Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	B. Singh, A. Chakraborty, S. Bhattacharya	NDS 147, 382 (2018)	1-Dec-2017

Q(β^-)=−3502 *16*; S(n)=7512 *16*; S(p)=1876 *14*; Q(α)=9832 *10* 2017Wa10
S(2n)=13470 *17*, S(2p)=6192 *13* (2017Wa10).

^{217}Ac evaluated by B. Singh, A. Chakraborty and S. Bhattacharya.

^{217}Ac produced and identified by 1972No06, 1973No09 and 1973No02 in reactions: ^{207}Pb(^{14}N,4n) and ^{208}Pb(^{14}N,5n) at E=70-96 MeV at the cyclotron laboratory of the Institute of Physical and Chemical Research (now RIKEN); measured Eα, half-life of ground state and isomers in ^{217}Ac, angular distribution of α particles.

Decay scheme is basically as proposed by 1985De14 from their $\alpha\gamma$-, $\gamma\gamma$- and γ(ce) coincidences. In the level scheme shown by 1982GoZU, ordering of the 478.9 and 349.0 gammas was reversed, and their (486.4γ)(γ) coincidence spectrum indicates presence of the 349.0γ and absence of the 478.9γ. A 501.6-371.7-380.0-327.6 γ cascade was placed by 1983GoZX (also 1982GoZU) above the 1682 level, proposing levels at 3263, 2762, 2390 and 2010 keV, respectively. Due to the tentative nature of this unpublished work, these levels as well as a proposed 957 level are not adopted here, although, the data from this work can be found in the ^{209}Bi(^{12}C,4nγ) dataset.

^{217}Ac Levels

Cross Reference (XREF) Flags

- A ^{217}Ac IT decay (740 ns)
- B ^{221}Pa α decay (5.9 μs)
- C ^{209}Bi(^{12}C,4nγ):delayed γ

E(level)†	J$^\pi$	T$_{1/2}$	XREF	Comments
0.0	9/2$^-$	69 ns *4*	ABC	%α=100; %ε+%β^+<2 μ=+3.83 *5* (1985De14,2014StZZ) J$^\pi$: favored α decay to 9/2$^-$ g.s. of ^{213}Fr, configuration=πh$_{9/2}$. T$_{1/2}$: from 1985De14 ((rf)α(t), previous value was 72 ns *5* in 1981MaYW). Others: 75 ns *3* (1982GoZU); 111 ns *7* (1973No09, from (rf)α(t), previous value was 0.10 μs *1* in 1972No06). μ: from g factor=+0.85 *1* (1985De14), from time-differential perturbed $\alpha(\theta)$ measurements (α-TDPAD) technique. See 1985De14 for discussion on probable admixture in the main πh$_{9/2}$ g.s. configuration, and on the core-polarization effect. See also 1981MaYW from the same group. No α decays from ^{217}Ra or its descendants were observed by 1976No09; upper limit for $\varepsilon+\beta^+$ decay was set as 2%. T$_{1/2}$($\varepsilon+\beta^+$)≈1000 sec from gross β decay theory calculations of 1973Ta30. Therefore, prediction for $\varepsilon+\beta^+$ decay branch is ≈6.9×10^{-9}%. Measured Eα=9650 keV *10* (1973No09, also 1972No06,1973No02). Additional information 1.
660.2 *3*	13/2$^-$		A C	J$^\pi$: 660.3, E2 γ to 9/2$^-$; systematics of 13/2$^-$ states in neighboring nuclides. Configuration=πh$_{9/2}\otimes^{216}$Ra 2$^+$.
670.2 *3*	11/2$^-$		A C	J$^\pi$: 670.1, M1+E2 γ to 9/2$^-$; systematics of 11/2$^-$ states and shell model suggest configuration=^{216}Ra 2$^+\otimes\pi$h$_{9/2}$.
1146.6 *4*	17/2$^-$		A C	%α ≤ 0.27 *4* (1985De14) 10780 *15* α transition from 1147 and/or 1149 levels to ^{213}Fr g.s. J$^\pi$: 486.4, E2 γ to 13/2$^-$; shell model and analogy to ^{215}Fr, configuration=^{216}Ra 4$^+\otimes\pi$h$_{9/2}$.
1149.1 *3*	15/2$^-$		A C	%α ≤ 0.27 *4* (1985De14) 10780 *15* α transition from 1147 and/or 1149 levels to ^{213}Fr g.s. J$^\pi$: 489, M1(+E2) γ to 13/2$^-$; 478.9, E2 γ to 11/2$^-$; configuration=^{216}Ra 4$^+\otimes\pi$h$_{9/2}$.

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Adopted Levels, Gammas (continued)

^{217}Ac Levels (continued)

E(level)[†]	J^π	$T_{1/2}$	XREF	Comments
				E(level): note that 1983GoZX (also 1982GoZU) suggested this level at 1019 based on reversed ordering of the 349.0-478.9 γ cascade. $T_{1/2}$: see comment on half-life for 1528 level.
1498.1 *4*	$19/2^-$		A C	%$\alpha\leq$0.46 *13* (1985De14) 11137 *15* α (a doublet) from 1498 and/or 1528 levels to ^{213}Fr g.s. J^π: 351.5, M1+E2 γ to $17/2^-$; 349.0, E2 γ to $15/2^-$; configuration=^{216}Ra $6^+\otimes\pi h_{9/2}$.
1528.4 *5*	$(21/2)^-$	<10 ns	A C	%$\alpha\leq$0.46 *13* (1985De14) 11137 *15* α (a doublet) from 1498 and/or 1528 levels to ^{213}Fr g.s. J^π: 381.8, E2 γ to $17/2^-$; configuration=^{216}Ra $6^+\otimes\pi h_{9/2}$ with some ^{216}Ra $8^+\otimes\pi f_{7/2}$ admixture suggested for the $21/2^-$ and $23/2^-$ states by 1985De14 from fast M1 transition between these levels. $T_{1/2}$: from $\gamma\gamma$(t) (1985De14). Other: 8 ns *2* was measured by 1973No02 for the 11130α from either the 1149 or 1528 level. No level with 8 ns half-life was found by 1985De14, but could not be definitely ruled out either by the authors.
1682.2 *6*	$(23/2)^-$	<10 ns	A C	J^π: 153.8, M1+E2 γ to $(21/2)^-$. Probable configuration=^{216}Ra $8^+\otimes\pi h_{9/2}$. Fast M1 transition to the $21/2^-$ and absence of an E2 transition to the $19/2^-$ state was interpreted by 1985De14 as being due to an admixture of ^{216}Ra $8^+\otimes\pi f_{7/2}$ configuration. $T_{1/2}$: from $\gamma\gamma$(t) (1985De14).
1792.2 *6*	$(25/2)^-$		A	J^π: 110, M1 γ to $(23/2)^-$.
1916.2 *6*	$(27/2)^-$		A	J^π: 234, E2 γ to $(23/2)^-$.
2012.2 *7*	$(29/2)^+$	740 ns *40*	A	%α=4.51 *18*; %IT=95.49 *18* μ=+5.03 *7* (1985De14,2014StZZ) μ: from g factor=+0.347 *5* (1985De14), from time-differential perturbed α-angular distribution (α-TDPAD) technique. See also 1981MaYW from the same group. 10541 *1* α to an 1105 level in ^{213}Fr (α in coincidence with 1105γ in ^{213}Fr); 11137 *15* α to a 498 level in ^{213}Fr (α in coincidence with 498γ in ^{213}Fr); 11625 *17* α to ^{213}Fr g.s. J^π: 96γ, E1+M2 γ to $(27/2)^-$; 220γ, M2 γ to $(25/2)^-$. 1985De14 proposed configuration=$\nu g_{9/2}^{+2}\otimes\pi i_{13/2}$ and calculated g=0.36 *1* by using the g factors of −0.31 and 1.18 for $\nu g_{9/2}$ and $\pi i_{13/2}$ orbitals, respectively, measured for ^{215}Ac. $T_{1/2}$: from γ(t) (1985De14). Other measurement: 400 ns *100* (1973No02).

[†] From least-squares fit to Eγ data, assuming 0.3 keV uncertainty for each γ ray, except 1 keV when Eγ stated to nearest keV.

Adopted Levels, Gammas (continued)

$\gamma(^{217}Ac)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	δ[†]	α[#]	$I_{(\gamma+ce)}$	Comments
660.2	13/2$^-$	660.3	100	0.0	9/2$^-$	E2		0.0218		α(K)=0.01544 *22*; α(L)=0.00474 *7*; α(M)=0.001198 *17* α(N)=0.000318 *5*; α(O)=7.20×10^{-5} *11*; α(P)=1.252×10^{-5} *18*; α(Q)=6.89×10^{-7} *10*
670.2	11/2$^-$	670.1	100	0.0	9/2$^-$	M1+E2		0.055 *34*		α(K)=0.043 *29*; α(L)=0.0088 *43*; α(M)=0.00213 *98* α(N)=5.6×10^{-4} *26*; α(O)=1.30×10^{-4} *62*; α(P)=2.4×10^{-5} *12*; α(Q)=1.9×10^{-6} *13* α: value with uncertainty overlaps pure M1 and pure E2.
1146.6	17/2$^-$	486.4	100	660.2	13/2$^-$	E2‡		0.0434		α(K)=0.0275 *4*; α(L)=0.01181 *17*; α(M)=0.00305 *5* α(N)=0.000811 *12*; α(O)=0.000182 *3*; α(P)=3.08×10^{-5} *5*; α(Q)=1.282×10^{-6} *18*
1149.1	15/2$^-$	478.9	100 *25*	670.2	11/2$^-$	E2‡		0.0450		α(K)=0.0283 *4*; α(L)=0.01241 *18*; α(M)=0.00321 *5* α(N)=0.000854 *12*; α(O)=0.000191 *3*; α(P)=3.24×10^{-5} *5*; α(Q)=1.324×10^{-6} *19*
		489	75 *25*	660.2	13/2$^-$	M1(+E2)	<1	0.16 *4*		α(K)=0.130 *35*; α(L)=0.026 *5*; α(M)=0.0062 *11* α(N)=0.0016 *3*; α(O)=0.00038 *7*; α(P)=7.0×10^{-5} *14*; α(Q)=5.8×10^{-6} *16*
1498.1	19/2$^-$	349.0	76 *10*	1149.1	15/2$^-$	E2‡		0.1028		α(K)=0.0529 *8*; α(L)=0.0369 *6*; α(M)=0.00975 *14* α(N)=0.00259 *4*; α(O)=0.000576 *9*; α(P)=9.50×10^{-5} *14*; α(Q)=2.62×10^{-6} *4*
		351.5	100 *10*	1146.6	17/2$^-$	M1+E2	+0.65 *+20−10*	0.38 *5*		α(K)=0.30 *5*; α(L)=0.063 *5*; α(M)=0.0154 *11* α(N)=0.0041 *3*; α(O)=0.00094 *7*; α(P)=0.000171 *14*; α(Q)=1.34×10^{-5} *19*
1528.4	(21/2)$^-$	(30.3 *6*)	0.9 *1*	1498.1	19/2$^-$	[M1]		114 *7*	102 *9*	ce(L)/(γ+ce)=0.75 *4*; ce(M)/(γ+ce)=0.180 *15* ce(N)/(γ+ce)=0.048 *5*; ce(O)/(γ+ce)=0.0111 *10*; ce(P)/(γ+ce)=0.00206 *19*; ce(Q)/(γ+ce)=0.000183 *17* α(L)=86 *6*; α(M)=20.7 *13* α(N)=5.5 *4*; α(O)=1.28 *8*; α(P)=0.236 *15*; α(Q)=0.0210 *14* Transition was not observed. Eγ is from the level scheme.
		381.8	100 *11*	1146.6	17/2$^-$	E2‡		0.0803		α(K)=0.0442 *7*; α(L)=0.0267 *4*; α(M)=0.00702 *10* α(N)=0.00187 *3*; α(O)=0.000415 *6*; α(P)=6.90×10^{-5} *10*; α(Q)=2.15×10^{-6} *3*
1682.2	(23/2)$^-$	153.8	100	1528.4	(21/2)$^-$	M1+E2	+0.39 *8*	4.57 *18*		α(K)=3.52 *20*; α(L)=0.795 *20*; α(M)=0.195 *7* α(N)=0.0518 *17*; α(O)=0.0119 *4*; α(P)=0.00214 *5*; α(Q)=0.000161 *9*
1792.2	(25/2)$^-$	110	100	1682.2	(23/2)$^-$	M1(+E2)	<0.4	12.5 *6*		α(K)=9.6 *8*; α(L)=2.17 *22*; α(M)=0.53 *7* α(N)=0.141 *17*; α(O)=0.033 *4*; α(P)=0.0059 *5*; α(Q)=0.00045 *4*

$^{217}_{89}Ac_{128}$-3

Adopted Levels, Gammas (continued)

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

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	δ[†]	α[#]	Comments
1916.2	$(27/2)^-$	234	100	1682.2	$(23/2)^-$	E2[‡]		0.357 *8*	α(K)=0.1185 *20*; α(L)=0.175 *4*; α(M)=0.0472 *11* α(N)=0.0126 *3*; α(O)=0.00276 *7*; α(P)=0.000445 *10*; α(Q)=6.66×10^{-6} *12*
2012.2	$(29/2)^+$	96	50 *10*	1916.2	$(27/2)^-$	E1+M2	0.17 *+5−6*	2.0 *12*	B(E1)(W.u.)=1.4×10^{-8} *9*; B(M2)(W.u.)=0.20 *17* α(L)=1.44 *87*; α(M)=0.39 *24* α(N)=0.105 *64*; α(O)=0.024 *15*; α(P)=0.0043 *27*; α(Q)=3.2×10^{-4} *20*
		220	100 *20*	1792.2	$(25/2)^-$	M2		7.62 *17*	B(M2)(W.u.)=0.21 *6* α(K)=5.31 *11*; α(L)=1.72 *4*; α(M)=0.444 *10* α(N)=0.120 *3*; α(O)=0.0277 *7*; α(P)=0.00501 *12*; α(Q)=0.000403 *9* Mult.: small E3 admixture is not excluded.

[†] From ^{217}Ac IT decay (740 ns).

[‡] From ce data as well as $\gamma(\theta)$ data, M1 admixture is possible, however, based on the level scheme, mult=E2 is required.

[#] 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.

$^{217}_{89}Ac_{128}$-4

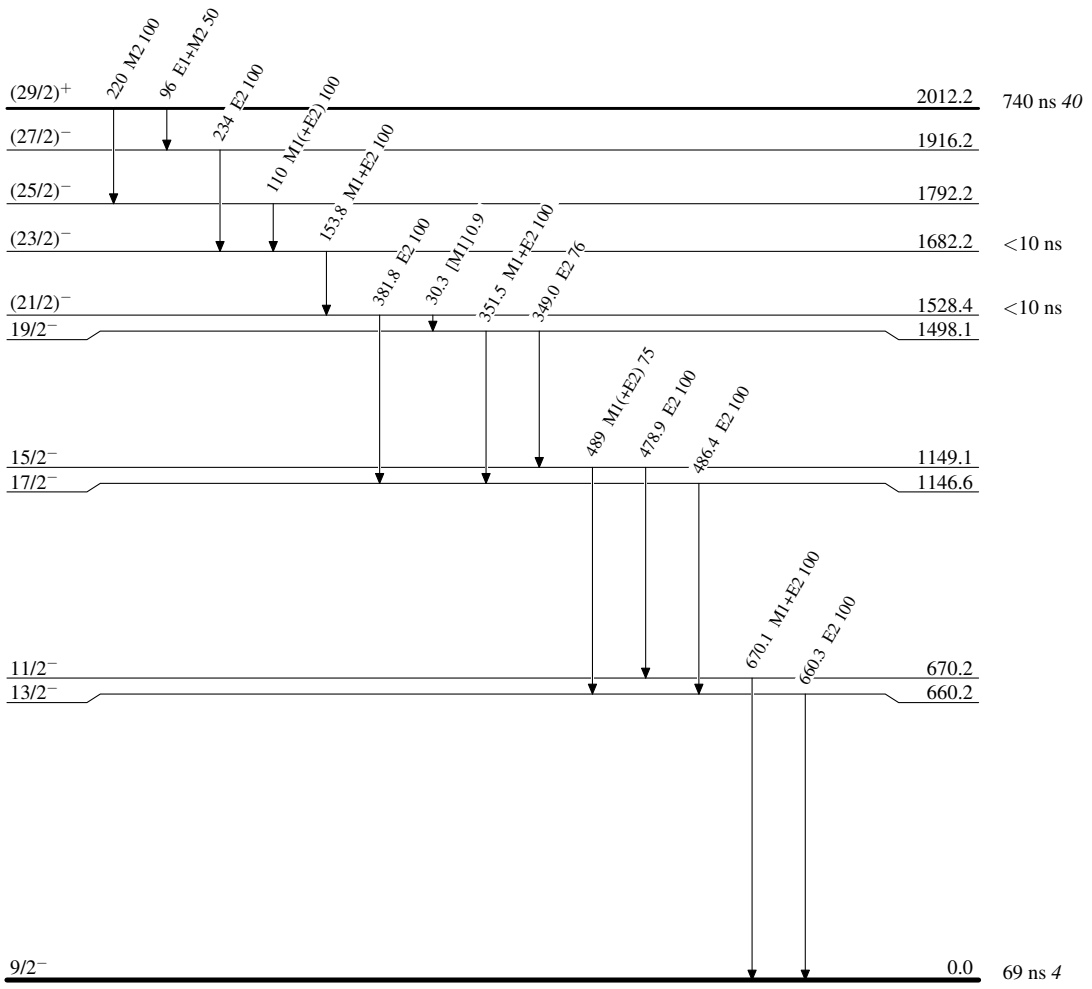
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{217}_{89}Ac_{128}$