Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne	NDS 110, 1745 (2009)	31-Dec-2008

Q(β^-)=7260 *9*; S(n)=5494 *5*; S(p)=10429 *9*; Q(α)=−6435 *9* 2012Wa38

Note: Current evaluation has used the following Q record.

Following (2007Ri01), from mass measurements, the energy difference between ^{102}Nb gs and ^{102}Nb isomer is 93 keV 23 with the high spin isomer being the ground state.

Q(β^-)=7.21×10^3 *4*; S(n)=5.48×10^3 *4*; S(p)=1.018×10^4 *5*; Q(α)=−6.30×10^3 *5* 2003Au03

^{102}Nb Levels

The level scheme of ^{102}Nb is extremely complicated and it is not even clear what the Jπ of the ground state and the long lived isomer is. Therefore the experimental results are given in 3 subsets of data as no unique level scheme could be obtained. Further experiments are absolutely necessary to solve that problem.

All band assignments are from 2001Hw01,1998Hw08 in ^{252}Cf SF decay. Due to the controversy about the position of the ground state an the isomer, BAND (B) on the Jπ=1$^+$ state mentioned in ^{252}Cf SF decay has been omitted.

Cross Reference (XREF) Flags

A ^{102}Zr β^- decay:2.9 s
B ^{252}Cf SF decay

E(level)‡	J$^\pi$†	T$_{1/2}$#	XREF	Comments
0.0	(4$^+$)	4.3 s *4*	AB	%β^-=100 %β^-=100. J$^\pi$: 1976Ah06 proposed a high spin for this level because it decays to levels with spin 3$^+$,4$^+$ and 6$^+$ in ^{102}Mo. From mass measurements of 2007Ri01 it is clear that the high spin level is the ground state and not the low spin state. 2007Ha32 claims the opposite but the data of 2007Ri01 are more convincing. J suggested from absence of IT from 1$^+$ isomeric state.
0.0+x	1$^+$	1.3 s *2*	A	%β^-=100 %β^-=100; no it decay reported. E(level): x=94 *7* (2012Au07) from mass measurement. E(level): x=93 *23* following 2007Ri01 from mass measurements. J$^\pi$: from allowed β-transition with log *ft*=4.71 from 0$^+$, ^{102}Zr g.s. decay.
20.37+x *9*			A	
64.39+x *9*	(2$^+$)		A	
93.95+x *17*			A	
156.36+x *11*			A	
160.72+x *21*			A	
246.31+x *18*			A	
258.43+x *15*			A	
430.7+x *6*			A	
599.49+x *8*	1$^+$		A	J$^\pi$: from allowed β-transition with log *ft*=4.8 from 0$^+$, ^{102}Zr g.s. decay.
705.08+x *24*	(1)		A	J$^\pi$: From log *ft*=5.65.
940.5+x *4*	(1)		A	J$^\pi$: From log *ft*=5.82.
0+y	(1$^+$)		B	
64.5+y	(2$^+$)		B	
161.9+y	(3$^+$)		B	
287.4+y	(4$^+$)		B	
453.1+y	(5$^+$)		B	
632.5+y@	(6$^+$)		B	
871.1+y@	(7$^+$)		B	

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Adopted Levels, Gammas (continued)

^{102}Nb Levels (continued)

E(level)‡	J$^{\pi}$†	XREF	Comments
1099.6+y@	(8$^+$)	B	
1406.9+y@	(9$^+$)	B	
1677.5+y@	(10$^+$)	B	
0.0+z&	(3$^-$)	B	Eγ=z could be γ to (4$^+$) g.s. and not to a level at 120 keV as suggested by 2001Hw01.
162.8+z*a*	(4$^-$)	B	
356.2+z&	(5$^-$)	B	
440.8+z*b*	(2$^-$)	B	
545.0+z*c*	(3$^-$)	B	
580.6+z*a*	(6$^-$)	B	
677.2+z*b*	(4$^-$)	B	
833.0+z&	(7$^-$)	B	
852.0+z*c*	(5$^-$)	B	
1045.1+z*b*	(6$^-$)	B	
1116.9+z*a*	(8$^-$)	B	
1284.2+z*c*	(7$^-$)	B	
1421.7+z&	(9$^-$)	B	
1584.0+z*b*	(8$^-$)	B	
1758.2+z*a*	(10$^-$)	B	
1854.2+z*c*	(9$^-$)	B	
2286.4+z*b*	(10$^-$)	B	

† The consequence of the fact that the high spin level would be the ground state and not the low spin is that the spin assignments proposed by 2001Hw01,1998Hw08 in (HI,xnγ) become very uncertain as they still consider the low spin isomer as the ground state.All other proposed spins for excited states are based on that assumption. Maybe what they consider as a 120 keV level could be the ground state.

‡ Calculated by the evaluator using a least-squares procedure based on adopted gammas.

From β-delayed gammas in ^{102}Nb β$^-$ decay (1976Ah06).

@ Band(A): ΔJ=1 Band based on (6$^+$).

& Band(B): K$^{\pi}$=3$^-$, α=1. π1/2[431]ν5/2[532] band, Semi-decoupled band.

a Band(b): K$^{\pi}$=3$^-$, α=0. π1/2[431]ν5/2[532] band.

b Band(C): K$^{\pi}$=2$^-$, α=0. π1/2[431]ν5/2[532] band, Semi-decoupled band.

c Band(c): K$^{\pi}$=2$^-$, α=1. π1/2[431]ν5/2[532] band.

γ(^{102}Nb)

Two sets of γ's 64.5 and 64.46 keV and 97.4 and 96.4 keV appear in both data sets and are very probably the same. However their exact position in the level scheme is not clear for the moment and more experiments are needed because the level scheme of ^{102}Nb remains very speculative.

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$†	I$_{\gamma}$†	E$_f$	J$_f^{\pi}$	Mult.‡
20.37+x		20.38 *9*	100	0.0+x	1$^+$	(E1)
64.39+x	(2$^+$)	64.46 *13*	100	0.0+x	1$^+$	M1
93.95+x		73.58 *14*	100	20.37+x		
156.36+x		136.35 *22*	41 *18*	20.37+x		
		156.14 *14*	100 *24*	0.0+x	1$^+$	
160.72+x		96.4 *5*	100	64.39+x	(2$^+$)	
246.31+x		85.59 *12*	70 *30*	160.72+x		

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Adopted Levels, Gammas (continued)

γ(^{102}Nb) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π
246.31+x		152.4 *60*	100 *40*	93.95+x	
		225.35 *32*	87 *30*	20.37+x	
		246.55 *26*	56 *8*	0.0+x	1^+
258.43+x		102.02 *17*	100 *11*	156.36+x	
		258.52 *22*	50 *7*	0.0+x	1^+
430.7+x		270.0 *5*	100	160.72+x	
599.49+x	1^+	442.3 *5*	3.5 *15*	156.36+x	
		535.13 *9*	77 *7*	64.39+x	(2^+)
		599.48 *9*	100 *9*	0.0+x	1^+
705.08+x	(1)	458.69 *21*	69 *25*	246.31+x	
		549.0 *5*	100 *31*	156.36+x	
		641.2 *8*	34 *13*	64.39+x	(2^+)
940.5+x	(1)	875.8 *8*	55 *18*	64.39+x	(2^+)
		940.6 *4*	100 *18*	0.0+x	1^+
0+y	(1^+)	y			
64.5+y	(2^+)	64.5	100	0+y	(1^+)
161.9+y	(3^+)	97.4	100	64.5+y	(2^+)
287.4+y	(4^+)	125.5	100	161.9+y	(3^+)
		222.9	17	64.5+y	(2^+)
453.1+y	(5^+)	165.7	100	287.4+y	(4^+)
		291.2	1.6	161.9+y	(3^+)
632.5+y	(6^+)	179.4	100	453.1+y	(5^+)
		345.1	6	287.4+y	(4^+)
871.1+y	(7^+)	238.6	100	632.5+y	(6^+)
		418.0	19	453.1+y	(5^+)
1099.6+y	(8^+)	228.5	100	871.1+y	(7^+)
		467.1	26	632.5+y	(6^+)
1406.9+y	(9^+)	307.3	100	1099.6+y	(8^+)
		535.8	28	871.1+y	(7^+)
1677.5+y	(10^+)	270.6	100	1406.9+y	(9^+)
		577.9	31	1099.6+y	(8^+)
0.0+z	(3^-)	z			
162.8+z	(4^-)	162.8	100	0.0+z	(3^-)
356.2+z	(5^-)	193.4	100	162.8+z	(4^-)
		356.2	27	0.0+z	(3^-)
440.8+z	(2^-)	278.0	75	162.8+z	(4^-)
		440.8	100	0.0+z	(3^-)
545.0+z	(3^-)	104.2	100	440.8+z	(2^-)
		188.8	36	356.2+z	(5^-)
		382.2	50	162.8+z	(4^-)
580.6+z	(6^-)	224.4	100	356.2+z	(5^-)
		417.8	50	162.8+z	(4^-)
677.2+z	(4^-)	96.6[§]		580.6+z	(6^-)
		132.2	100	545.0+z	(3^-)
		236.4	9	440.8+z	(2^-)
833.0+z	(7^-)	252.4	100	580.6+z	(6^-)
		476.8	42	356.2+z	(5^-)
852.0+z	(5^-)	174.8	100	677.2+z	(4^-)
		307.0	13	545.0+z	(3^-)
1045.1+z	(6^-)	193.1	100	852.0+z	(5^-)
		212.1[§]		833.0+z	(7^-)
		367.9	58	677.2+z	(4^-)
1116.9+z	(8^-)	283.9	100	833.0+z	(7^-)
		536.3	72	580.6+z	(6^-)

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Adopted Levels, Gammas (continued)

γ(^{102}Nb) (continued)

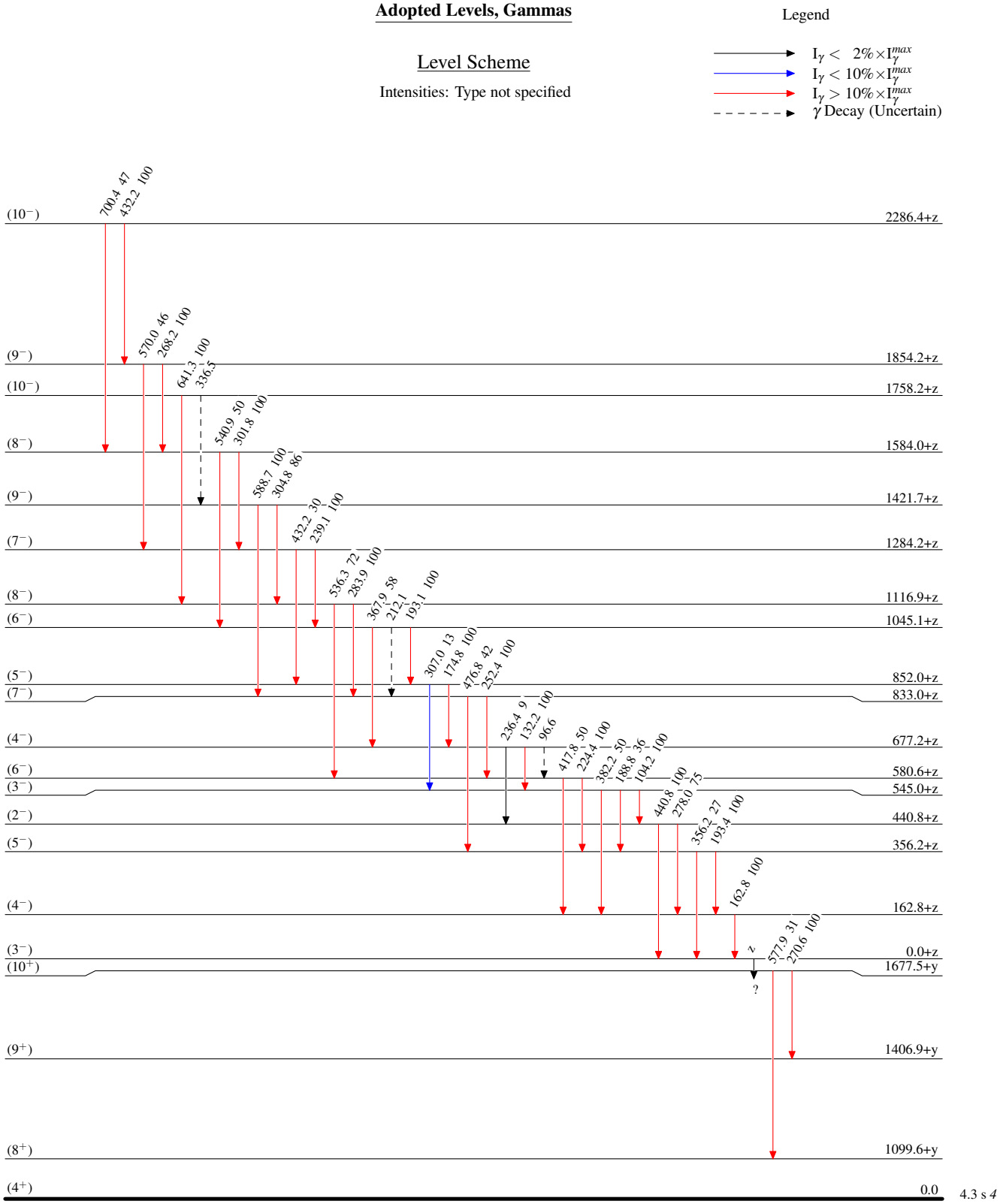
E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π
1284.2+z	(7^-)	239.1	100	1045.1+z	(6^-)	1758.2+z	(10^-)	336.5§		1421.7+z	(9^-)
		432.2	30	852.0+z	(5^-)			641.3	100	1116.9+z	(8^-)
1421.7+z	(9^-)	304.8	86	1116.9+z	(8^-)	1854.2+z	(9^-)	268.2	100	1584.0+z	(8^-)
		588.7	100	833.0+z	(7^-)			570.0	46	1284.2+z	(7^-)
1584.0+z	(8^-)	301.8	100	1284.2+z	(7^-)	2286.4+z	(10^-)	432.2	100	1854.2+z	(9^-)
		540.9	50	1045.1+z	(6^-)			700.4	47	1584.0+z	(8^-)

† Adopted gammas either from ^{102}Zr β^- decay (mostly low-spin states) or from ^{252}Cf SF decay (mostly high-spin states).
‡ Based on measured conversion coefficients.
§ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Type not specified

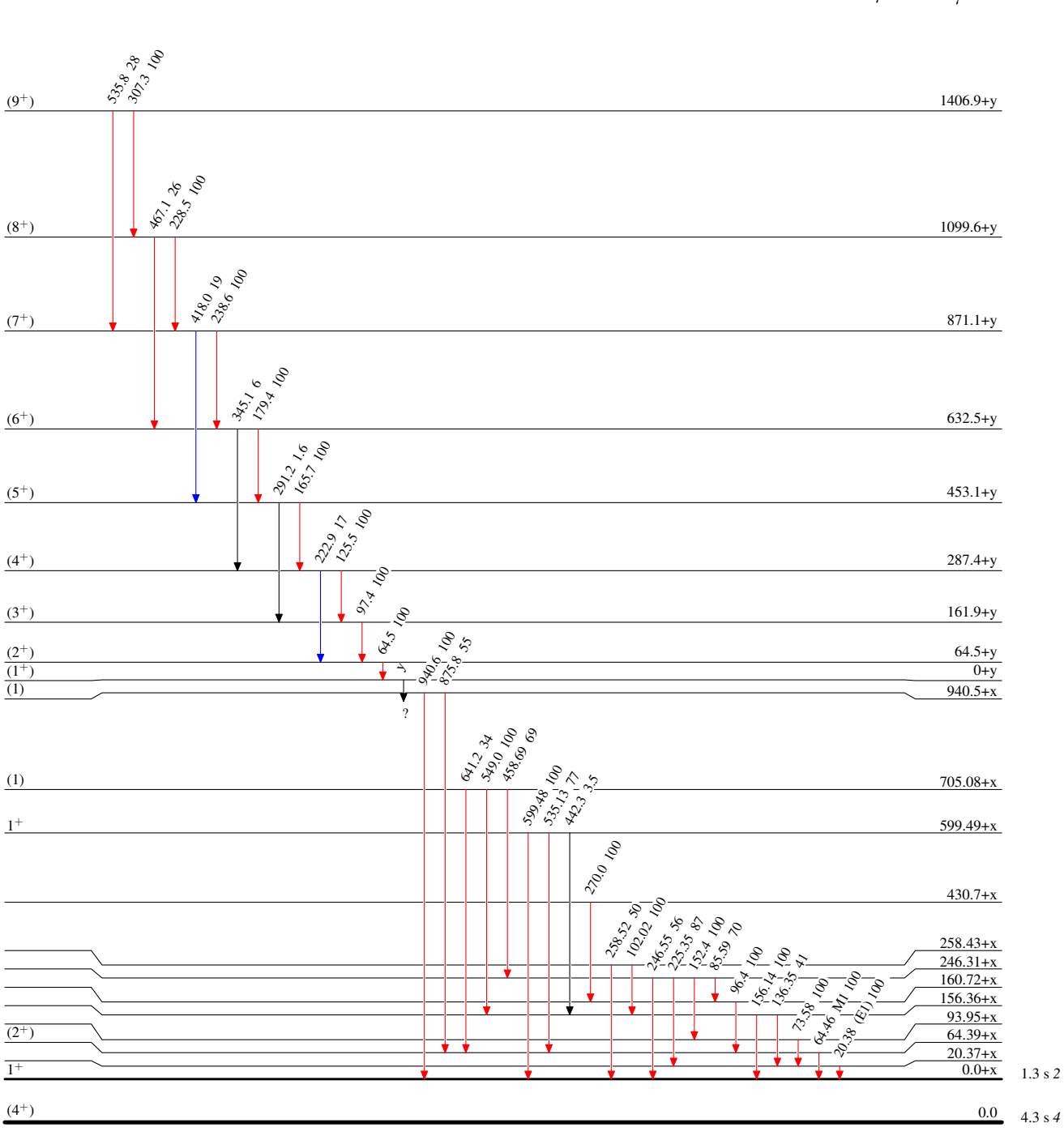


$^{102}_{41}Nb_{61}$

Adopted Levels, Gammas

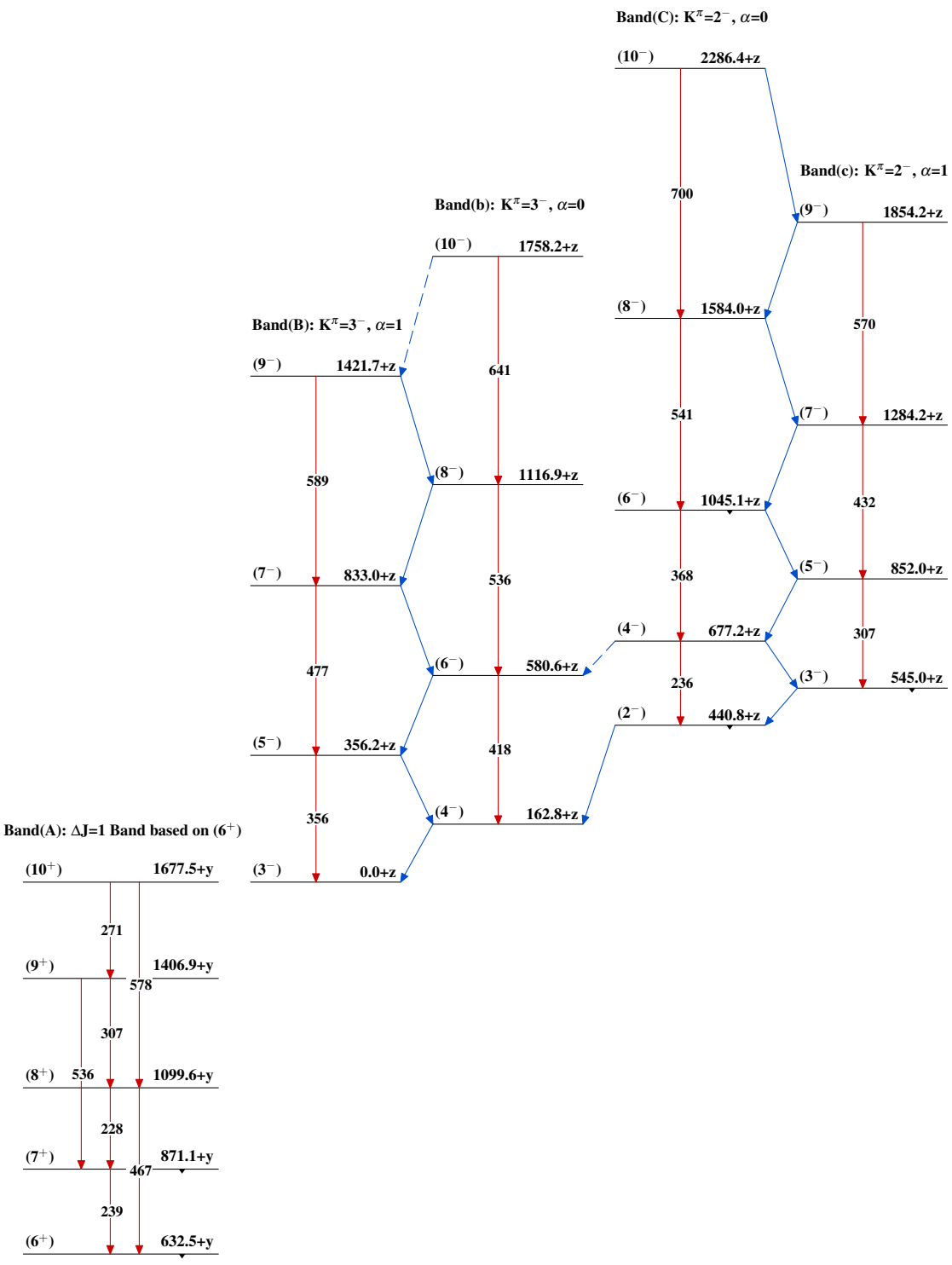
Level Scheme (continued)

Intensities: Type not specified



$^{102}_{41}Nb_{61}$

Adopted Levels, Gammas



$^{102}_{41}Nb_{61}$