Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Ictp-2014 Workshop Group	NDS 132, 257 (2016)	15-Jan-2016

Q(β^-)=2506 *13*; S(n)=5926 *18*; S(p)=6350 *17*; Q(α)=3833 *19* 2012Wa38
S(2n)=10278 *18*, S(2p)=15290 *300* (syst) (2012Wa38).

^{227}Fr evaluated by J. Tuli, S. Deepa, R. Gowrishankar, M. Sainath and K. Vijay Sai.

All data are from 1997Ku20, unless indicated otherwise.

^{227}Fr Levels

Cross Reference (XREF) Flags

A ^{227}Rn β^- decay (20.2 s)

E(level)[@]	J$^\pi$[†‡]	T$_{1/2}$[#]	XREF	Comments
0.0[&]	1/2$^+$	2.47 min *3*	A	%β^-=100 μ=+1.50 *3* (1985Co24,2014StZZ) Evaluated rms charge radius=5.734 fm *18* (2013An02). T$_{1/2}$: from 1981Vo03. Other value: 2.4 min *2* (1975Ra03). J$^\pi$: J from atomic beam laser spect (1985Co24). Parity assignment is based on the agreement between calculated μ (=+0.94 to +1.5) for a 1/2$^+$,1/2[400] Nilsson state, and the measured value of +1.50 *3* (1985Co24). This assignment is supported by the energy systematics of this Nilsson state in ^{231}Ac and ^{237}Pa, the g.s. in both nuclei. Although the calculated μ (=2.15 to 2.50) for a 1/2$^+$,1/2[660] Nilsson state may also be consistent with the measured value, this assignment would be unlikely because of the large (≈6.7) theoretical decoupling constant for this band. Such a decoupling constant would cause the J=5/2 and 9/2 members of the band to lie below the J=1/2 state. Nevertheless, the g.s. of ^{227}Fr is very likely mixed with other even-parity states through the Coriolis and ΔN=2 interactions (1987Bo04). See 1986Ek02 for a detailed discussion of magnetic moments in this nucleus. A stable octupole deformation is preferred over a reflection-symmetric interpretation (1988Le13). %α is negligible (Theory, 1997Mo25). μ: atomic beam laser optical pumping method (1985Co24). Other: 1987Co19. Measured isotope shifts: 1985Co24.
2.74[c] *4*	(3/2$^-$)		A	J$^\pi$: the 141.5- and 162.2-keV E1 γ rays strongly feed this level from the J^π=3/2$^+$ and J^π=5/2$^+$ members of the K^π=3/2$^+$ band, respectively. The strength of these E1 transitions suggest that the 2.74 state is the bandhead of a K^π=3/2$^-$ parity doublet rotational band. This assignment supports the transitional character of ^{227}Fr and explains the presence of octupole correlations in this nucleus (1997Ku20).
31.96[&] *4*	(5/2$^+$)		A	
34.09[c] *10*	(5/2$^-$)		A	
39.90[&] *4*	3/2$^+$	2.7 ns *2*	A	J$^\pi$: 39.9γ M1+E2 to 1/2$^+$.
56.03 *9*	1/2,3/2		A	J$^\pi$: 56.0γ M1,E1 to 1/2$^+$.
59.10 *5*	1/2$^-$,3/2$^-$		A	J$^\pi$: 59.1γ E1 to 1/2$^+$.
62.97[a] *7*	1/2$^-$		A	J$^\pi$: 63.1γ E1 to 1/2$^+$.
66.35 *5*	3/2$^+$		A	J$^\pi$: 66.5γ M1+E2 to 1/2$^+$.
87.98[c] *6*	(7/2$^-$)		A	J$^\pi$: 54.3γ to (5/2$^-$).
95.40[a] *4*	3/2$^-$		A	J$^\pi$: 95.4γ E1 to 1/2$^+$.
121.45[&] *16*	(7/2$^+$)		A	J$^\pi$: 89.5γ to (5/2$^+$).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{227}Fr Levels (continued)

E(level)[@]	Jπ[†‡]	$T_{1/2}$[#]	XREF	Comments
				Band assignment is tentative.
132.08 *8*			A	
144.16[b] *4*	$3/2^+$	38 ps *12*	A	Jπ: 77.9γ M1+E2 to $3/2^+$, 112.2γ M1+E2 to $(5/2^+)$.
164.95[b] *4*	$5/2^+$	49 ps *8*	A	Jπ: 98.5γ M1 to $3/2^+$, 132.9γ M1 to $(5/2^+)$.
224.07 *4*	$3/2^-,5/2^-$	<36 ps	A	Jπ: 128.8γ M1 to $3/2^-$, 135.9γ to $(7/2^-)$.
298.19 *8*			A	
306.49 *4*	$3/2^+$	<24 ps	A	Jπ: 306.5γ M1 to $1/2^+$, 141.5γ M1 to $5/2^+$.
330.77 *12*			A	267.8γ M1(+E2) to $1/2^-$ suggests $J^\pi=3/2^-$. 209.3γ to $(7/2^+)$ is inconsistent with this assignment.
378.55 *9*			A	
418.95 *4*	$3/2^-,5/2^-$	<29 ps	A	Jπ: 194.9γ M1+E2 to $3/2^-,5/2^-$, 379.0γ to $3/2^+$.
427.73 *5*			A	
444.88 *7*			A	
534.63 *5*	$(3/2)^-$		A	
579.96 *12*	$1/2^-,3/2^-,5/2^-$		A	Jπ: 520.9γ M1 to $1/2^-,3/2^-$.
675.46 *5*	$3/2^+,5/2^+$		A	Jπ: 643.5γ M1 to $5/2^+$, 672.7γ to $3/2^-$.
686.23 *5*	$3/2^+$		A	Jπ: 686.2γ M1 to $1/2^+$, 623.6γ to $1/2^-$.
689.09 *6*	$(3/2^+,5/2^+)$		A	Jπ: 656.9γ M1(+E0) to $(5/2^+)$, 593.8γ to $3/2^-$.
690.31 *11*			A	
715.91 *9*			A	
849.95 *21*			A	
860.88 *10*			A	
872.03 *8*			A	
892.83 *5*	$(3/2,5/2)^+$		A	Jπ: 586.2γ M1 to $3/2^+$.
898.79 *8*			A	
904.10 *4*	$3/2^+,5/2^+$		A	Jπ: 597.6γ M1 to $3/2^+$, 739.2γ M1 to $5/2^+$.
922.92 *16*			A	
949.00 *5*	$(3/2,5/2)^-$		A	Jπ: 724.9γ M1 to $3/2^-,5/2^-$.
955.02 *6*			A	

† Spin, parity, and rotational band assignments are based mostly on γ-ray multipolarities and the band structure expected from the reflection-symmetric rotor model, including an octupole deformation. Only the better established rotational bands are presented here. In addition, arguments based on γ-ray multipolarities have been included for individual levels.

‡ Although octupole deformations are small in this region, nuclear states are no longer fully characterized by single Nilsson orbitals. K=1/2 and 3/2 bands are expected parity-doublet pairs with same K but different parity. Decoupling parameters for these bands are the same but of opposite sign and enhanced E1 transitions connecting parity-pair band levels (1997Ku20).

From βγ(t) and βγγ(t) in ^{227}Rn decay (1997Ku20).

@ From 1997Ku20. See also ^{227}Rn β^- decay (20.2 s).

& Band(A): $K^\pi=1/2^+$ Band. Possible Configuration=(π 1/2[400]) (1997KU20).

a Band(a): $K^\pi=1/2^-$ Band. Possible Configuration=(π 1/2[530]) (1997KU20).

b Band(B): $K^\pi=3/2^+$ Band. Possible Configuration=(π 3/2[402]) (1997KU20).

c Band(b): $K^\pi=3/2^-$ Band. Possible Configuration=(π 3/2[532]) (1997KU20).

Adopted Levels, Gammas (continued)

$\gamma(^{227}Fr)$

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	$\alpha^\dagger$	Comments
2.74	(3/2$^-$)	(2.74)	100.0	0.0	1/2$^+$	[E1]		74.5	α(N)=67.5 *10*; α(O)=6.77 *10*; α(P)=0.262 *4*; α(Q)=0.00218 *3*
31.96	(5/2$^+$)	(31.96)	100.0	0.0	1/2$^+$	[E2]		2.12×10^3	α(L)=1567 *22*; α(M)=420 *6* α(N)=109.8 *16*; α(O)=22.6 *4*; α(P)=2.87 *4*; α(Q)=0.00364 *6*
34.09	(5/2$^-$)	(31.35)	100.0	2.74	(3/2$^-$)	[E2]		2.34×10^3	α(L)=1727 *25*; α(M)=463 *7* α(N)=121.0 *17*; α(O)=25.0 *4*; α(P)=3.16 *5*; α(Q)=0.00399 *6*
39.90	3/2$^+$	39.88 *8*	100.0	0.0	1/2$^+$	M1+E2	0.16 *14*	59 *40*	B(E2)(W.u.)≈9.4; B(M1)(W.u.)≈0.0021 α(L)=44 *29*; α(M)=10.9 *79* α(N)=2.9 *21*; α(O)=0.62 *43*; α(P)=0.094 *53*; α(Q)=0.00389 *17*
56.03	1/2,3/2	56.00 *10*	100.0	0.0	1/2$^+$	M1,E1		7.9 *74*	α(L)=6.0 *56*; α(M)=1.4 *14* α(N)=0.37 *35*; α(O)=0.084 *79*; α(P)=0.013 *13*; α(Q)=7.4×10^{-4} *72*
59.10	1/2$^-$,3/2$^-$	59.10 *5*	100.0	0.0	1/2$^+$	E1		0.436	α(L)=0.330 *5*; α(M)=0.0801 *12* α(N)=0.0206 *3*; α(O)=0.00429 *6*; α(P)=0.000578 *9*; α(Q)=1.78×10^{-5} *3*
62.97	1/2$^-$	63.07 *10*	100.0	0.0	1/2$^+$	E1		0.366	α(L)=0.278 *4*; α(M)=0.0672 *10* α(N)=0.0173 *3*; α(O)=0.00361 *6*; α(P)=0.000491 *8*; α(Q)=1.545×10^{-5} *23*
66.35	3/2$^+$	7.40		59.10	1/2$^-$,3/2$^-$	[E1]		27.8	α(M)=21.6 *3* α(N)=5.26 *8*; α(O)=0.845 *12*; α(P)=0.0625 *9*; α(Q)=0.000875 *13*
		66.50 *10*	100 *7*	0.0	1/2$^+$	M1+E2	0.57 *23*	21.9 *75*	α(L)=16.3 *55*; α(M)=4.2 *16* α(N)=1.11 *40*; α(O)=0.235 *81*; α(P)=0.0324 *99*; α(Q)=0.00070 *11*
87.98	(7/2$^-$)	54.3 *5*	100.0	34.09	(5/2$^-$)				
95.40	3/2$^-$	32.35		62.97	1/2$^-$	[M1,E2]		1.05×10^3 *98*	α(L)=7.8×10^2 *72*; α(M)=2.1×10^2 *20* α(N)=54 *51*; α(O)=11 *11*; α(P)=1.4 *13*; α(Q)=0.0054 *20*
		61.22	≤9.6	34.09	(5/2$^-$)	E2		90.4	α(L)=66.6 *10*; α(M)=18.0 *3* α(N)=4.71 *7*; α(O)=0.974 *14*; α(P)=0.1244 *18*; α(Q)=0.000203 *3*
		92.65 *5*	53.6 *22*	2.74	(3/2$^-$)	(M1)		3.52	α(L)=2.67 *4*; α(M)=0.637 *9* α(N)=0.1669 *24*; α(O)=0.0373 *6*; α(P)=0.00599 *9*; α(Q)=0.000335 *5*
		95.42 *5*	100 *4*	0.0	1/2$^+$	E1		0.1212	α(L)=0.0920 *13*; α(M)=0.0221 *4* α(N)=0.00571 *8*; α(O)=0.001215 *17*; α(P)=0.0001723 *25*; α(Q)=6.18×10^{-6} *9*
121.45	(7/2$^+$)	89.51[#]	100.0	31.96	(5/2$^+$)				
132.08		97.90 *10*	100.0	34.09	(5/2$^-$)				
144.16	3/2$^+$	48.77 *10*	10 *4*	95.40	3/2$^-$	[E1]		0.729	B(E1)(W.u.)=0.00019 *10* α(L)=0.552 *9*; α(M)=0.1346 *21* α(N)=0.0345 *6*; α(O)=0.00712 *11*; α(P)=0.000934 *14*; α(Q)=2.69×10^{-5} *4*
		77.85 *5*	67.9 *25*	66.35	3/2$^+$	M1+E2	0.5 *4*	10.4 *57*	B(E2)(W.u.)=4.E+2 *4*; B(M1)(W.u.)=0.031 *20* α(L)=7.8 *42*; α(M)=2.0 *12* α(N)=0.52 *31*; α(O)=0.111 *62*; α(P)=0.0159 *74*;

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							α(Q)=4.6×10^{-4} *12*
104.4 *1*	81 *7*	39.90	3/2$^+$	M1+E2	1.0 *5*	10.0 *16*	B(E2)(W.u.)=2.0×10^2 *11*; B(M1)(W.u.)=0.012 *5* α(K)=5.2 *30*; α(L)=3.6 *11*; α(M)=0.94 *30* α(N)=0.247 *78*; α(O)=0.052 *16*; α(P)=0.0071 *18*; α(Q)=1.32×10^{-4} *63*
112.22 *5*	33 *3*	31.96	(5/2$^+$)	M1+E2	1.0 *5*	7.9 *15*	B(E2)(W.u.)=8.E+1 *4*; B(M1)(W.u.)=0.0031 *14* α(K)=4.3 *24*; α(L)=2.66 *68*; α(M)=0.69 *20* α(N)=0.182 *52*; α(O)=0.039 *11*; α(P)=0.0053 *12*; α(Q)=1.07×10^{-4} *52*
141.53‡ *5*	100‡ *7*	2.74	(3/2$^-$)	E1		0.204	B(E1)(W.u.)=8.E−5 *3* α(K)=0.1607 *23*; α(L)=0.0326 *5*; α(M)=0.00780 *11* α(N)=0.00202 *3*; α(O)=0.000435 *7*; α(P)=6.37×10^{-5} *9*; α(Q)=2.54×10^{-6} *4*
144.4 *3*	6.9 *11*	0.0	1/2$^+$	[M1+E2]		3.5 *16*	α(K)=2.2 *19*; α(L)=0.97 *23*; α(M)=0.250 *74*

Adopted Levels, Gammas (continued)

γ(^{227}Fr) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	α[†]	Comments
									α(N)=0.066 *20*; α(O)=0.0140 *37*; α(P)=0.0020 *4*; α(Q)=5.2×10^{-5} *42*
164.95	5/2$^+$	20.63		144.16	3/2$^+$	[M1+E2]		9.4×10^3 *92*	α(L)=7.0×10^3 *68*; α(M)=1.9×10^3 *19*
									α(N)=4.9×10^2 *48*; α(O)=1.01×10^2 *98*; α(P)=13 *13*; α(Q)=0.0274 *6*
		98.53 *10*	6.4 *20*	66.35	3/2$^+$	M1		2.94	B(M1)(W.u.)=0.008 *3*
									α(L)=2.23 *4*; α(M)=0.533 *8*
									α(N)=0.1397 *20*; α(O)=0.0312 *5*; α(P)=0.00501 *8*; α(Q)=0.000280 *4*
		124.6 *4*	1.15 *14*	39.90	3/2$^+$	[M1,E2]		5.6 *21*	α(K)=3.2 *30*; α(L)=1.73 *60*; α(M)=0.45 *18*
									α(N)=0.118 *48*; α(O)=0.0251 *93*; α(P)=0.00350 *96*; α(Q)=7.9×10^{-5} *64*
		132.95 *5*	30.0 *10*	31.96	(5/2$^+$)	M1		6.37	B(M1)(W.u.)=0.015 *3*
									α(K)=5.13 *8*; α(L)=0.943 *14*; α(M)=0.225 *4*
									α(N)=0.0589 *9*; α(O)=0.01317 *19*; α(P)=0.00211 *3*; α(Q)=0.0001179 *17*
		162.17 *8*	100 *4*	2.74	(3/2$^-$)	E1		0.1462	B(E1)(W.u.)=0.00022 *4*
									α(K)=0.1160 *17*; α(L)=0.0229 *4*; α(M)=0.00547 *8*
									α(N)=0.001419 *20*; α(O)=0.000307 *5*; α(P)=4.53×10^{-5} *7*; α(Q)=1.87×10^{-6} *3*
		165.3 *5*	3.9 *7*	0.0	1/2$^+$	[E2]		1.123 *21*	B(E2)(W.u.)=11 *3*
									α(K)=0.233 *4*; α(L)=0.656 *13*; α(M)=0.177 *4*
									α(N)=0.0464 *9*; α(O)=0.00966 *19*; α(P)=0.001268 *25*; α(Q)=7.22×10^{-6} *12*
224.07	3/2$^-$,5/2$^-$	128.78 *5*	100 *3*	95.40	3/2$^-$	M1		6.97	α(K)=5.61 *8*; α(L)=1.033 *15*; α(M)=0.246 *4*
									α(N)=0.0645 *9*; α(O)=0.01443 *21*; α(P)=0.00231 *4*; α(Q)=0.0001292 *19*
		135.9 *2*	10.1 *10*	87.98	(7/2$^-$)				
		157.90 *10*	18.2 *19*	66.35	3/2$^+$	[E1]		0.1560	α(K)=0.1237 *18*; α(L)=0.0245 *4*; α(M)=0.00587 *9*
									α(N)=0.001520 *22*; α(O)=0.000328 *5*; α(P)=4.84×10^{-5} *7*; α(Q)=1.98×10^{-6} *3*
		192.06 *5*	31 *5*	31.96	(5/2$^+$)	[E1]		0.0971	α(K)=0.0776 *11*; α(L)=0.01487 *21*; α(M)=0.00355 *5*
									α(N)=0.000921 *13*; α(O)=0.000200 *3*; α(P)=2.98×10^{-5} *5*; α(Q)=1.275×10^{-6} *18*
298.19		133.0 *2*	50 *8*	164.95	5/2$^+$				
		154.25 *10*	100 *10*	144.16	3/2$^+$				
		235.06 *10*	72 *8*	62.97	1/2$^-$				
306.49	3/2$^+$	141.53[‡] *5*	43[‡] *5*	164.95	5/2$^+$	M1		5.33	α(K)=4.29 *6*; α(L)=0.788 *11*; α(M)=0.188 *3*
									α(N)=0.0493 *7*; α(O)=0.01101 *16*; α(P)=0.001766 *25*; α(Q)=9.86×10^{-5} *14*
		162.22 *8*	100 *8*	144.16	3/2$^+$	M1		3.62	α(K)=2.92 *5*; α(L)=0.534 *8*; α(M)=0.1273 *18*
									α(N)=0.0334 *5*; α(O)=0.00746 *11*; α(P)=0.001196 *17*; α(Q)=6.68×10^{-5} *10*
		174.43 *10*	18.4 *19*	132.08					

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Adopted Levels, Gammas (continued)

γ(^{227}Fr) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	α[†]	Comments
306.49	3/2+	210.76 *10*	16.6 *17*	95.40	3/2−	[E1]		0.0778	α(K)=0.0623 *9*; α(L)=0.01177 *17*; α(M)=0.00281 *4* α(N)=0.000729 *11*; α(O)=0.0001584 *23*; α(P)=2.38×10^{-5} *4*; α(Q)=1.037×10^{-6} *15*
		240.3 *5*	≈9.278	66.35	3/2+	[M1+E2]		0.75 *46*	α(K)=0.54 *43*; α(L)=0.155 *22*; α(M)=0.039 *4* α(N)=0.0102 *9*; α(O)=0.0022 *3*; α(P)=0.00033 *7*; α(Q)=1.24×10^{-5} *96*
		266.55 *5*	39.5 *24*	39.90	3/2+	M1+E2	1.0 *3*	0.56 *12*	α(K)=0.41 *11*; α(L)=0.110 *8*; α(M)=0.0274 *15* α(N)=0.0072 *4*; α(O)=0.00157 *10*; α(P)=0.000235 *21*; α(Q)=9.4×10^{-6} *25*
		303.74 *5*	45.3 *18*	2.74	(3/2−)	(E1)		0.0333	α(K)=0.0269 *4*; α(L)=0.00484 *7*; α(M)=0.001149 *16* α(N)=0.000299 *5*; α(O)=6.54×10^{-5} *10*; α(P)=1.000×10^{-5} *14*; α(Q)=4.68×10^{-7} *7*
		306.53 *5*	74.9 *23*	0.0	1/2+	M1		0.613	α(K)=0.495 *7*; α(L)=0.0897 *13*; α(M)=0.0214 *3* α(N)=0.00560 *8*; α(O)=0.001251 *18*; α(P)=0.000201 *3*; α(Q)=1.120×10^{-5} *16*
330.77		209.32 *10*	27 *3*	121.45	(7/2+)				
		267.81 *10*	100 *6*	62.97	1/2−	M1(+E2)	≈0.3	≈0.833	α(K)≈0.666; α(L)≈0.1268; α(M)≈0.0304 α(N)≈0.00796; α(O)≈0.001774; α(P)≈0.000282; α(Q)≈1.512×10^{-5}
		296.3 *5*	≈33	34.09	(5/2−)				
378.55		213.66 *10*	100.0	164.95	5/2+				
418.95	3/2−,5/2−	88.08		330.77					
		112.38 *10*	≈14	306.49	3/2+	[E1]		0.356	α(K)=0.277 *4*; α(L)=0.0596 *9*; α(M)=0.01432 *21* α(N)=0.00370 *6*; α(O)=0.000791 *12*; α(P)=0.0001139 *17*; α(Q)=4.27×10^{-6} *6*
		194.95 *5*	100 *10*	224.07	3/2−,5/2−	M1+E2	0.9 *3*	1.5 *3*	α(K)=1.04 *29*; α(L)=0.319 *5*; α(M)=0.0803 *23* α(N)=0.0211 *6*; α(O)=0.00456 *9*; α(P)=0.000672 *19*; α(Q)=2.40×10^{-5} *64*
		253.85 *10*	12.7 *13*	164.95	5/2+	[E1]		0.0502	α(K)=0.0404 *6*; α(L)=0.00744 *11*; α(M)=0.001770 *25* α(N)=0.000460 *7*; α(O)=0.0001004 *14*; α(P)=1.521×10^{-5} *22*; α(Q)=6.89×10^{-7} *10*
		331.00 *5*	44 *4*	87.98	(7/2−)				
		379.05 *5*	48.6 *23*	39.90	3/2+	[E1]		0.0204	α(K)=0.01656 *24*; α(L)=0.00290 *4*; α(M)=0.000687 *10* α(N)=0.000179 *3*; α(O)=3.93×10^{-5} *6*; α(P)=6.07×10^{-6} *9*; α(Q)=2.95×10^{-7} *5*
		387.03 *5*	60.4 *25*	31.96	(5/2+)	[E1]		0.0195	α(K)=0.01584 *23*; α(L)=0.00277 *4*; α(M)=0.000655 *10* α(N)=0.0001706 *24*; α(O)=3.75×10^{-5} *6*; α(P)=5.79×10^{-6} *9*; α(Q)=2.82×10^{-7} *4*
		416.16 *5*	84 *3*	2.74	(3/2−)	[M1+E2]		0.16 *11*	α(K)=0.126 *91*; α(L)=0.028 *11*; α(M)=0.0068 *25* α(N)=0.00179 *64*; α(O)=3.9×10^{-4} *15*; α(P)=6.1×10^{-5} *26*; α(Q)=2.8×10^{-6} *21*
427.73		262.63 *10*	31 *4*	164.95	5/2+				

$^{227}_{87}Fr_{140}$-6

Adopted Levels, Gammas (continued)

γ(^{227}Fr) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α†	Comments
427.73		283.60 *10*	20.5 *22*	144.16	3/2+			
		295.54 *10*	87 *5*	132.08		M1	0.678	α(K)=0.548 *8*; α(L)=0.0993 *14*; α(M)=0.0236 *4* α(N)=0.00619 *9*; α(O)=0.001384 *20*; α(P)=0.000222 *4*; α(Q)=1.239×10^{-5} *18*
		332.40 *5*	100 *6*	95.40	3/2−			
		427.4 *2*	35 *3*	0.0	1/2+			
444.88		66.39 *10*		378.55				
		279.9 *2*	65 *7*	164.95	5/2+			
		300.80 *10*	100 *6*	144.16	3/2+			
534.63	(3/2)−	369.5 *5*	31 *6*	164.95	5/2+	[E1]	0.0215	α(K)=0.0175 *3*; α(L)=0.00307 *5*; α(M)=0.000728 *11* α(N)=0.000190 *3*; α(O)=4.16×10^{-5} *6*; α(P)=6.42×10^{-6} *10*; α(Q)=3.10×10^{-7} *5*
		468.4 *5*	13.2 *20*	66.35	3/2+	[E1]	0.01303	α(K)=0.01064 *15*; α(L)=0.00182 *3*; α(M)=0.000430 *6* α(N)=0.0001120 *16*; α(O)=2.47×10^{-5} *4*; α(P)=3.84×10^{-6} *6*; α(Q)=1.92×10^{-7} *3*
		502.88 *10*	52 *3*	31.96	(5/2+)	(E1)	0.01126	α(K)=0.00921 *13*; α(L)=0.001564 *22*; α(M)=0.000369 *6* α(N)=9.61×10^{-5} *14*; α(O)=2.12×10^{-5} *3*; α(P)=3.31×10^{-6} *5*; α(Q)=1.675×10^{-7} *24*
		531.87 *5*	100 *4*	2.74	(3/2−)	M1	0.1383	α(K)=0.1120 *16*; α(L)=0.0200 *3*; α(M)=0.00475 *7* α(N)=0.001246 *18*; α(O)=0.000279 *4*; α(P)=4.47×10^{-5} *7*; α(Q)=2.50×10^{-6} *4*
		534.52 *10*	32 *4*	0.0	1/2+	[E1]	0.00996	α(K)=0.00815 *12*; α(L)=0.001376 *20*; α(M)=0.000324 *5* α(N)=8.45×10^{-5} *12*; α(O)=1.87×10^{-5} *3*; α(P)=2.92×10^{-6} *4*; α(Q)=1.489×10^{-7} *21*
579.96	1/2−,3/2−,5/2−	520.86 *10*	100.0	59.10	1/2−,3/2−	M1	0.1462	α(K)=0.1184 *17*; α(L)=0.0212 *3*; α(M)=0.00503 *7* α(N)=0.001318 *19*; α(O)=0.000295 *5*; α(P)=4.73×10^{-5} *7*; α(Q)=2.65×10^{-6} *4*
675.46	3/2+,5/2+	247.8 *5*	≈10	427.73				
		510.4 *5*	19 *4*	164.95	5/2+	[M1+E2]	0.095 *60*	α(K)=0.074 *51*; α(L)=0.0155 *69*; α(M)=0.0038 *16* α(N)=9.9×10^{-4} *41*; α(O)=2.18×10^{-4} *93*; α(P)=3.4×10^{-5} *16*; α(Q)=1.7×10^{-6} *12*
		643.51 *5*	92 *4*	31.96	(5/2+)	M1	0.0835	α(K)=0.0676 *10*; α(L)=0.01203 *17*; α(M)=0.00285 *4* α(N)=0.000748 *11*; α(O)=0.0001672 *24*; α(P)=2.69×10^{-5} *4*; α(Q)=1.505×10^{-6} *21*
		672.71 *5*	100 *3*	2.74	(3/2−)	[E1]	0.00635	α(K)=0.00522 *8*; α(L)=0.000862 *12*; α(M)=0.000203 *3* α(N)=5.28×10^{-5} *8*; α(O)=1.171×10^{-5} *17*; α(P)=1.84×10^{-6} *3*; α(Q)=9.67×10^{-8} *14*
686.23	3/2+	623.6 *3*	4.2 *5*	62.97	1/2−	[E1]	0.00735	α(K)=0.00603 *9*; α(L)=0.001003 *14*; α(M)=0.000236 *4* α(N)=6.15×10^{-5} *9*; α(O)=1.362×10^{-5} *20*; α(P)=2.14×10^{-6} *3*; α(Q)=1.112×10^{-7} *16*
		686.22 *5*	100 *3*	0.0	1/2+	M1	0.0704	α(K)=0.0571 *8*; α(L)=0.01014 *15*; α(M)=0.00241 *4*

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Adopted Levels, Gammas (continued)

$\gamma(^{227}Fr)$ (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	$\alpha^\dagger$	Comments
								α(N)=0.000630 *9*; α(O)=0.0001409 *20*; α(P)=2.26×10^{-5} *4*; α(Q)=1.269×10^{-6} *18*
689.09	(3/2$^+$,5/2$^+$)	244.33 *10*	12.8 *12*	444.88				
		593.8 *2*	15.4 *18*	95.40	3/2$^-$	[E1]	0.00809	α(K)=0.00663 *10*; α(L)=0.001108 *16*; α(M)=0.000261 *4* α(N)=6.80×10^{-5} *10*; α(O)=1.504×10^{-5} *21*; α(P)=2.36×10^{-6} *4*; α(Q)=1.219×10^{-7} *17*
		601.10 *5*	55 *3*	87.98	(7/2$^-$)			
		655.3 *2*	25 *4*	34.09	(5/2$^-$)	[E1]	0.00668	α(K)=0.00549 *8*; α(L)=0.000908 *13*; α(M)=0.000214 *3* α(N)=5.57×10^{-5} *8*; α(O)=1.233×10^{-5} *18*; α(P)=1.94×10^{-6} *3*; α(Q)=1.015×10^{-7} *15*
		656.95 *10*	100 *5*	31.96	(5/2$^+$)	M1(+E0)		
690.31		546.15 *10*	100.0	144.16	3/2$^+$			
715.91		652.94 *5*	100.0	62.97	1/2$^-$			
849.95		431.0 *2*	100.0	418.95	3/2$^-$,5/2$^-$			
860.88		442.3 *5*	≈71	418.95	3/2$^-$,5/2$^-$			
		765.8 *2*	49 *5*	95.40	3/2$^-$			
		794.41 *10*	100 *4*	66.35	3/2$^+$			
		798.7 *5*	16.3 *22*	62.97	1/2$^-$			
		801.7 *5*	21 *3*	59.10	1/2$^-$,3/2$^-$			
872.03		815.97 *10*	71 *3*	56.03	1/2,3/2			
		838.2 *5*	16.7 *18*	34.09	(5/2$^-$)			
		872.05 *10*	100 *3*	0.0	1/2$^+$			
892.83	(3/2,5/2)$^+$	473.95 *10*	31.9 *16*	418.95	3/2$^-$,5/2$^-$			
		586.16 *10*	100 *10*	306.49	3/2$^+$	M1	0.1068	α(K)=0.0865 *13*; α(L)=0.01543 *22*; α(M)=0.00366 *6* α(N)=0.000960 *14*; α(O)=0.000215 *3*; α(P)=3.45×10^{-5} *5*; α(Q)=1.93×10^{-6} *3*
		748.78 *5*	25.7 *10*	144.16	3/2$^+$			
		826.4 *5*	9.3 *7*	66.35	3/2$^+$			
		892.54 *10*	16.7 *11*	0.0	1/2$^+$			
898.79		470.5 *5*	25 *5*	427.73				
		754.48 *10*	55 *6*	144.16	3/2$^+$			
		835.98 *10*	100 *6*	62.97	1/2$^-$			
		864.7 *5*	38 *4*	34.09	(5/2$^-$)			
904.10	3/2$^+$,5/2$^+$	485.16 *5*	11.3 *6*	418.95	3/2$^-$,5/2$^-$	[E1]	0.01212	α(K)=0.00990 *14*; α(L)=0.001688 *24*; α(M)=0.000398 *6* α(N)=0.0001038 *15*; α(O)=2.29×10^{-5} *4*; α(P)=3.57×10^{-6} *5*; α(Q)=1.80×10^{-7} *3*
		597.57 *5*	35.84	306.49	3/2$^+$	M1	0.1015	α(K)=0.0822 *12*; α(L)=0.01465 *21*; α(M)=0.00348 *5* α(N)=0.000912 *13*; α(O)=0.000204 *3*; α(P)=3.27×10^{-5} *5*; α(Q)=1.83×10^{-6} *3*
		680.06 *10*	9.2 *4*	224.07	3/2$^-$,5/2$^-$	[E1]	0.00622	α(K)=0.00512 *8*; α(L)=0.000844 *12*; α(M)=0.000198 *3* α(N)=5.17×10^{-5} *8*; α(O)=1.146×10^{-5} *16*; α(P)=1.80×10^{-6} *3*; α(Q)=9.48×10^{-8} *14*
		739.16 *5*	100 *3*	164.95	5/2$^+$	M1	0.0579	α(K)=0.0470 *7*; α(L)=0.00832 *12*; α(M)=0.00197 *3* α(N)=0.000517 *8*; α(O)=0.0001157 *17*; α(P)=1.86×10^{-5} *3*;

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Adopted Levels, Gammas (continued)

$\gamma(^{227}Fr)$ (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	$\alpha^\dagger$	Comments
								α(Q)=1.043×10^{-6} *15*
		759.97 *5*	40.9 *11*	144.16	3/2$^+$	M1	0.0539	α(K)=0.0437 *7*; α(L)=0.00773 *11*; α(M)=0.00183 *3*

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Adopted Levels, Gammas (continued)

$\gamma(^{227}Fr)$ (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	$\alpha^\dagger$	Comments
								α(N)=0.000481 *7*; α(O)=0.0001075 *15*; α(P)=1.726×10^{-5} *25*; α(Q)=9.69×10^{-7} *14*
904.10	3/2$^+$,5/2$^+$	901.38 *10*	10.3 *4*	2.74	(3/2$^-$)	[E1]	0.00369	α(K)=0.00305 *5*; α(L)=0.000491 *7*; α(M)=0.0001151 *17* α(N)=3.00×10^{-5} *5*; α(O)=6.67×10^{-6} *10*; α(P)=1.058×10^{-6} *15*; α(Q)=5.72×10^{-8} *8*
922.92		592.15 *10*	100.00	330.77				
949.00	(3/2,5/2)$^-$	529.90 *10*	15.7 *11*	418.95	3/2$^-$,5/2$^-$	[M1+E2]	0.086 *54*	α(K)=0.067 *46*; α(L)=0.0140 *63*; α(M)=0.0034 *15* α(N)=8.9×10^{-4} *37*; α(O)=1.96×10^{-4} *85*; α(P)=3.1×10^{-5} *15*; α(Q)=1.5×10^{-6} *11*
		724.95 *5*	53.6 *16*	224.07	3/2$^-$,5/2$^-$	M1	0.0610	α(K)=0.0494 *7*; α(L)=0.00876 *13*; α(M)=0.00208 *3* α(N)=0.000545 *8*; α(O)=0.0001218 *17*; α(P)=1.96×10^{-5} *3*; α(Q)=1.098×10^{-6} *16*
		804.96 *5*	100 *4*	144.16	3/2$^+$	[E1]	0.00454	α(K)=0.00374 *6*; α(L)=0.000608 *9*; α(M)=0.0001427 *20* α(N)=3.72×10^{-5} *6*; α(O)=8.26×10^{-6} *12*; α(P)=1.305×10^{-6} *19*; α(Q)=6.99×10^{-8} *10*
		853.17 *10*	18.1 *19*	95.40	3/2$^-$	[M1,E2]	0.026 *14*	α(K)=0.021 *12*; α(L)=0.0039 *18*; α(M)=9.3×10^{-4} *42* α(N)=2.4×10^{-4} *11*; α(O)=5.4×10^{-5} *25*; α(P)=8.6×10^{-6} *41*; α(Q)=4.5×10^{-7} *27*
955.02		536.10 *5*	100 *8*	418.95	3/2$^-$,5/2$^-$			
		810.75 *10*	56 *4*	144.16	3/2$^+$			

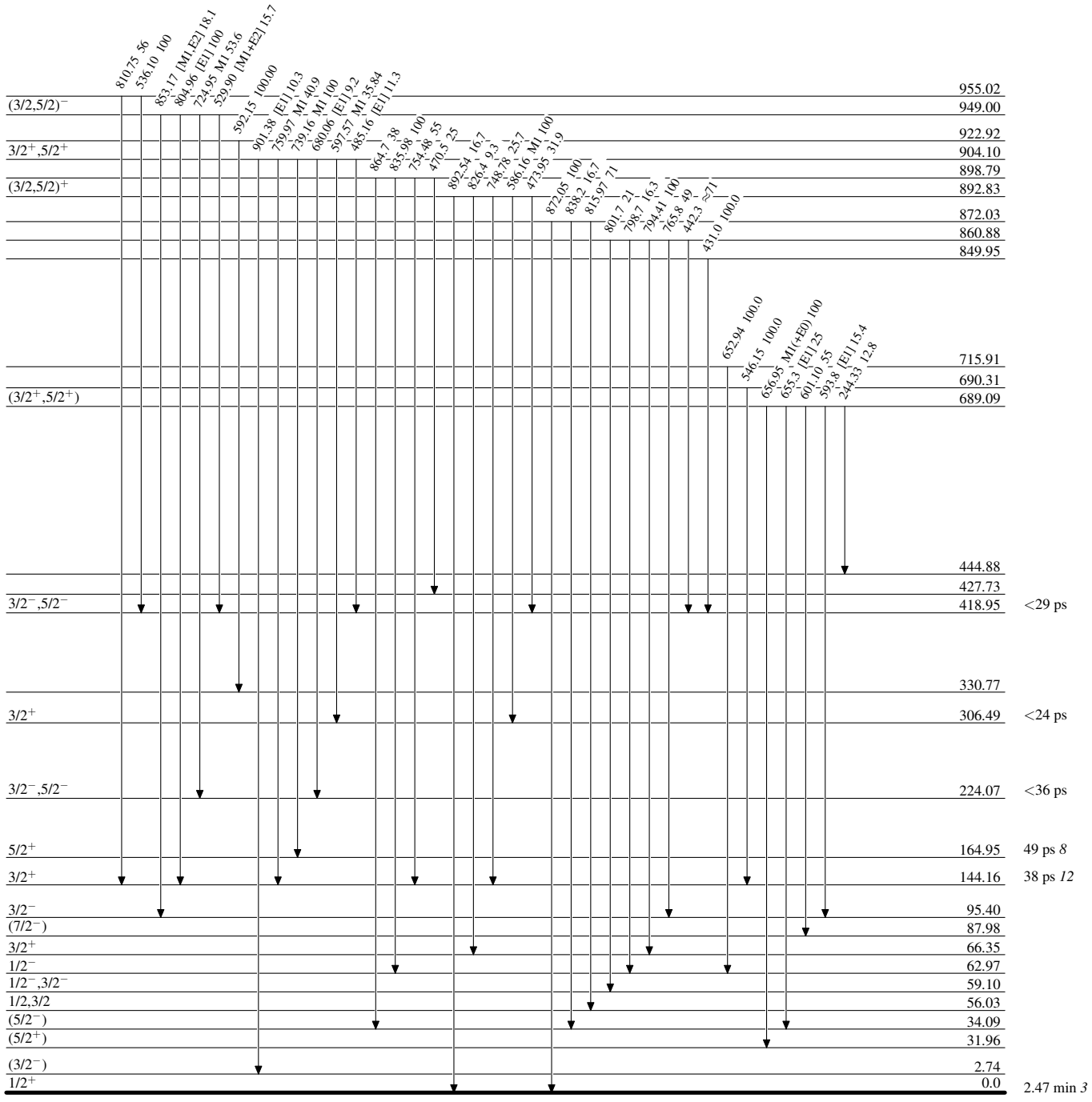
† From BrIcc v2.3 (9-Dec-2011) 2008Ki07, "Frozen Orbitals" appr. α overlaps M1 and E2 if δ not given.
‡ Multiply placed with intensity suitably divided.
$^\#$ Placement of transition in the level scheme is uncertain.

$^{227}_{87}Fr_{140}$-10

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



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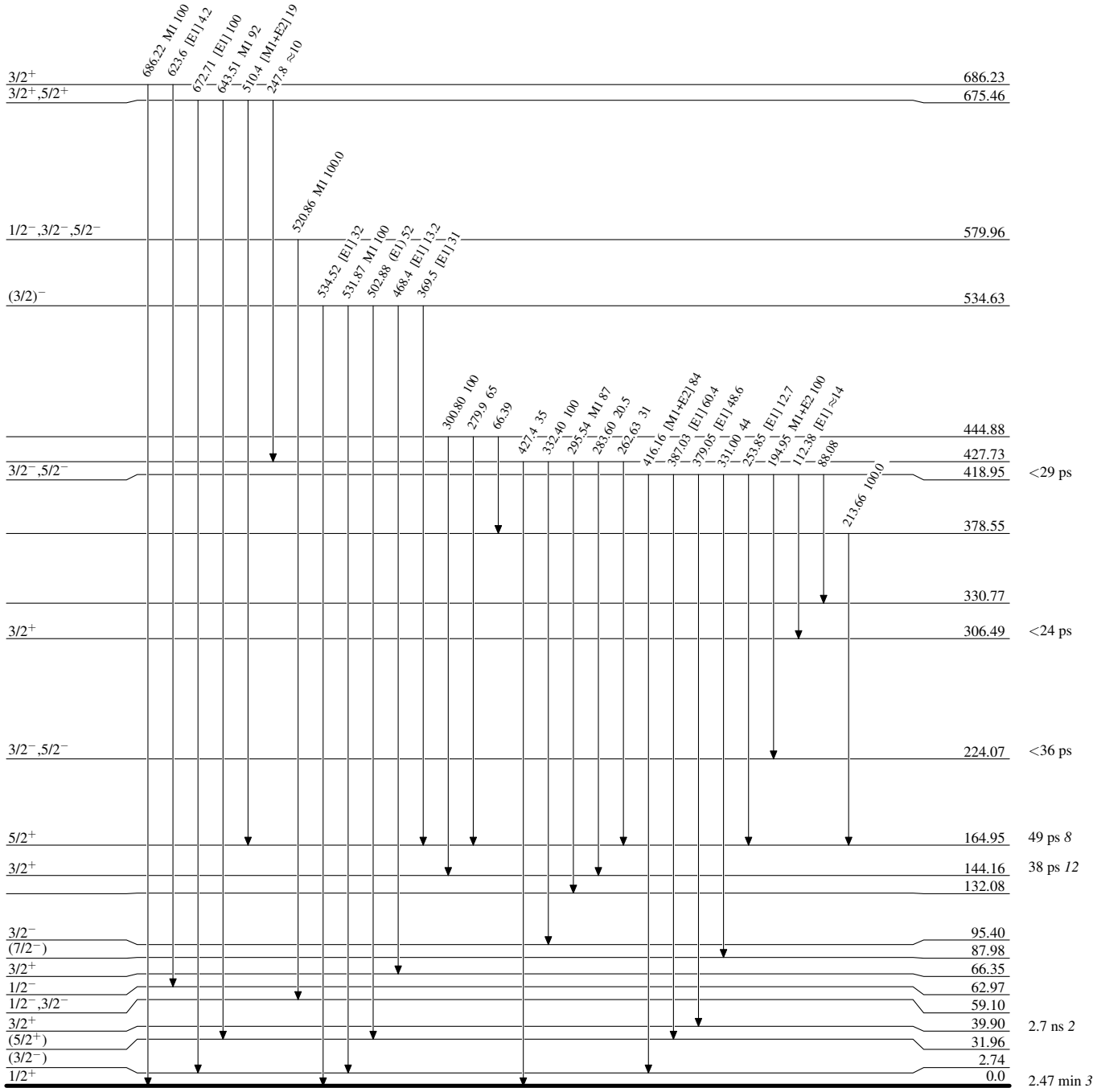
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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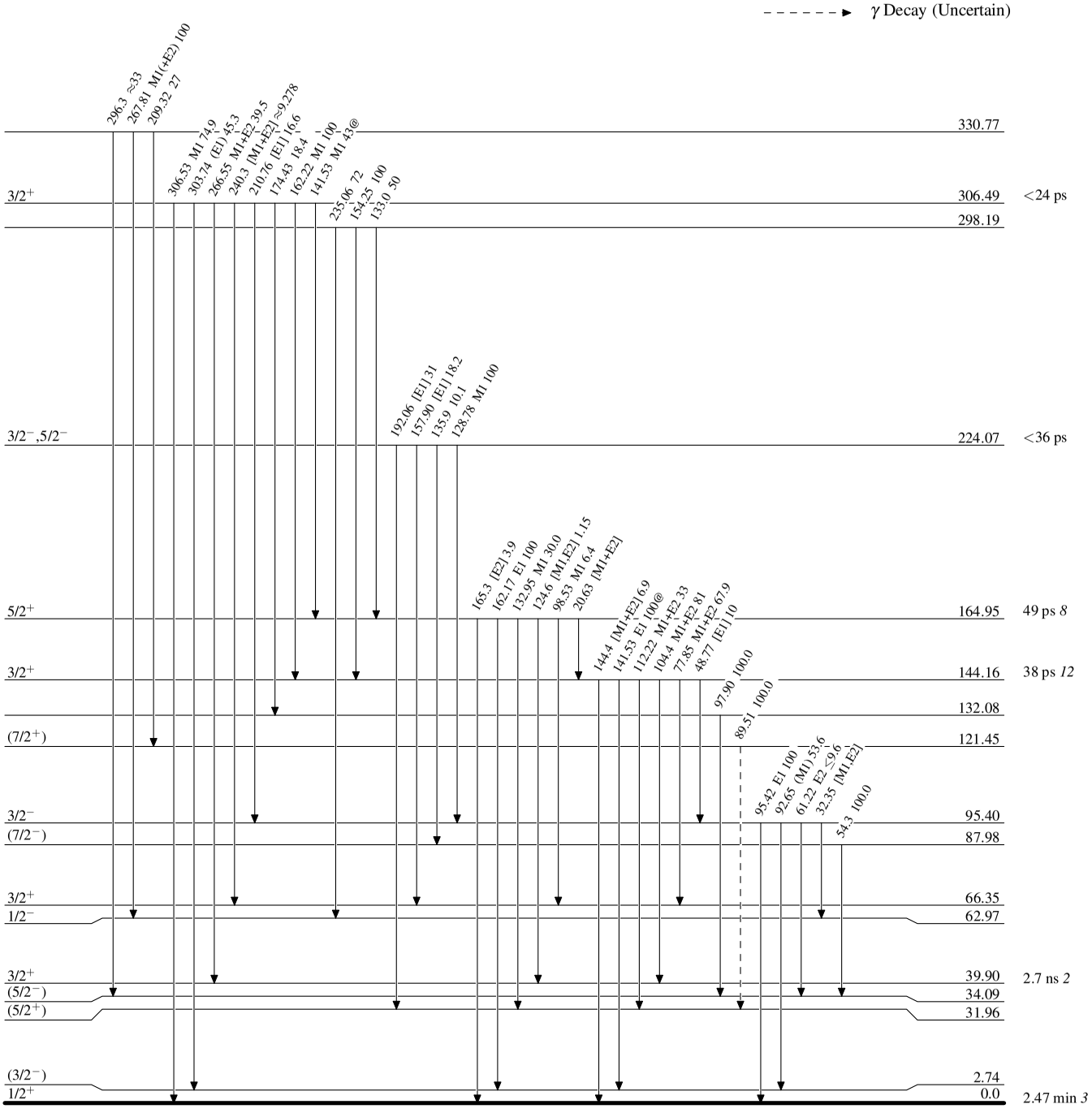
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

γ Decay (Uncertain)



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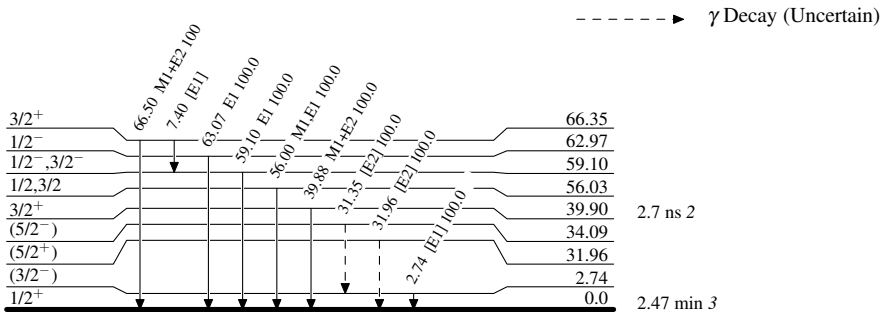
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



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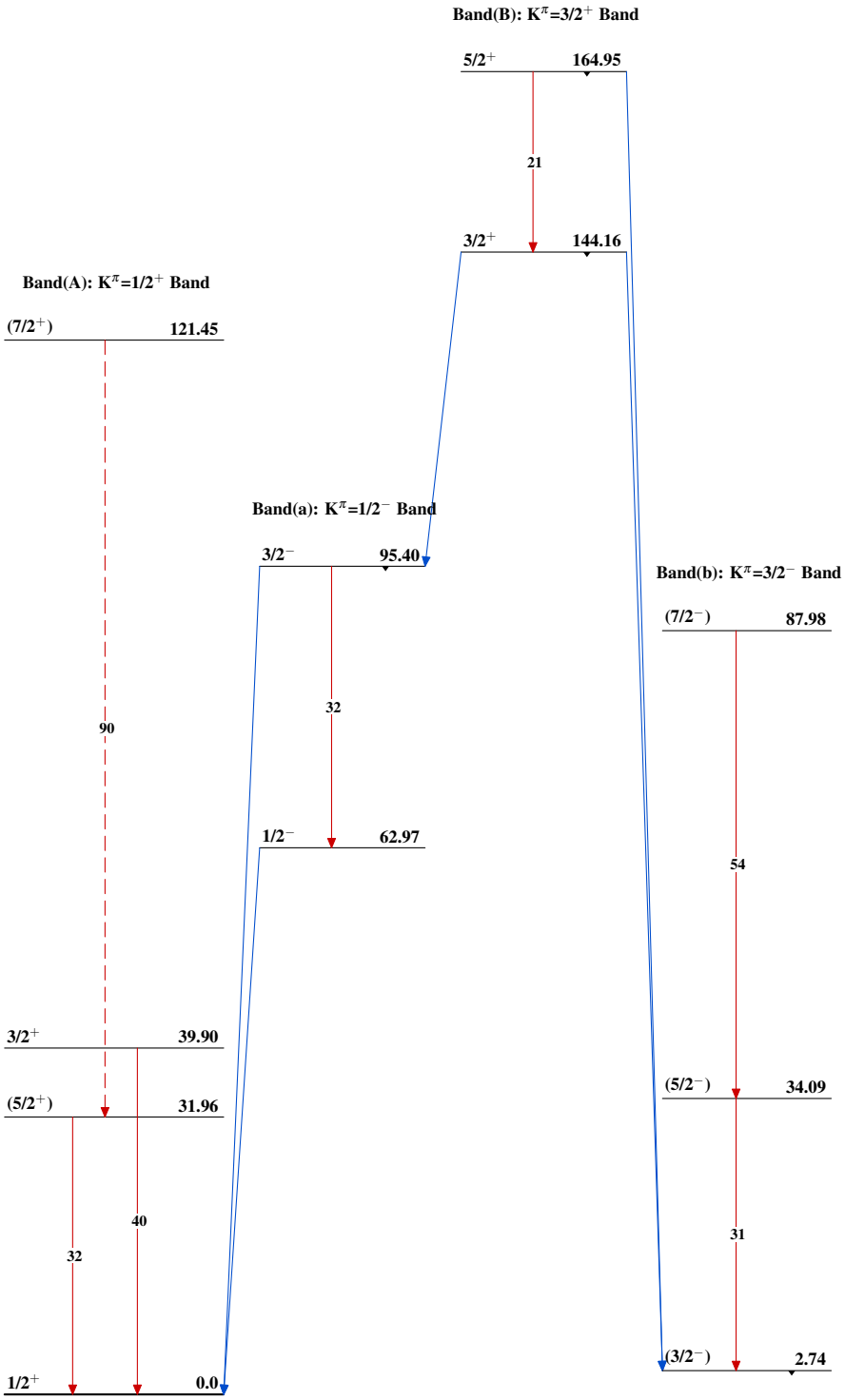
Adopted Levels, Gammas



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