Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 201,346 (2025)	21-Jan-2025

Q(β^-)=−4810 *30*; S(n)=8008 *29*; S(p)=826 *28*; Q(α)=6923 *3* 2021Wa16
S(2n)=18000 *40*, S(2p)=3950 *40*, Q(ε)=7886 *29*, Q(εp)=4450 *30* (2021Wa16).

^{206}Fr Levels

Cross Reference (XREF) Flags

A ^{210}Ac α decay
B ^{181}Ta(^{30}Si,5nγ)

E(level)	J$^\pi$	T$_{1/2}$	XREF	Comments
0	3$^+$	≈16 s	A	%α=88.4 *33*; %ε+%β^+=11.6 *33* μ=+3.97 *5*; Q=−0.359 *8* %α: From 2016Ly01. Others (assigned to both the 3$^+$ and 7$^+$ states): 84% *2* (1992Hu04), 85% *3* (1974Ho27) and 93% *4* (1981Ri04). J$^\pi$: From hyperfine structure analysis in 2013Vo10, 2015Vo15, 2014Ly01, 2016Ly01 and 2015Zh20. π from μ and values expected for configurations involving $\pi h_{9/2}$ and $\nu p_{3/2}$, $\nu f_{5/2}$ and $\nu i_{13/2}$. μ: From 2016Ly01,2019StZV using collinear laser spectroscopy; Others: +3.97 *6* (2013Vo10), +3.91 *3* (2015Vo15), +3.99 *5* (2014Ly01). Q: From 2016Ly01,2021StZZ using collinear laser spectroscopy; Others: −0.355 *10* (2013Vo10) and −0.253 *18* (2015Vo15). δ<r^2>(^{206}Fr,^{208}Fr)=−0.1018 fm^2 *4* (2013Vo10) and −0.0998 fm^2 *1* (2015Vo15); δ<r^2>(^{221}Fr,^{206}Fr)=−1.465 fm^2 *6* (stat) *16* (syst) (2014Ly01) and −1.4851 fm^2 *1* (stat) *162* (syst) (2016Ly01). T$_{1/2}$: Approximate value assigned to both the 3$^+$ and 7$^+$ states. Individually reported values are 15.8 s *4* (1961Gr42,1964Gr04), 15.7 s *3* (1967Va20), 16.0 s *1* (1974Ho27) and 15.9 s *3* (1981Ri04). Eα=6792 keV *5* (1992Hu04), a doublet with Eα depopulating the 7$^+$ state. Others: 6802 keV *7* (2015Ma63), 6790 keV *5* (1981Ri04), 6785 keV *5* (1974Ho27), 6792 keV *5* (1967Va20), 6.92 MeV *2* (1964Gr04) and 6.74 MeV (1961Gr42). Configuration=[$\pi(h^{+1}_{9/2})\otimes\nu(p^{-1}_{3/2})$]$_{3+}$.
0.0+x	7$^+$	≈16 s	AB	%α=84.7 *15*; %ε+%β^+=15.3 *15* μ=+4.70 *5*; Q=−0.143 *11* Additional information 1. E(level): x=200 keV *40* in 2021Ko07. %α: From 2016Ly01. Others (assigned to both the 3$^+$ and 7$^+$ states): 84% *2* (1992Hu04), 85% *3* (1974Ho27) and 93% *4* (1981Ri04). J$^\pi$: From hyperfine structure analysis in 2015Vo15, 2014Ly01, 2016Ly01 and 2015Zh20. π from μ and values expected for configurations involving $\pi h_{9/2}$ and $\nu p_{3/2}$, $\nu f_{5/2}$ and $\nu i_{13/2}$. μ: From 2016Ly01,2019StZV using collinear laser spectroscopy; Others: +4.68 *4* (2015Vo15) and +4.69 *6* (2014Ly01). Q: From 2016Ly01,2021StZZ using collinear laser spectroscopy; Other: −0.138 *17* (2015Vo15). δ<r^2>(^{206m1}Fr,^{208}Fr)=−0.1022 fm^2 *1* (2015Vo15); δ<r^2>(^{221}Fr,^{206m1}Fr)=−1.4870 fm^2 *1* (stat) *162* (syst) (2016Ly01) and −1.475 fm^2 *8* (stat) *16* (syst) (2014Ly01). T$_{1/2}$: Approximate value assigned to both the 3$^+$ and 7$^+$ states. Individually reported values are 15.8 s *4* (1961Gr42,1964Gr04), 15.7 s *3* (1967Va20), 16.0 s *1* (1974Ho27) and 15.9 s *3* (1981Ri04). Eα=6792 keV *5* (1992Hu04), a doublet with Eα depopulating the 3$^+$ state. Others: 6802 keV *7* (2015Ma63), 6790 keV *5* (1981Ri04), 6785 keV *5* (1974Ho27), 6792 keV *5* (1967Va20), 6.92 MeV *2* (1964Gr04) and 6.74 MeV (1961Gr42). Configuration=[$\pi(h^{+1}_{9/2})\otimes\nu(f^{-1}_{5/2})$]$_{7+}$.

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Adopted Levels, Gammas (continued)

^{206}Fr Levels (continued)

E(level)	J^π	$T_{1/2}$	XREF	Comments
531.0+x *10*	10^-	0.7 s *1*	AB	%α=13 *2*; %IT=87 *2* μ=+2.45 *3*; Q=+1.255 *28* %α: From 2016Ly01. Other: %α=0.3 *1* in 1981Ri04, but this value results in HF=60, an unprecedented value for a favored α-decay transition; 1992Hu04 indicated that the value of 1981Ri04 is based on an incorrect analysis. J^π: From hyperfine structure analysis in 2015Vo15, 2014Ly01, and 2016Ly01. π from μ and values expected for configurations involving $\pi h_{9/2}$ and $\nu p_{3/2}$, $\nu f_{5/2}$ and $\nu i_{13/2}$. μ: From 2016Ly01,2019StZV using collinear laser spectroscopy; Others: +3.55 *5* (2014Ly01) and +2.44 *2* (2015Vo15). Q: From 2016Ly01,2021StZZ using collinear laser spectroscopy; Other: +1.307 *9* (2015Vo15). $\delta<r^2>(^{206m2}Fr,^{208}Fr)$=−0.0298 fm^2 *1* (2015Vo15); $\delta<r^2>(^{211}Fr,^{206m2}Fr)$=−1.4154 fm^2 *1* (stat) *155* (syst) (2016Ly01) and −1.153 fm^2 *14* (2014Ly01). $T_{1/2}$: From 1981Ri04. Eα=6930 keV *5* (1981Ri04,1992Hu04). Configuration=$[\pi(h^{+1}_{9/2})\otimes\nu(i^{-1}_{13/2})]_{10-}$.
574.4+x *12*			B	
655.6+x *12*			B	
1098.1+x *11*	(11)		B	J^π: From 2008Ha39.
1208.7+x *11*	(11)		B	J^π: From 2008Ha39.
1592.3+x *12*			B	
y	J		B	Additional information 2.
140.4+y *5*	J+1		B	
407.9+y *7*	J+2		B	
670.3+y *9*	J+3		B	
964.4+y *10*	J+4		B	
1212.7+y *10*			B	
1242.0+y *12*	J+5		B	
1484.6+y *13*	J+6		B	
1683.1+y *14*	J+7		B	
1909.7+y *15*	J+8		B	
2214.1+y *15*	J+9		B	

$\gamma(^{206}Fr)$

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[†]	α[‡]	Comments
531.0+x	10^-	531 *1*	100	0.0+x	7^+	[E3]	0.1086 *16*	B(E3)(W.u.)=4.5×10^{-5} *7* α(K)=0.0536 *8*; α(L)=0.0406 *6*; α(M)=0.01081 *17* α(N)=0.00285 *5*; α(O)=0.000608 *10*; α(P)=8.59×10^{-5} *14*; α(Q)=1.779×10^{-6} *27* E_γ: From 1981Ri04. Uncertainty estimated by the evaluator from comparison of 391γ in ^{202}At: Eγ=391 keV in 1981Ri04 and 391.7 *2* keV in 1992Hu04 (adopted in 2008Zh05).
1098.1+x	(11)	523.7 *5*	57 *6*	574.4+x				A_2=−0.08 *10*
		567.1 *5*	≈100	531.0+x	10^-			A_2=−0.12 *8*
1208.7+x	(11)	553.1 *5*	≈100	655.6+x				A_2=−0.71 *20*
		634.4 *5*	54 *4*	574.4+x				
		677.7 *5*	63 *6*	531.0+x	10^-			A_2=−0.24 *14*
1592.3+x		383.5 *5*	100	1208.7+x	(11)			A_2=−0.04 *9*
		494.2 *5*	40 *6*	1098.1+x	(11)			
140.4+y	J+1	140.4 *5*	100	y	J	(M1)	5.45 *9*	α(K)=4.39 *8*; α(L)=0.806 *14*; α(M)=0.1922 *33*

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Adopted Levels, Gammas (continued)

γ(^{206}Fr) (continued)

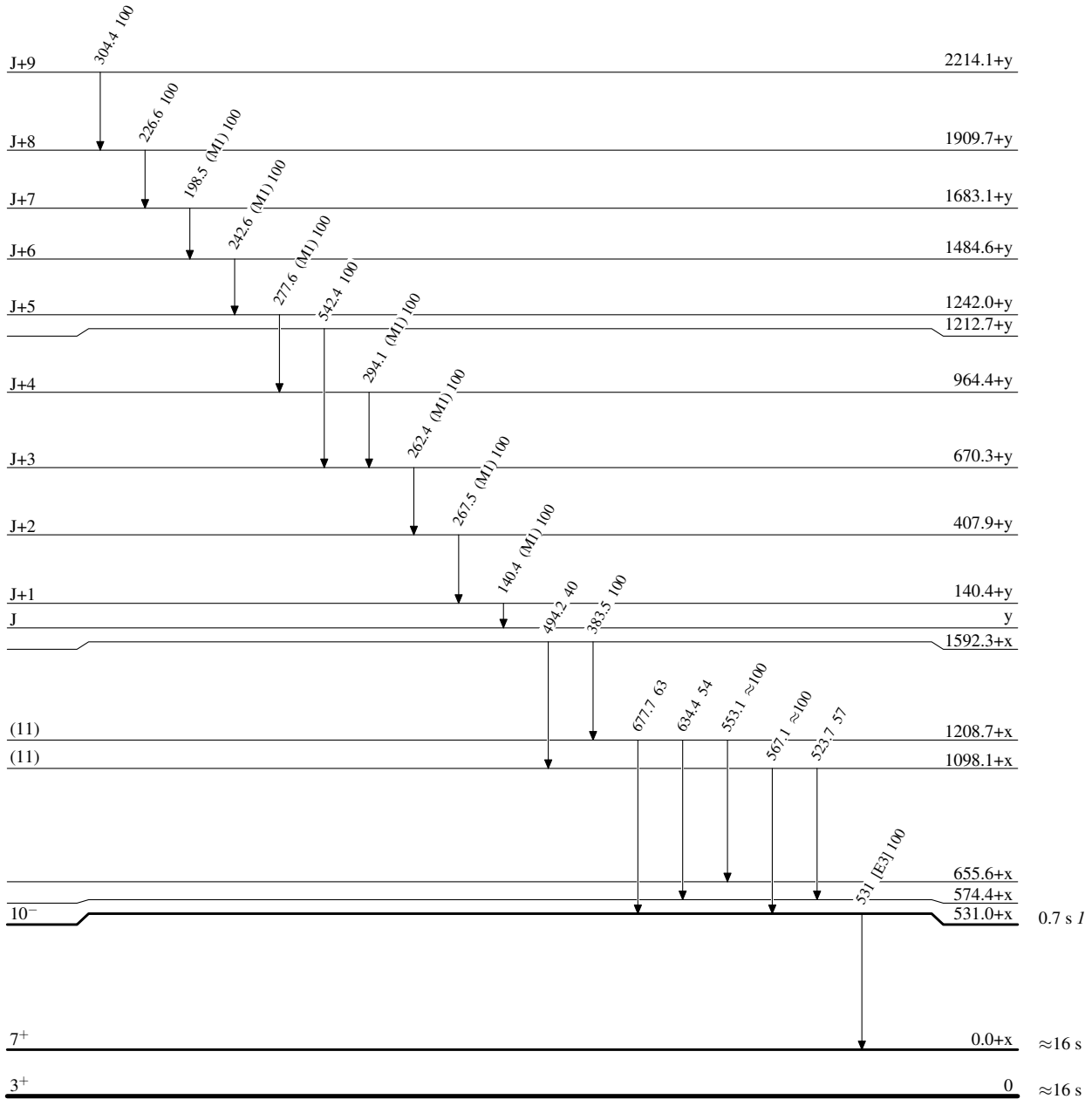
E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	α[‡]	Comments
								α(N)=0.0504 *9*; α(O)=0.01126 *20*; α(P)=0.001807 *31*; α(Q)=0.0001009 *18*
407.9+y	J+2	267.5 *5*	100	140.4+y	J+1	(M1)	0.893 *13*	A_2=−0.40 *5* α(K)=0.720 *11*; α(L)=0.1309 *20*; α(M)=0.0311 *5* α(N)=0.00817 *12*; α(O)=0.001825 *27*; α(P)=0.000293 *4*; α(Q)=1.634×10^{-5} *24*
670.3+y	J+3	262.4 *5*	100	407.9+y	J+2	(M1)	0.942 *14*	A_2=−0.41 *6* α(K)=0.760 *11*; α(L)=0.1380 *21*; α(M)=0.0329 *5* α(N)=0.00862 *13*; α(O)=0.001926 *29*; α(P)=0.000309 *5*; α(Q)=1.724×10^{-5} *26*
964.4+y	J+4	294.1 *5*	100	670.3+y	J+3	(M1)	0.687 *10*	A_2=−0.44 *5* α(K)=0.555 *8*; α(L)=0.1006 *15*; α(M)=0.02394 *35* α(N)=0.00628 *9*; α(O)=0.001403 *21*; α(P)=0.0002251 *33*; α(Q)=1.256×10^{-5} *19*
1212.7+y		542.4 *5*	100	670.3+y	J+3			
1242.0+y	J+5	277.6 *5*	100	964.4+y	J+4	(M1)	0.806 *12*	A_2=−0.29 *12* α(K)=0.650 *10*; α(L)=0.1181 *18*; α(M)=0.0281 *4* α(N)=0.00737 *11*; α(O)=0.001647 *24*; α(P)=0.000264 *4*; α(Q)=1.474×10^{-5} *22*
1484.6+y	J+6	242.6 *5*	100	1242.0+y	J+5	(M1)	1.170 *18*	A_2=−0.30 *12* α(K)=0.944 *14*; α(L)=0.1718 *26*; α(M)=0.0409 *6* α(N)=0.01072 *16*; α(O)=0.00240 *4*; α(P)=0.000384 *6*; α(Q)=2.145×10^{-5} *32*
1683.1+y	J+7	198.5 *5*	100	1484.6+y	J+6	(M1)	2.049 *32*	A_2=−0.76 *21* α(K)=1.652 *26*; α(L)=0.302 *5*; α(M)=0.0718 *11* α(N)=0.01884 *30*; α(O)=0.00421 *7*; α(P)=0.000675 *11*; α(Q)=3.77×10^{-5} *6*
1909.7+y	J+8	226.6 *5*	100	1683.1+y	J+7			
2214.1+y	J+9	304.4 *5*	100	1909.7+y	J+8			

[†] From 2008Ha39, unless otherwise stated.
[‡] Additional information 3.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{206}_{87}Fr_{119}$