Adopted Levels, Gammas

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

Q(β^-)=−7150 *70*; S(n)=9988 *26*; S(p)=629 *11*; Q(α)=7054.7 *24* 2017Wa10

^{205}Fr Levels

Cross Reference (XREF) Flags

A ^{209}Ac α decay
B ^{169}Tm(^{40}Ar,4nγ)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0	9/2$^-$	3.90 s *7*	AB	%α=98.5 *4*; %ε+%β^+=1.5 *4* μ=+3.80 *3*; Q=−0.308 *18* %ε+%β^+: 1.5% 2 from 2010De04 using the γ-ray intensities in ^{201}Po and ^{205}Rn, assuming no direct feeding to the ground and first-excited states, and %ε+%β^+(^{201}At)=29%. The recommended uncertainty is determined by the evaluator by taking in quadratures the uncertainties of %ε+%β^+(^{205}Fr)=1.5% 2 (2010De04) and %ε+%β^+(^{201}At)=29% 7. Others: upper limit on %ε+%β^+<3 (1974Ho27) based on non-observation of Eα=6262 keV (^{205}Rn); %ε+%β^+<1 (1981Ri04). μ: From 2015Vo05, using the collinear laser spectroscopy technique. Others: +3.83 *5* (2013Fl09,2014Ly01) and +3.81 *5* (2013Vo10). Q: From 2015Vo05, using the collinear laser spectroscopy technique. Other: −0.351 *4* (2013Vo10). δ<r^2>(^{205}Fr,^{208}Fr)=−0.0983 fm^2 *1* (2015Vo05) and −0.0995 fm^2 *4* (2013Vo10). δ<r^2>(^{203}Fr,^{221}Fr)=−1.475 fm^2 *7*(exp) *15*(syst) (2013Fl09,2014Ly01). J$^\pi$: From the measure hyperfine structure (2013Vo10,2013Fl09,2015Vo05); π is from μ and systematics of similar structures in neighboring nuclei. $T_{1/2}$: Weighted average (external uncertainty) of 3.96 s *4* (1981Ri04), 3.80 s *3* (2005De01), and 4.02 s *4* (2010De04, weighted average of all values quoted in Table I). Others: 3.7 s *1* (1974Ho27), 3.7 s *2* (1967Va20), and 3.7 s *4* (1964Gr04), 3.7 s *6* (2015Ma63). Eα=6910 keV *20* (1964Gr04), 6917 keV *5* (1967Va20), 6912 keV *5* (1974Ho27), 6917 keV *5* (1981Ri04), 6915 keV *1* (1995Le04), 6916 keV *5* (2005De01), and 6934 keV *3* (2015Ma63). configuration: $\pi(h^{+1}_{9/2})$.
209.0 *10*	(7/2$^-$)		B	J$^\pi$: 209γ to 9/2$^-$; proposed configuration. configuration: $\pi(f^{+1}_{7/2})$.
444.0 *12*	(5/2$^-$)		B	J$^\pi$: 237γ to 7/2$^-$, 444γ to 9/2$^-$; proposed configuration. configuration: $\pi(h^{+1}_{9/2})\otimes 2^+$.
516.80[#] *20*	13/2$^-$		B	J$^\pi$: 516.8γ (E2) to 9/2$^-$; proposed configuration. configuration: $\pi(h^{+1}_{9/2})\otimes 2^+$.
544.0[@] *10*	13/2$^+$	80 ns *20*	B	J$^\pi$: 544γ (M2) to 9/2$^-$; proposed configuration. $T_{1/2}$: From 2012Ja01 (estimate) in ^{169}Tm(^{40}Ar,4nγ), based on the feeding intensity of the isomer measured by the JUROGAM array (target position), the number of events detected in the GREAT clover detector (focal plane), and the time-of-flight of the recoiling nuclei between the target position and focal plane. configuration: $\pi(i^{+1}_{13/2})$.
609 *6*	(1/2$^+$)	1.15 ms *4*	B	%IT=100 J$^\pi$: 165γ to (5/2$^-$); proposed configuration. $T_{1/2}$: From implant-ce(t) in ^{169}Tm(^{40}Ar,4nγ) (2012Ja01). configuration: $\pi(s^{+1}_{1/2})$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{205}Fr Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
763 *6*	(5/2$^+$)	B	J$^{\pi}$: 154.3γ to (1/2$^+$).
840.0? *14*	(11/2$^-$)	B	J$^{\pi}$: 631γ to (7/2$^-$).
1020.6[@] *10*	15/2$^+$	B	J$^{\pi}$: 476.6γ (M1) to 13/2$^+$.
1097.30[#] *23*	17/2$^-$	B	J$^{\pi}$: 580.5γ (E2) to 13/2$^-$; proposed configuration. configuration: $\pi(h^{+1}_{9/2})\otimes 4^+$.
1169.8 *11*		B	
1176? *6*	(9/2$^+$)	B	J$^{\pi}$: 413.1γ to (5/2$^+$).
1197.2[@] *10*	17/2$^+$	B	J$^{\pi}$: 175.8γ to 15/2$^+$, 653.2γ (E2) to 13/2$^+$.
1588.5 *10*	(17/2$^+$)	B	J$^{\pi}$: 390.6γ to 17/2$^+$, 568.5γ D to 15/2$^+$. configuration: $\pi(h^{+1}_{9/2})\otimes\nu(f^{-1}_{5/2},i^{-1}_{13/2})_{5^-}$ or $\pi(h^{+1}_{9/2})\otimes\nu(p^{-1}_{3/2},i^{-1}_{13/2})_{5^-}$.
1592.8 *3*		B	
1643.9[@] *10*	19/2$^+$	B	J$^{\pi}$: 446.6γ to 17/2$^+$, 623.5γ to 15/2$^+$.
1761.90[#] *25*	21/2$^-$	B	J$^{\pi}$: 664.6γ (E2) to 17/2$^-$; proposed configuration. configuration: $\pi(h^{+1}_{9/2})\otimes 6^+$.
1827.8[@] *11*	21/2$^+$	B	J$^{\pi}$: 183.6γ to 19/2$^+$, 630.9γ (E2) to 17/2$^+$.
1873.5 *11*	(19/2$^+$)	B	J$^{\pi}$: 285.0γ to (17/2$^+$).
1894.1 *11*	(21/2$^+$)	B	J$^{\pi}$: 305.6γ to (17/2$^+$).
2037.2 *3*	(23/2$^-$)	B	J$^{\pi}$: 275.3γ D to 21/2$^-$. configuration: $\pi(h^{+2}_{9/2}f^{+1}_{7/2})$.
2039.7 *3*		B	
2080.5 *3*		B	
2139.5? *11*	(21/2$^+$)	B	J$^{\pi}$: 550.6γ to (17/2$^+$).
2185.4[@] *11*	23/2$^+$	B	J$^{\pi}$: 358.2γ (M1) to 21/2$^+$, 541.4γ (E2) to 19/2$^+$. configuration: $\pi(h^{+1}_{9/2})\otimes\nu(f^{-1}_{5/2},i^{-1}_{13/2})_{7^-}$ or $\pi(h^{+1}_{9/2})\otimes\nu(p^{-1}_{3/2},i^{-1}_{13/2})_{7^-}$.
2189.8 *11*	(21/2$^+$)	B	J$^{\pi}$: 601.3γ to (17/2$^+$).
2348.3 *11*	(27/2$^+$)	B	J$^{\pi}$: 162.9γ (E2) to 23/2$^+$. configuration: $\pi(h^{+1}_{9/2})\otimes\nu(f^{-1}_{5/2},i^{-1}_{13/2})_{9^-}$.
2441.6 *11*	(23/2$^+$)	B	J$^{\pi}$: 547.5γ D to (21/2$^+$).
2481.1[#] *4*	(25/2$^-$)	B	J$^{\pi}$: 719.2γ to 21/2$^-$; proposed configuration. configuration: $\pi(h^{+5}_{9/2})$ or $\pi(h^{+3}_{9/2})\otimes 2^+$.
2643.0 *4*	(27/2$^-$)	B	J$^{\pi}$: 605.8γ to (23/2$^-$). configuration: $\pi(h^{+4}_{9/2}f^{+1}_{7/2})$ or $\pi(h^{+2}_{9/2}f^{+1}_{7/2})\otimes 2^+$.
2644.3 *11*	(29/2$^+$)	B	J$^{\pi}$: 296.0γ to (27/2$^+$). configuration: $\pi(h^{+1}_{9/2})\otimes\nu(f^{-1}_{7/2},i^{-1}_{13/2})$.
2831.1? *11*	(25/2$^+$)	B	J$^{\pi}$: 640.9γ to (21/2$^+$).
2922.8 *11*	(27/2$^+$)	B	J$^{\pi}$: 481.2γ to (23/2$^+$).
2996.5 *11*	(31/2$^+$)	B	J$^{\pi}$: 648.2γ to (27/2$^+$).
3081.6 *11*	(33/2$^+$)	B	J$^{\pi}$: 437.3γ (Q) to (29/2$^+$).

[†] From least squares fit to Eγ.

[‡] From the deduced γ-ray transition multipolarities in ^{169}Tm(^{40}Ar,4nγ) and systematics of structures in neighboring nuclei. Specific arguments are given with most levels.

[#] Seq.(A): Based on the $\pi(h^{+1}_{9/2})$ state.

[@] Seq.(B): Based on the $\pi(i^{+1}_{13/2})$ state.

Adopted Levels, Gammas (continued)

$\gamma(^{205}Fr)$

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	Comments
209.0	$(7/2^-)$	209 *1*	100	0.0	$9/2^-$		
444.0	$(5/2^-)$	235 *1*		209.0	$(7/2^-)$		
		444 *2*		0.0	$9/2^-$		
516.80	$13/2^-$	516.8 *2*	100	0.0	$9/2^-$	(E2)	Mult.: A_2=+0.25 *1*.
544.0	$13/2^+$	544 *1*	100	0.0	$9/2^-$	(M2)	B(M2)(W.u.)=0.23 *6* Mult.: α(K)exp=0.25 *10* (2012Ja01).
609	$(1/2^+)$	(165 *5*)	100	444.0	$(5/2^-)$	[M2]	B(M2)(W.u.)=0.0063 *10* E_γ: From the observed summed (K+L+M)ce peak at 169 keV and GEANT4 simulations of the $J^\pi=(1/2^+)$ isomer decay in ^{169}Tm(^{40}Ar,4nγ) (2012Ja01).
763	$(5/2^+)$	154.3[#] *5*	100	609	$(1/2^+)$		
840.0?	$(11/2^-)$	631[‡] *1*	100	209.0	$(7/2^-)$		
1020.6	$15/2^+$	476.6 *2*	100	544.0	$13/2^+$	(M1)	Mult.: A_2=−0.17 *4*.
1097.30	$17/2^-$	580.5 *1*	100	516.80	$13/2^-$	(E2)	Mult.: A_2=0.28 *4*.
1169.8		653[‡] *1*	100	516.80	$13/2^-$		
1176?	$(9/2^+)$	413.1[#] *5*	100	763	$(5/2^+)$		
1197.2	$17/2^+$	175.8 *1*	6.7 *6*	1020.6	$15/2^+$		
		653.2[‡] *1*	100 *3*	544.0	$13/2^+$	(E2)	Mult.: A_2=+0.21 *5*.
1588.5	$(17/2^+)$	390.6 *1*	14.2 *11*	1197.2	$17/2^+$		
		568.5 *1*	100 *4*	1020.6	$15/2^+$	D	Mult.: A_2=−0.28 *16*.
1592.8		1076.0 *2*	100	516.80	$13/2^-$		
1643.9	$19/2^+$	446.6 *1*	100 *4*	1197.2	$17/2^+$		
		623.5 *2*	37 *4*	1020.6	$15/2^+$		
1761.90	$21/2^-$	664.6 *1*	100	1097.30	$17/2^-$	(E2)	Mult.: A_2=+0.29 *7*.
1827.8	$21/2^+$	183.6 *2*	10.0 *13*	1643.9	$19/2^+$		
		630.9[‡] *2*	100 *4*	1197.2	$17/2^+$	(E2)	Mult.: A_2=+0.24 *3*.
1873.5	$(19/2^+)$	285.0 *1*	100	1588.5	$(17/2^+)$		
1894.1	$(21/2^+)$	305.6 *1*	100	1588.5	$(17/2^+)$		
2037.2	$(23/2^-)$	275.3 *1*	100	1761.90	$21/2^-$	D	Mult.: A_2=−0.51 *13*.
2039.7		942.4 *2*	100	1097.30	$17/2^-$		
2080.5		983.2 *2*	100	1097.30	$17/2^-$	Q	Mult.: A_2=+0.25 *1*.
2139.5?	$(21/2^+)$	550.6[#] *3*	100	1588.5	$(17/2^+)$		
2185.4	$23/2^+$	358.2 *6*	100 *6*	1827.8	$21/2^+$	(M1)	Mult.: A_2=−0.29 *11*.
		541.4 *2*	40 *6*	1643.9	$19/2^+$	(E2)	Mult.: A_2=+0.6 *3*.
2189.8	$(21/2^+)$	601.3 *1*	100	1588.5	$(17/2^+)$		
2348.3	$(27/2^+)$	162.9 *1*	100	2185.4	$23/2^+$	(E2)	Mult.: A_2=+0.23 *9*.
2441.6	$(23/2^+)$	547.5 *1*	100	1894.1	$(21/2^+)$	D	Mult.: A_2=−0.48 *4*.
2481.1	$(25/2^-)$	719.2 *2*	100	1761.90	$21/2^-$		
2643.0	$(27/2^-)$	605.8 *3*	100	2037.2	$(23/2^-)$		
2644.3	$(29/2^+)$	296.0 *2*	100	2348.3	$(27/2^+)$		
2831.1?	$(25/2^+)$	640.9[#] *2*	100	2189.8	$(21/2^+)$		
2922.8	$(27/2^+)$	481.2 *2*	100	2441.6	$(23/2^+)$		
2996.5	$(31/2^+)$	648.2 *2*	100	2348.3	$(27/2^+)$		
3081.6	$(33/2^+)$	437.3 *1*	100	2644.3	$(29/2^+)$	(Q)	Mult.: A_2=+0.43 *17*.

[†] From ^{169}Tm(^{40}Ar,4nγ) (2012Ja01).
[‡] Doublet in ^{169}Tm(^{40}Ar,4nγ) (2012Ja01).
[#] Placement of transition in the level scheme is uncertain.

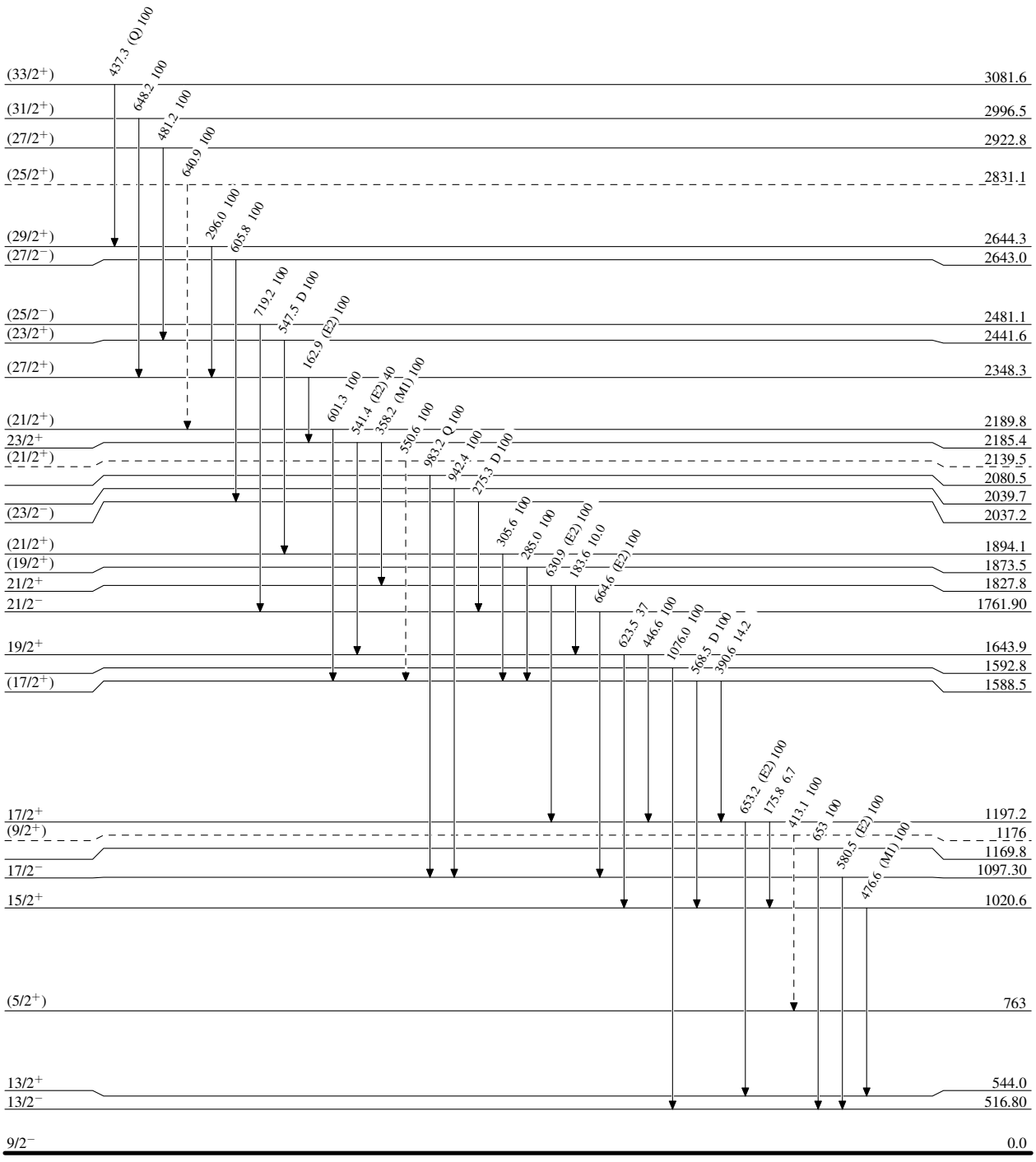
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{205}_{87}Fr_{118}$

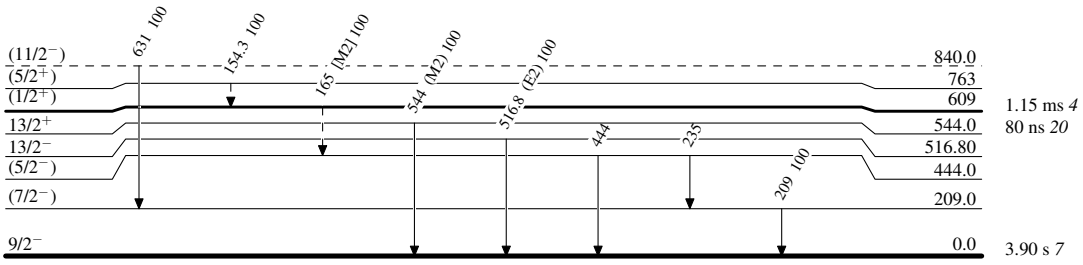
Adopted Levels, Gammas

Legend

Level Scheme (continued)

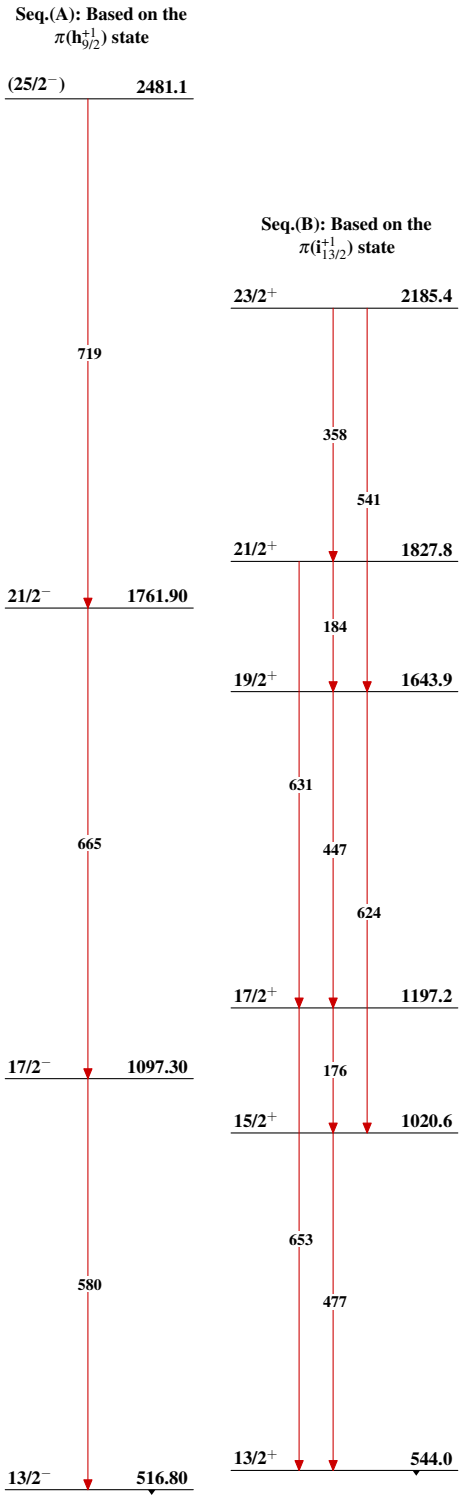
Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{205}_{87}Fr_{118}$

Adopted Levels, Gammas



$^{205}_{87}Fr_{118}$