^{205}Fr ε decay 2010De04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 166, 1 (2020)	20-Apr-2020

Parent: ^{205}Fr: E=0; J^π=9/2$^-$; $T_{1/2}$=3.90 s *7*; Q(ε)=6400 *9*; %ε+%β^+ decay=1.5 *4*

^{205}Fr-Q(ε): From 2017Wa10.

2010De04: 1.4 GeV proton beam induced spallation on a 49 mg/cm^2 UC_2-C target at ISOLDE-CERN facility. Francium was surface ionized, accelerated to 30 keV and mass separated. Moving-tape system. Measured Eγ, Iγ, γγ-t coin, ce, γ(ce)-t coin using two HPGe detectors, located at 90° and 180°, surrounding a 4 mm thick Si(Li) detector placed inside a MINI-ORANGE spectrometer.

^{205}Rn Levels

E(level)†	J^π‡	$T_{1/2}$‡	Comments
0.0#	5/2$^-$	170 s *4*	
31.40@ *20*	(3/2$^-$)		
387.60 *18*	(7/2$^-$)		
545.30? *20*	(7/2$^-$,9/2$^-$)		E(level),J^π: The assignment is uncertain, since the depopulating 545.3-keV γ ray could feed the 31.4-keV level (J^π=3/2$^-$).
596.20 *18*	(7/2$^-$)		
633.10 *20*	(7/2$^-$)		
657.1?& *5*	(13/2$^+$)	>10 s	$T_{1/2}$: Estimated in 2010De04, based on observed ce events within a 18.6 s time window.
1049.1? *3*	(7/2$^-$,9/2$^-$,11/2$^-$)		E(level),J^π: Tentative assignment, given the uncertainty with the energy of the 545.30-keV level (1080.5 if 545.3γ feeds the 31.4 keV level).

† From a least-squares fit to Eγ.

‡ From Adopted Levels, based on deduced γ-ray transition multipolarities in 2010De04.

configuration=$\nu(f^{-1}_{5/2})$.

@ configuration=$\nu(p^{-1}_{3/2})$.

& configuration=$\nu(i^{-1}_{13/2})$.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ †	Iε†	Log *ft*	I(ε+β^+)†	Comments
(5351 *9*)	1049.1?	0.040 *16*	0.060 *24*	6.96 *21*	0.10 *4*	av Eβ=1946.3 *41*; εK=0.4770 *12*; εL=0.08961 *22*; εM+=0.02999 *8*
(5743 *9*)	657.1?	≈0.062	≈0.18	≈8.6^{1u}	≈0.24	av Eβ=2051.0 *40*; εK=0.5910 *9*; εL=0.11405 *18*; εM+=0.03834 *6* I(ε+β^+): From log *ft*=8.6 for the same $\pi h_{9/2}$ to $\nu i_{13/2}$ transition in the ^{201}Pb isotone (2007Ko06).
(5767 *9*)	633.10	0.09 *3*	0.11 *3*	6.77 *18*	0.20 *6*	av Eβ=2135.4 *41*; εK=0.4266 *11*; εL=0.07998 *20*; εM+=0.02676 *7*
(5804 *9*)	596.20	0.21 *6*	0.23 *7*	6.44 *18*	0.44 *13*	av Eβ=2152.3 *41*; εK=0.4224 *11*; εL=0.07916 *20*; εM+=0.02648 *7*
(5855 *9*)	545.30?	0.10 *3*	0.10 *3*	6.79 *18*	0.20 *6*	av Eβ=2175.5 *41*; εK=0.4165 *11*; εL=0.07804 *20*; εM+=0.02611 *7*
(6012 *9*)	387.60	0.16 *5*	0.15 *4*	6.65 *18*	0.31 *9*	av Eβ=2247.5 *42*; εK=0.3986 *10*; εL=0.07464 *19*; εM+=0.02497 *7*

† Absolute intensity per 100 decays.

^{205}Fr ε decay 2010De04 (continued)

$\gamma(^{205}Rn)$

Iγ normalization: From the decay scheme and ΣI$_i$(γ+ce)(g.s.)=100% and by assuming no %ε+%β$^+$ direct feeding to the ground (J^π=5/2$^-$) and the first excited (J^π=3/2$^-$) states.

E_γ	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[‡]	Comments
31.4 *2*	2.06 *7*	31.40	(3/2$^-$)	0.0	5/2$^-$	[M1]		76.1 *18*	%Iγ=0.00604 *17* α(L)=57.8 *14*; α(M)=13.8 *4* α(N)=3.59 *9*; α(O)=0.786 *19*; α(P)=0.115 *3* Iγ: From intensity balance at the 31.40-keV level and by assuming no direct %ε+%β$^+$ feeding to this level (ΔJ=3).
356.3 *2*	52 *4*	387.60	(7/2$^-$)	31.40	(3/2$^-$)	E2		0.0840	%Iγ=0.16 *5* α(K)=0.0476 *7*; α(L)=0.0271 *4*; α(M)=0.00704 *10* α(N)=0.00183 *3*; α(O)=0.000380 *6*; α(P)=4.65×10^{-5} *7* Mult.: α(K)exp=0.048 *11*.
387.5 *2*	36 *3*	387.60	(7/2$^-$)	0.0	5/2$^-$	M1		0.297	%Iγ=0.11 *3* α(K)=0.241 *4*; α(L)=0.0429 *6*; α(M)=0.01017 *15* α(N)=0.00265 *4*; α(O)=0.000580 *9*; α(P)=8.47×10^{-5} *12* Mult.: α(K)exp=0.205 *40*.
503.8 *2*	33 *3*	1049.1?	(7/2$^-$,9/2$^-$,11/2$^-$)	545.30?	(7/2$^-$,9/2$^-$)	E2		0.0345	%Iγ=0.102 *29* α(K)=0.0233 *4*; α(L)=0.00844 *12*; α(M)=0.00214 *3* α(N)=0.000558 *8*; α(O)=0.0001171 *17*; α(P)=1.506×10^{-5} *22* Mult.: α(K)exp=0.022 *5*.
545.3 *2*	98 *8*	545.30?	(7/2$^-$,9/2$^-$)	0.0	5/2$^-$	E2		0.0287	%Iγ=0.30 *9* α(K)=0.0199 *3*; α(L)=0.00662 *10*; α(M)=0.001672 *24* α(N)=0.000435 *7*; α(O)=9.17×10^{-5} *13*; α(P)=1.192×10^{-5} *17* Mult.: α(K)exp=0.016 *7*.
564.7 *2*	100	596.20	(7/2$^-$)	31.40	(3/2$^-$)	E2		0.0265	%Iγ=0.30 *8* α(K)=0.0186 *3*; α(L)=0.00597 *9*; α(M)=0.001503 *21* α(N)=0.000391 *6*; α(O)=8.25×10^{-5} *12*; α(P)=1.078×10^{-5} *16* Mult.: α(K)exp=0.022 *3*.
596.3 *2*	41 *4*	596.20	(7/2$^-$)	0.0	5/2$^-$	M1		0.0939	%Iγ=0.13 *4* α(K)=0.0763 *11*;

Continued on next page (footnotes at end of table)

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γ(^{205}Rn) (continued)

E_γ	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[‡]	Comments
									α(L)=0.01343 *19*; α(M)=0.00318 *5* α(N)=0.000828 *12*; α(O)=0.000181 *3*; α(P)=2.65×10^{-5} *4* Mult.: α(K)exp=0.069 *9*.
633.1 *2*	63 *5*	633.10	(7/2$^-$)	0.0	5/2$^-$	M1+E2	1.8 *4*	0.035 *6*	%Iγ=0.20 *6* α(K)=0.027 *6*; α(L)=0.0060 *8*; α(M)=0.00146 *17* α(N)=0.00038 *5*; α(O)=8.2×10^{-5} *10*; α(P)=1.13×10^{-5} *16* Mult.: α(K)exp=0.027 *3*. δ: From α(K)exp and the briccmixing program.
657.1 *5*	≈36	657.1?	(13/2$^+$)	0.0	5/2$^-$	[M4]		0.889	%Iγ≈0.11 α(K)=0.586 *9*; α(L)=0.224 *4*; α(M)=0.0593 *9* α(N)=0.01571 *23*; α(O)=0.00337 *5*; α(P)=0.000458 *7* E_γ: From 2010De04, based on the observed 558.7-keV ce line in coincidence with the Rn X rays. The γ rays is highly contaminated. I_γ: From %ε+%β^+ feeding to this level.

† From the measured α(K)exp in 2010De04.
‡ Additional information 1.
# For absolute intensity per 100 decays, multiply by 0.0031 *8*.

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Decay Scheme