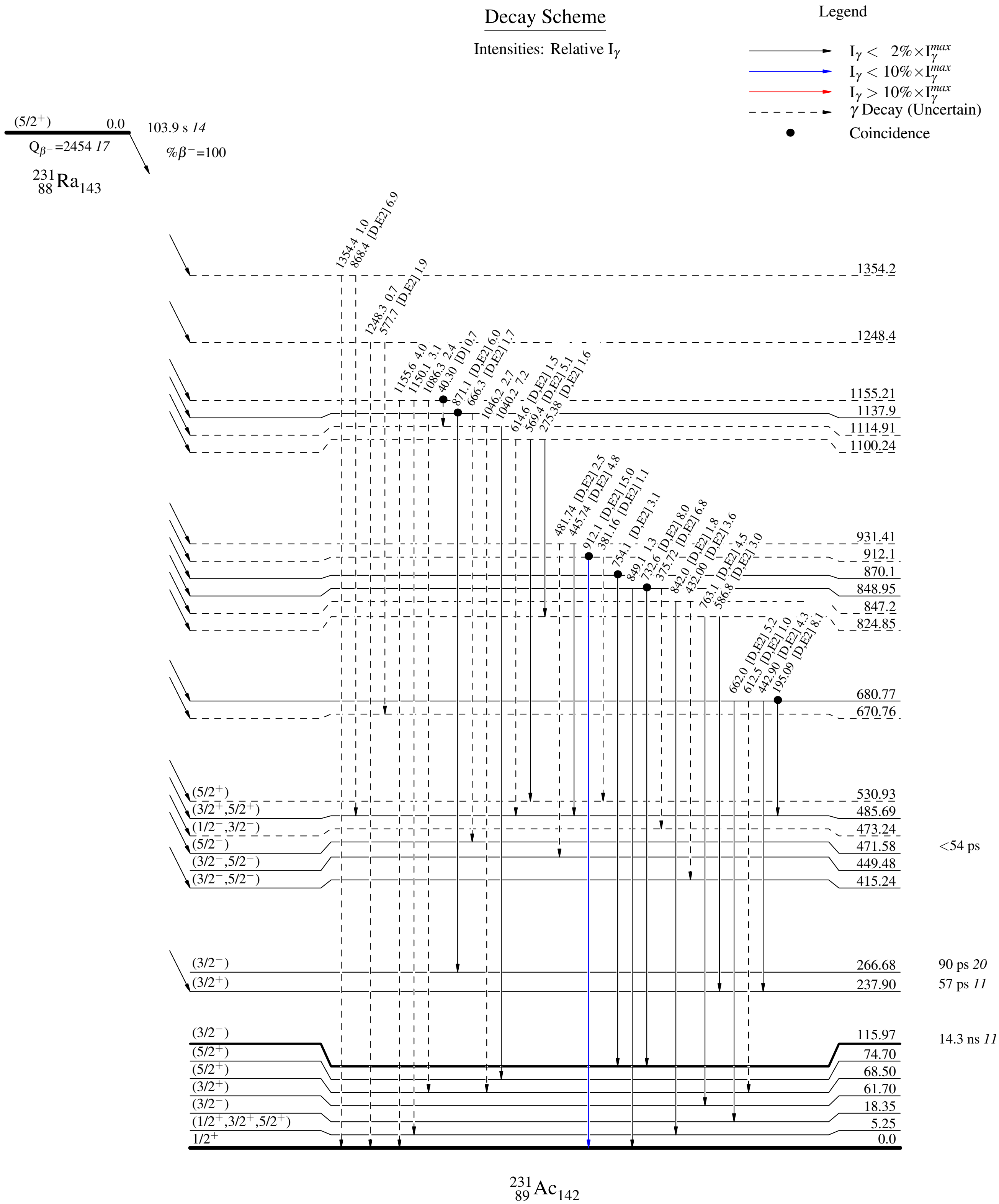
$\gamma(^{231}$Ac) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Comments
1040.2 *5*	7.2 *7*	1114.91?		74.70	$(5/2^+)$	
1046.2[b] *5*	2.7 *3*	1114.91?		68.50	$(5/2^+)$	
1086.3[b] *6*	2.4 *3*	1155.21?		68.50	$(5/2^+)$	
1150.1[b] *4*	3.1 *4*	1155.21?		5.25	$(1/2^+,3/2^+,5/2^+)$	
1155.6[b] *6*	4.0 *12*	1155.21?		0.0	$1/2^+$	
1248.3[b] *5*	0.7 *2*	1248.4?		0.0	$1/2^+$	
1354.4[b] *9*	1.0 *2*	1354.2?		0.0	$1/2^+$	I_γ: 4.0 in Fig. 5 of 2008Bo29 is incorrect.

† Contribution from Th subtracted.
‡ From ce data in 2008Bo29. For M1 transitions, small E2 admixtures are not ruled out. E1 or M1 assumed when not listed by 2008Bo29, according to a general statement by the authors. The same multipolarities are recommended in the Adopted dataset.
# Deduced by evaluators from experimental conversion data. For dominant M1 transitions, deduced δ(E2/M1) limits are given in comments.
@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
& Multiply placed.
[a] Multiply placed with intensity suitably divided.
[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{231}_{89}$Ac$_{142}$-12

^{231}Ra β^- decay (103.9 s) 2008Bo29

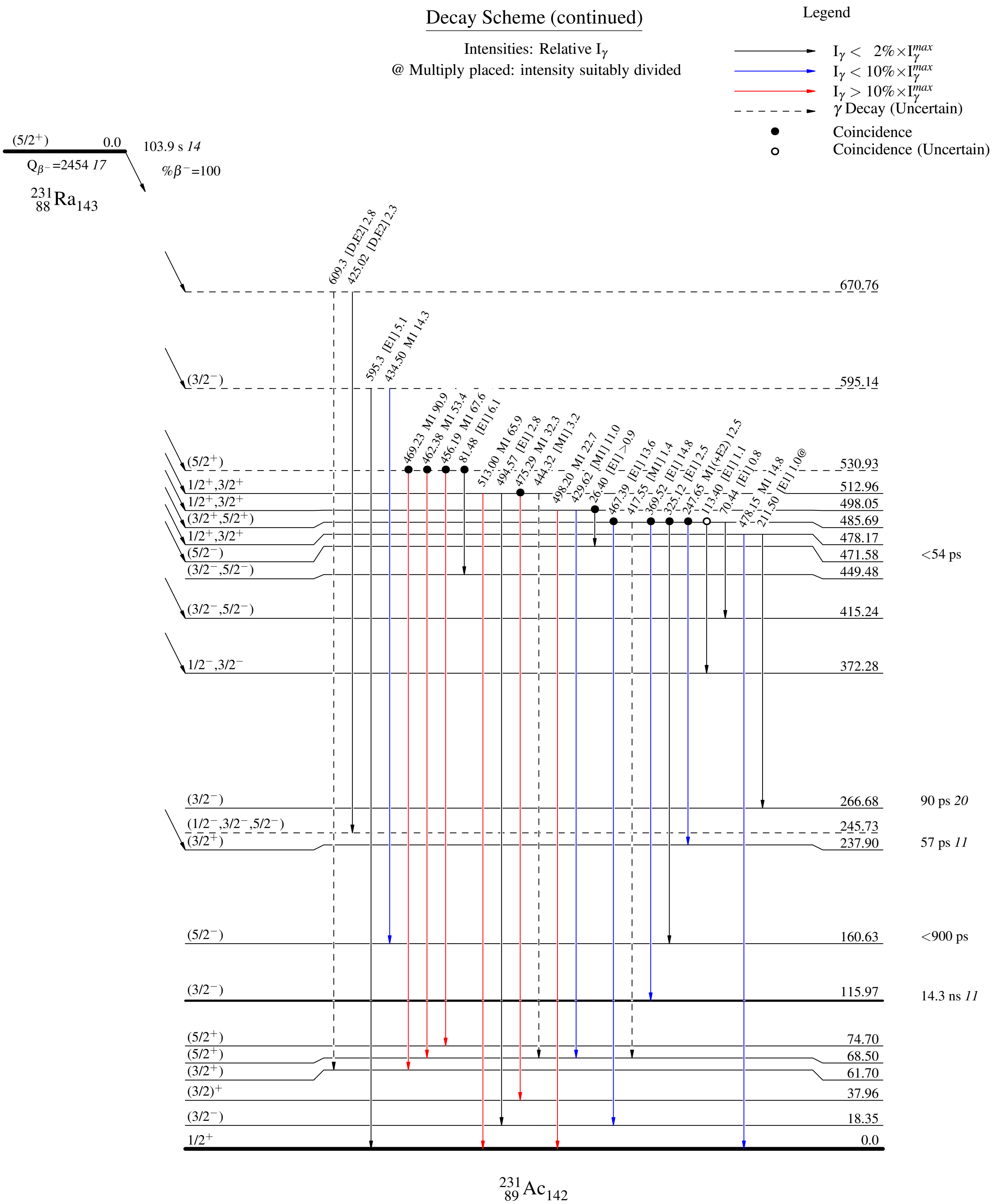


^{231}Ra β^- decay (103.9 s) 2008Bo29

Decay Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided



^{231}Ra β^- decay (103.9 s) 2008Bo29

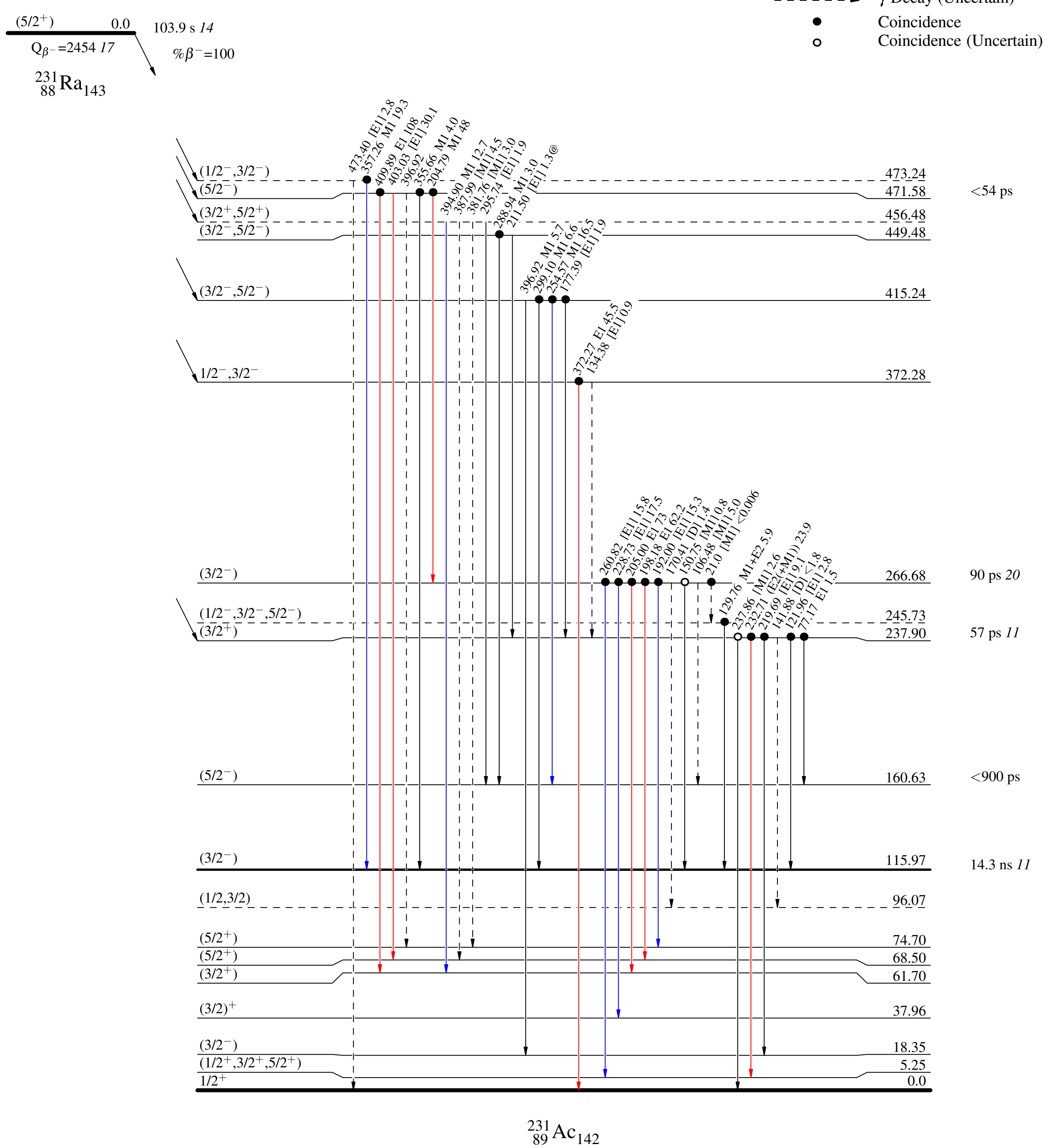
Decay Scheme (continued)

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)
- Coincidence
- Coincidence (Uncertain)



^{231}Ra β^- decay (103.9 s) 2008Bo29

Decay Scheme (continued)

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided