^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 121, 561 (2014)	31-Mar-2014

Parent: ^{210}Rn: E=0.0; $J^\pi=0^+$; $T_{1/2}$=2.4 h *1*; Q(ε)=2367 *9*; %ε+%β^+ decay=4 *1*
Measured Eγ, Iγ, γγ coin, Ice. Detectors:Ge(Li), Si(Li), magnetic spectrometer.

^{210}At Levels

E(level)[†]	J^π[‡]	$T_{1/2}$	E(level)[†]	J^π[‡]	E(level)[†]	J^π[‡]
0.0	(5)$^+$	8.1 h *4*	768.95 *7*	(2)$^+$	1292.23 *6*	(2)$^+$
72.65 *5*	(4)$^+$		984.9 *1*	(3$^+$)	1488.59 *7*	(1)$^+$
496.17 *5*	(4)$^+$		1036.7 *1*	(3)$^+$	1525.52 *7*	(1)$^+$
530.88 *6*	(3)$^+$		1052.76 *7*	(2)$^+$	1967.0 *1*	(1,2)$^-$
721.28 *6*	(3)$^+$		1129.00 *7*	(2)$^+$	2281.0 *1*	(0,1)$^-$

† Deduced by evaluator from a least-squares fit to γ-ray energies.
‡ From Adopted Levels.

ε,β^+ radiations

E(decay)	E(level)	Iε[†]	Log *ft*	I(ε+β^+)[†]	Comments
(86 *9*)	2281.0	12 *3*	4.9 *3*	12 *3*	εL= 0.7 *3*; εM+= 0.32 *11*
(841 *9*)	1525.52	48 *3*	7.1 *1*	48 *3*	εK= 0.77 *3*; εL= 0.170 *6*; εM+= 0.0580 *21*
(878 *9*)	1488.59	40 *3*	7.2 *1*	40 *3*	εK= 0.77 *3*; εL= 0.169 *6*; εM+= 0.0575 *20*

† For absolute intensity per 100 decays, multiply by 0.04 *1*.

γ(^{210}At)

Iγ normalization: from decay scheme using Σ I(γ+ce) (g.s. + 72.2 level)=4 *1*%.
α(K)exp presented here have been deduced by evaluator using weighted averages with χ^2 minimization of K-electron and photon intensities from 1978Vy01 and 1973Jo09. These intensities were normalized to the same scale using α(K)(571γ)=0.0793 (M1, theory). K/L subshell ratios are from 1978Vy01.
Measured x-ray intensities: I(Kα_1 x ray)=1300 *120* (1978Vy01), 1560 *200* (1973Jo09); I(Kα_2 x ray)=760 *70*, I(Kβ_1' x ray)=450 *45*, I(Kβ_2' x ray)=145 *15* (1978Vy01), compare with I(Kα_1 x ray)=^{1365,}I(Kα_2 x ray)=^{818,}I(Kβ_1' x ray)=482, and I(Kβ_2' x ray)=150 deduced by evaluator from decay scheme, and thus confirm the quality and interpretation of the data.

E_γ[†]	I_γ[‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α[@]	Comments
72.70 *7*	347 *17*	72.65	(4)$^+$	0.0	(5)$^+$	M1	5.87	α(L)=4.47 *7*; α(M)=1.059 *16* α(N)=0.274 *4*; α(O)=0.0588 *9*; α(P)=0.00812 *12* Mult.: from α(L)exp=4.8 *6*.
^{x}147.3 *1*	9.3 *9*							
190.35 *7*	86 *4*	721.28	(3)$^+$	530.88	(3)$^+$	M1	1.95	α(K)=1.577 *23*; α(L)=0.281 *4*; α(M)=0.0665 *10* α(N)=0.01724 *25*; α(O)=0.00369 *6*; α(P)=0.000510 *8* Mult.: from α(K)exp=1.5 *2*, ce(K)/ce(L) exp=4.4 *8*.
196.3 *1*	196 *10*	1488.59	(1)$^+$	1292.23	(2)$^+$	M1	1.78	α(K)=1.446 *21*; α(L)=0.258 *4*; α(M)=0.0610 *9* α(N)=0.01580 *23*; α(O)=0.00338 *5*; α(P)=0.000467 *7* Mult.: from α(K)exp=1.6 *2*, ce(K)/ce(L) exp=4.7 *10*.
225.1 *1*	30 *3*	721.28	(3)$^+$	496.17	(4)$^+$	M1	1.217	α(K)=0.987 *14*; α(L)=0.1755 *25*; α(M)=0.0415 *6*

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^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09 (continued)

γ(^{210}At) (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.	δ[&]	α[@]	Comments
									α(N)=0.01076 *16*; α(O)=0.00230 *4*; α(P)=0.000318 *5* Mult.: from α(K)exp=1.2 *2*, ce(K)/ce(L) exp=3.8 *13*.
233.3 *1*	308 *9*	1525.52	$(1)^+$	1292.23	$(2)^+$	M1		1.102	α(K)=0.893 *13*; α(L)=0.1588 *23*; α(M)=0.0376 *6* α(N)=0.00973 *14*; α(O)=0.00208 *3*; α(P)=0.000288 *4* Mult.: from α(K)exp=0.85 *8*, ce(K)/ce(L) exp=4.0 *9*.
238.1 *1*	88 *4*	768.95	$(2)^+$	530.88	$(3)^+$	M1		1.041	α(K)=0.844 *12*; α(L)=0.1500 *21*; α(M)=0.0355 *5* α(N)=0.00919 *13*; α(O)=0.00197 *3*; α(P)=0.000272 *4* Mult.: from α(K)exp=0.93 *10*, ce(K)/ce(L) exp≈6.
239.5 *10*	≈10	1292.23	$(2)^+$	1052.76	$(2)^+$				
^{x}248[#]	≈5								
255.5 *1*	58 *3*	1292.23	$(2)^+$	1036.7	$(3)^+$	M1		0.856	α(K)=0.695 *10*; α(L)=0.1232 *18*; α(M)=0.0292 *4* α(N)=0.00755 *11*; α(O)=0.001617 *23*; α(P)=0.000223 *4* Mult.: from α(K)exp=0.71 *8*, ce(K)/ce(L) exp≈4.
283.75 *7*	30.0 *21*	1052.76	$(2)^+$	768.95	$(2)^+$	M1		0.641	α(K)=0.520 *8*; α(L)=0.0921 *13*; α(M)=0.0218 *3* α(N)=0.00564 *8*; α(O)=0.001208 *17*; α(P)=0.0001669 *24* Mult.: from α(K)exp=0.73 *18*.
307.3 *1*	47 *3*	1292.23	$(2)^+$	984.9	(3^+)	M1		0.515	α(K)=0.418 *6*; α(L)=0.0739 *11*; α(M)=0.01748 *25* α(N)=0.00453 *7*; α(O)=0.000970 *14*; α(P)=0.0001339 *19* Mult.: from α(K)exp=0.49 *9*, ce(K)/ce(L) exp=5.6 *20*.
314.0 *1*	226 *15*	2281.0	$(0,1)^-$	1967.0	$(1,2)^-$	M1		0.486	α(K)=0.394 *6*; α(L)=0.0697 *10*; α(M)=0.01647 *24* α(N)=0.00427 *6*; α(O)=0.000914 *13*; α(P)=0.0001262 *18* Mult.: from α(K)exp=0.40 *5*, ce(K)/ce(L) exp=5.2 *8*.
331.7 *3*	10.0 *15*	1052.76	$(2)^+$	721.28	$(3)^+$				
360.00 *7*	28.7 *17*	1129.00	$(2)^+$	768.95	$(2)^+$	M1		0.335	α(K)=0.272 *4*; α(L)=0.0479 *7*; α(M)=0.01132 *16* α(N)=0.00293 *5*; α(O)=0.000628 *9*; α(P)=8.67×10^{-5} *13* Mult.: from α(K)exp=0.30 *4*.
396.55 *7*	27.5 *14*	1525.52	$(1)^+$	1129.00	$(2)^+$	M1		0.258	α(K)=0.209 *3*; α(L)=0.0368 *6*; α(M)=0.00870 *13* α(N)=0.00225 *4*; α(O)=0.000482 *7*; α(P)=6.66×10^{-5} *10* Mult.: from α(K)exp=0.25 *3*.
423.5 *1*	91 *3*	496.17	$(4)^+$	72.65	$(4)^+$	M1		0.216	α(K)=0.1755 *25*; α(L)=0.0308 *5*; α(M)=0.00727 *11* α(N)=0.00188 *3*; α(O)=0.000403 *6*; α(P)=5.58×10^{-5} *8*

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^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09 (continued)

γ(^{210}At) (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ[&]	α[@]	Comments
[x]437.85 *7*	21 *2*					M1		0.197	Mult.: from α(K)exp=0.19 *2*, ce(K)/ce(L) exp=4.8 *7*. α(K)=0.1605 *23*; α(L)=0.0281 *4*; α(M)=0.00665 *10* α(N)=0.001721 *25*; α(O)=0.000369 *6*; α(P)=5.09×10^{-5} *8*
458.25 *7*	1000	530.88	(3)$^+$	72.65	(4)$^+$	M1+E2	≈0.68	≈0.1326	Mult.: from α(K)exp=0.17 *3*. α(K)≈0.1058; α(L)≈0.0204; α(M)≈0.00487 α(N)≈0.001261; α(O)≈0.000268; α(P)≈3.61×10^{-5}
472.80 *7*	75 *3*	1525.52	(1)$^+$	1052.76	(2)$^+$	M1		0.1608	Mult.,δ: from α(K)exp=0.11 *1*, ce(K)/ce(L) exp=5.2 *8*. α(K)=0.1308 *19*; α(L)=0.0229 *4*; α(M)=0.00540 *8* α(N)=0.001399 *20*; α(O)=0.000300 *5*; α(P)=4.14×10^{-5} *6*
[x]484.5[#]	≈5								
488.7 *1*	22.0 *10*	984.9	(3$^+$)	496.17	(4)$^+$	(M1+E2)		0.09 *6*	Mult.: from α(K)exp=0.13 *2*, ce(K)/ce(L) exp=4.5 *9*. α(K)=0.07 *5*; α(L)=0.015 *7*; α(M)=0.0036 *14* α(N)=0.0009 *4*; α(O)=0.00019 *8*; α(P)=2.6×10^{-5} *12*
496.15 *7*	86 *3*	496.17	(4)$^+$	0.0	(5)$^+$	M1		0.1414	Mult.: from α(K)exp≈0.08. α(K)=0.1150 *17*; α(L)=0.0201 *3*; α(M)=0.00474 *7* α(N)=0.001228 *18*; α(O)=0.000263 *4*; α(P)=3.64×10^{-5} *5*
521.9 *2*	71 *5*	1052.76	(2)$^+$	530.88	(3)$^+$	M1		0.1236	Mult.: from α(K)exp=0.09 *1*. α(K)=0.1006 *15*; α(L)=0.01754 *25*; α(M)=0.00414 *6* α(N)=0.001072 *15*; α(O)=0.000230 *4*; α(P)=3.18×10^{-5} *5*
540.0 *2*	38 *5*	1036.7	(3)$^+$	496.17	(4)$^+$	(M1+E2)		0.07 *5*	Mult.: from α(K)exp=0.12 *2*. α(K)=0.06 *4*; α(L)=0.011 *5*; α(M)=0.0027 *11* α(N)=0.0007 *3*; α(O)=0.00015 *7*; α(P)=2.0×10^{-5} *10*
570.95 *7*	494 *13*	1292.23	(2)$^+$	721.28	(3)$^+$	M1		0.0974	Mult.: from α(K)exp≈0.04. α(K)=0.0793 *12*; α(L)=0.01380 *20*; α(M)=0.00326 *5* α(N)=0.000843 *12*; α(O)=0.000181 *3*; α(P)=2.50×10^{-5} *4* Mult.: assumed M1 for normalizing K-conversion electron and photon intensities.
[x]591.9 *1*	23 *5*								α(K)exp≤0.03.
598.2 *1*	45 *4*	1129.00	(2)$^+$	530.88	(3)$^+$	(M1+E2)		0.05 *4*	α(K)=0.04 *3*; α(L)=0.008 *4*; α(M)=0.0020 *9* α(N)=0.00052 *22*; α(O)=0.00011 *5*; α(P)=1.5×10^{-5} *8*
648.70 *7*	496 *13*	721.28	(3)$^+$	72.65	(4)$^+$	M1		0.0696	Mult.: from α(K)exp≈0.03. α(K)=0.0567 *8*; α(L)=0.00982 *14*;

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^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09 (continued)

γ(^{210}At) (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[@]	Comments
								α(M)=0.00232 *4* α(N)=0.000600 *9*; α(O)=0.0001285 *18*; α(P)=1.778×10^{-5} *25* Mult.: from α(K)exp=0.056 *6*, ce(K)/ce(L) exp=5.8 *8*.
^{x}673[#]	≈20							
^{x}689[#]	≈10							
696.25 *7*	172 *5*	768.95	(2)$^+$	72.65	(4)$^+$	E2	0.01602	α(K)=0.01193 *17*; α(L)=0.00309 *5*; α(M)=0.000762 *11* α(N)=0.000197 *3*; α(O)=4.09×10^{-5} *6*; α(P)=5.14×10^{-6} *8* Mult.: from α(K)exp=0.012 *1*.
721.2 *1*	40.6 *18*	721.28	(3)$^+$	0.0	(5)$^+$	(E2)	0.01488	α(K)=0.01116 *16*; α(L)=0.00281 *4*; α(M)=0.000692 *10* α(N)=0.000179 *3*; α(O)=3.72×10^{-5} *6*; α(P)=4.70×10^{-6} *7* Mult.: M1+E2 from α(K)exp=0.028 *3*. Level scheme requires E2.
756.6 *1*	98 *4*	1525.52	(1)$^+$	768.95	(2)$^+$	M1	0.0465	α(K)=0.0379 *6*; α(L)=0.00654 *10*; α(M)=0.001542 *22* α(N)=0.000399 *6*; α(O)=8.55×10^{-5} *12*; α(P)=1.184×10^{-5} *17* Mult.: from α(K)exp=0.037 *4*, ce(K)/ce(L) exp≈5.6.
761.4 *1*	317 *10*	1292.23	(2)$^+$	530.88	(3)$^+$	M1	0.0457	α(K)=0.0373 *6*; α(L)=0.00643 *9*; α(M)=0.001517 *22* α(N)=0.000393 *6*; α(O)=8.41×10^{-5} *12*; α(P)=1.164×10^{-5} *17* Mult.: from α(K)exp=0.032 *3*, ce(K)/ce(L) exp=5.8 *11*.
767.30 *7*	195 *6*	1488.59	(1)$^+$	721.28	(3)$^+$	E2	0.01309	α(K)=0.00992 *14*; α(L)=0.00239 *4*; α(M)=0.000587 *9* α(N)=0.0001517 *22*; α(O)=3.16×10^{-5} *5*; α(P)=4.02×10^{-6} *6* Mult.: from α(K)exp=0.010 *1*, ce(K)/ce(L) exp=5.3 *14*.
796	≈8	1292.23	(2)$^+$	496.17	(4)$^+$			
804.2 *1*	82 *4*	1525.52	(1)$^+$	721.28	(3)$^+$	E2	0.01190	α(K)=0.00909 *13*; α(L)=0.00212 *3*; α(M)=0.000519 *8* α(N)=0.0001342 *19*; α(O)=2.80×10^{-5} *4*; α(P)=3.59×10^{-6} *5* Mult.: from α(K)exp=0.010 *2*.
^{x}828[#]	≈3.5							
837	≈9	1967.0	(1,2)$^-$	1129.00	(2)$^+$			
^{x}879.65 *7*	28 *2*					(E2)	0.00994	α(K)=0.00769 *11*; α(L)=0.001703 *24*; α(M)=0.000414 *6* α(N)=0.0001070 *15*; α(O)=2.24×10^{-5} *4*; α(P)=2.90×10^{-6} *4* Mult.: from α(K)exp≈0.01.
911.9 *1*	35 *4*	984.9	(3$^+$)	72.65	(4)$^+$			
914.15 *7*	174 *6*	1967.0	(1,2)$^-$	1052.76	(2)$^+$	(E1)	0.00332	α(K)=0.00276 *4*; α(L)=0.000435 *6*; α(M)=0.0001013 *15* α(N)=2.61×10^{-5} *4*; α(O)=5.56×10^{-6} *8*; α(P)=7.57×10^{-7} *11* Mult.: from α(K)exp=0.0044 *14*.

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^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09 (continued)

γ(^{210}At) (continued)

Eγ[†]	Iγ[‡a]	Ei(level)	J^π_i	Ef	J^π_f	Mult.	α[@]	Comments
957.75 *7*	166 *7*	1488.59	(1)+	530.88	(3)+	E2	0.00841	α(K)=0.00657 *10*; α(L)=0.001391 *20*; α(M)=0.000336 *5* α(N)=8.70×10^{-5} *13*; α(O)=1.83×10^{-5} *3*; α(P)=2.38×10^{-6} *4* Mult.: from α(K)exp=0.0075 *12*.
964.05 *7*	76 *5*	1036.7	(3)+	72.65	(4)+	M1(+E2)	0.017 *9*	α(K)=0.013 *7*; α(L)=0.0024 *11*; α(M)=0.00057 *25* α(N)=0.00015 *7*; α(O)=3.2×10^{-5} *14*; α(P)=4.3×10^{-6} *20* Mult.: from α(K)exp=0.016 *3*.
980.15 *7*	163 *11*	1052.76	(2)+	72.65	(4)+	E2	0.00804	α(K)=0.00630 *9*; α(L)=0.001319 *19*; α(M)=0.000318 *5* α(N)=8.23×10^{-5} *12*; α(O)=1.731×10^{-5} *25*; α(P)=2.26×10^{-6} *4* Mult.: from α(K)exp=0.0068 *11*.
994.60 *7*	173 *7*	1525.52	(1)+	530.88	(3)+	E2	0.00782	α(K)=0.00614 *9*; α(L)=0.001275 *18*; α(M)=0.000308 *5* α(N)=7.95×10^{-5} *12*; α(O)=1.672×10^{-5} *24*; α(P)=2.19×10^{-6} *3* Mult.: from α(K)exp=0.0060 *1*.
[x]1164.5[#]	≈6							
1198.05 *7*	138 *6*	1967.0	(1,2)−	768.95	(2)+	E1	0.00207	α(K)=0.001711 *24*; α(L)=0.000265 *4*; α(M)=6.17×10^{-5} *9* α(N)=1.591×10^{-5} *23*; α(O)=3.39×10^{-6} *5*; α(P)=4.65×10^{-7} *7*; α(IPF)=1.368×10^{-5} *20* Mult.: from α(K)exp=0.0022 *6*.
[x]1202.5 *1*	27 *3*					M1	0.01398	α(K)=0.01143 *16*; α(L)=0.00195 *3*; α(M)=0.000458 *7* α(N)=0.0001185 *17*; α(O)=2.54×10^{-5} *4*; α(P)=3.52×10^{-6} *5*; α(IPF)=7.60×10^{-6} *11* Eγ,Iγ: from 1978Vy01. Mult.: from α(K)exp=0.013 *4*.
[x]1743[#]								

[†] Weighted average of values from 1978Vy01 and 1973Jo09.
[‡] Weighted average with χ^2 minimization of values from 1978Vy01 and 1973Jo09.
[#] From 1978Vy01. Tentatively assigned to ^{210}Rn ε decay.
[@] Additional information 1.
[&] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.
[a] For absolute intensity per 100 decays, multiply by 0.0019 *5*.
[x] γ ray not placed in level scheme.

^{210}Rn ε decay (2.4 h) 1978Vy01,1973Jo09

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays