Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 116,1 (2014)	31-Dec-2013

Q(β^-)=−8770 *16*; S(n)=13330 *syst*; S(p)=2148 *7*; Q(α)=−2993 *7* 2012Wa38

Estimated ΔS(n)=300 (syst,2012Wa38).

Q(εp)=325 *6*, S(2n)=24010 *300*, S(2p)=8653 *19* (2012Wa38).

1988Ku14: Isotope produced by ^{58}Ni(32Se,αp) and ^{60}Ni(^{28}Si,p2n), identified by $\beta\gamma$ coincidences with 50γ of ^{85}Zr, measured half-life.

Earlier reports about the production of ^{85}Nb: 1981SaZO, 1978DeYC.

There are no data for decay of ^{85}Mo to ^{85}Nb. An isomer identified by 2005Ka39, and another tentative isomer by 1998Oi02.

Mass measurements: 2011Ha08 (Penning trap mass spectrometer SHIPTRAP), 2006Ka48, 2012Ka13 (Penning-trap method).

Mass excess=−66273 keV *7* (2006Ka48) is most likely for the ground state since only one resonance was seen. There may be small contribution from the 3.3−s isomer at 69+y with J^π=(1/2$^-$,3/2$^-$). 2006Ka48 suggested that the low-spin isomer would be much less populated than the (9/2$^+$) g.s. in the heavy-ion fusion reaction used to obtain the ^{85}Nb isotope.

^{85}Nb Levels

Cross Reference (XREF) Flags

A ^{85}Nb IT decay (3.3 s)
B ^{58}Ni(^{40}Ca,3αpγ)

E(level)[†]	J^π[‡]	$T_{1/2}$	XREF	Comments
0.0	(9/2$^+$)	20.5 s *12*	A	%ε+%β^+=100 $T_{1/2}$: from timing of the 50.1γ from the decay of ^{85}Nb; weighted average of 20.9 s *7* (1988Ku14) and 17 s *2* (2005Ka39). Value of 2.3 min *3* from 1982De36 is in severe disagreement. J^π: from systematics of odd-A Nb nuclides.
0+x	(3/2$^-$)		B	
0+y			A	
0+z?		12 s *5*		%ε+%β^+=?; %IT=? E(level),$T_{1/2}$: possible isomer reported by 1998Oi02 in Ni(^{32}S,X) reaction at 165 MeV. Measured γ, β-gated γ spectra, half-life. IGISOL facility at Jyvaskyla. Delayed γ rays reported at 166, 272, 423, 434, 484, 532, 538, 590, 610, 660, 709 and 759 keV. These γ rays are from A=85 spectra, thus some of these could belong to the decay of ^{85}Mo. The identification of this isomer is considered as tentative. In the later work (2005Ka39) shared by some of the common authors, this isomer was not discussed. Instead, 2005Ka39 found evidence for for a 3.3-s isomer.
15.44+x[#] *17*	(9/2$^+$)		B	E(level): this (9/2$^+$) level seems different from the spherical (9/2$^+$) g.s.
69+y	(1/2$^-$,3/2$^-$)	3.3 s *9*	A	%ε+%β^+=?; %IT=? J^π: from systematics of odd-A Nb nuclides (2005Ka39). $T_{1/2}$: from 2005Ka39. E(level): 150 *80* proposed from syst (2012Au07).
134.15+x[&] *5*	(5/2$^-$)		B	
503.69+x[@] *9*	(7/2$^-$)		B	
649.79+x[#] *17*	(13/2$^+$)		B	
812.18+x[&] *11*	(9/2$^-$)		B	
1171.81+x[@] *12*	(11/2$^-$)		B	
1491.05+x[#] *18*	(17/2$^+$)		B	
1557.90+x[&] *13*	(13/2$^-$)		B	
1899.74+x[@] *13*	(15/2$^-$)		B	

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Adopted Levels, Gammas (continued)

^{85}Nb Levels (continued)

E(level)†	$J^{\pi\ddagger}$	XREF	Comments
2326.43+x$^{\&}$ 18	(17/2$^-$)	B	
2361.84+x 23	(17/2)	B	
2487.05+x$^{\#}$ 18	(21/2$^+$)	B	
2649.87+x$^{@}$ 15	(19/2$^-$)	B	
2780.1+x? 4		B	
3180.45+x$^{\&}$ 22	(21/2$^-$)	B	
3510.94+x$^{\#}$ 19	(25/2$^+$)	B	
3522.32+x$^{@}$ 16	(23/2$^-$)	B	
4178.6+x$^{\&}$ 3	(25/2$^-$)	B	
4543.16+x$^{@}$ 19	(27/2$^-$)	B	
4568.90+x$^{\#}$ 20	(29/2$^+$)	B	
5289.9+x$^{\&}$ 3	(29/2$^-$)	B	
5637.14+x$^{@}$ 21	(31/2$^-$)	B	
5794.06+x$^{\#}$ 21	(33/2$^+$)	B	
6386.1+x$^{\&}$ 4	(33/2$^-$)	B	
6739.38+x$^{@}$ 24	(35/2$^-$)	B	
7216.01+x$^{\#}$ 25	(37/2$^+$)	B	
7508.2+x$^{\&}$ 4	(37/2$^-$)	B	
7950.0+x$^{@}$ 3	(39/2$^-$)	B	
8739.6+x 4	(41/2$^+$)	B	E(level): member of the 9/2$^+$ band as a fork-type structure, two 41/2$^+$ states are produced, this 41/2$^+$ member seems to be part of the non-collective terminating structure, while the other 41/2$^+$ state at 8960+X keV seems to be a continuation of the rotational band.
8795.4+x$^{\&}$ 5	(41/2$^-$)	B	
8960.0+x$^{\#}$ 11	(41/2$^+$)	B	E(level): see comment for 8739.6+x level.
9366.6+x$^{@}$ 4	(43/2$^-$)	B	
10264.7+x$^{\&}$ 6	(45/2$^-$)	B	
10317.8+x 6	(45/2$^+$)	B	E(level): continuation of 9/2$^+$ band as a fork-type structure. This level is interpreted (1999Jo01) as a terminating 45/2$^+$ state with configuration= $\pi[(g_{9/2})^3(p_{1/2})^{-2}]_{21/2+}\otimes(\nu g_{9/2})^4(12^+)$.
11010.3+x$^{@}$ 5	(47/2$^-$)	B	
11962.5+x$^{\&}$ 7	(49/2$^-$)	B	
12916.5+x$^{@}$ 9	(51/2$^-$)	B	
13906.0+x$^{\&}$ 14	(53/2$^-$)	B	
15144.6+x?$^{@}$ 17	(55/2$^-$)	B	

† From least-squares fit to Eγ data.

‡ As proposed by 1999Jo01 based on band assignments from comparisons with TRS calculations and systematics. The measured DCO ratios for selected transitions are consistent with these assignments. The parentheses are added by the evaluators.

$^{\#}$ Band(A): $\pi g_{9/2}$ band. This band shows an upbend at $\hbar\omega\approx0.5$ MeV due to the alignment of a pair of $\gamma_{9/2}$ neutrons. Above 37/2$^+$, this band splits into into two structures (fork-type structure): one continuing as a rotational band and the other forming a non-collective structure terminating in a 45/2$^+$ state. The model calculations also predict crossing by configuration= $\pi[(g_{9/2})^3(p_{1/2})^{-2}](21/2^+)\otimes(\nu g_{9/2})^4(12^+)$ with $J^\pi=45/2^+$.

$^{@}$ Band(B): Strongly-coupled band, $\alpha=-1/2$. Possible mixed configuration=3/2[312]+5/2[303]. Both signatures show two upbends, first at $\hbar\omega\approx0.35$ MeV and the second at ≈0.55 MeV. The first upbend is interpreted as due to the alignment of a pair of $g_{9/2}$ protons while the second due to the alignment of a pair of $g_{9/2}$ neutrons.

$^{\&}$ Band(b): Strongly-coupled band, $\alpha=+1/2$. For configuration and alignments, see comments for the $\alpha=-1/2$ signature partner.

Adopted Levels, Gammas (continued)

$\gamma(^{85}$Nb)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f	Mult.†	Comments
69+y	(1/2⁻,3/2⁻)	69		0+y		(E2,M2)	Mult.: from α(K)exp>2.6, K/L=4.1 *13* (2005Ka39), ce measurements. For E2, α(K)=3.2, K/L=4.5 *4*. For M2, α(K)=6.3, K/L=6.1 *6*. The theoretical K/L ratio tends to support E2.
134.15+x	(5/2⁻)	134.15 *5*	100	0+x	(3/2⁻)	D+Q	
503.69+x	(7/2⁻)	369.53 *8*	100 *7*	134.15+x	(5/2⁻)	D	
		488.5 *2*	33 *13*	15.44+x	(9/2⁺)		
649.79+x	(13/2⁺)	634.34 *4*	100	15.44+x	(9/2⁺)	Q	
812.18+x	(9/2⁻)	308.1 *6*	9 *4*	503.69+x	(7/2⁻)	D	
		678.03 *11*	100 *17*	134.15+x	(5/2⁻)	Q	
1171.81+x	(11/2⁻)	359.5 *2*	6 *3*	812.18+x	(9/2⁻)		
		668.19 *10*	100 *13*	503.69+x	(7/2⁻)		
		1156.2‡ *4*	61 *13*	15.44+x	(9/2⁺)		
1491.05+x	(17/2⁺)	841.25 *4*	100	649.79+x	(13/2⁺)	Q	
1557.90+x	(13/2⁻)	386.1 *10*	16 *5*	1171.81+x	(11/2⁻)		
		745.75 *11*	100 *16*	812.18+x	(9/2⁻)		
1899.74+x	(15/2⁻)	341.9# *10*	<10#	1557.90+x	(13/2⁻)		
		727.95 *9*	100 *6*	1171.81+x	(11/2⁻)		
		1249.8‡ *3*	48 *4*	649.79+x	(13/2⁺)	(D)	
2326.43+x	(17/2⁻)	426.7 *4*	37 *7*	1899.74+x	(15/2⁻)		
		768.50 *15*	100 *15*	1557.90+x	(13/2⁻)	Q	
2361.84+x	(17/2)	803.9 *2*	100	1557.90+x	(13/2⁻)	Q	
2487.05+x	(21/2⁺)	995.99 *5*	100	1491.05+x	(17/2⁺)	Q	
2649.87+x	(19/2⁻)	322.9 *10*	2 *2*	2326.43+x	(17/2⁻)		
		750.16 *8*	100 *8*	1899.74+x	(15/2⁻)	Q	
		1158.5‡ *3*	10 *6*	1491.05+x	(17/2⁺)		
2780.1+x?		419@ *4*	25 *25*	2361.84+x	(17/2)		
		453.7@ *3*	100 *50*	2326.43+x	(17/2⁻)		
3180.45+x	(21/2⁻)	530.7 *3*	26 *5*	2649.87+x	(19/2⁻)		
		818.4 *5*	18 *5*	2361.84+x	(17/2)		
		854.0 *2*	100 *21*	2326.43+x	(17/2⁻)	(Q)	
3510.94+x	(25/2⁺)	1023.89 *5*	100	2487.05+x	(21/2⁺)	Q	
3522.32+x	(23/2⁻)	341.9# *10*	10# *4*	3180.45+x	(21/2⁻)		
		872.44 *7*	100 *6*	2649.87+x	(19/2⁻)	Q	
4178.6+x	(25/2⁻)	998.11 *14*	100	3180.45+x	(21/2⁻)		
4543.16+x	(27/2⁻)	1020.83 *9*	100	3522.32+x	(23/2⁻)		
4568.90+x	(29/2⁺)	1057.95 *6*	100	3510.94+x	(25/2⁺)	Q	
5289.9+x	(29/2⁻)	1111.35 *14*	100	4178.6+x	(25/2⁻)	Q	
5637.14+x	(31/2⁻)	1093.98 *10*	100	4543.16+x	(27/2⁻)	Q	
5794.06+x	(33/2⁺)	1225.15 *8*	100	4568.90+x	(29/2⁺)	Q	
6386.1+x	(33/2⁻)	1096.2 *2*	100	5289.9+x	(29/2⁻)		
6739.38+x	(35/2⁻)	1102.23 *12*	100	5637.14+x	(31/2⁻)		
7216.01+x	(37/2⁺)	1421.94 *12*	100	5794.06+x	(33/2⁺)	Q	
7508.2+x	(37/2⁻)	1122.1 *2*	100	6386.1+x	(33/2⁻)		
7950.0+x	(39/2⁻)	1210.60 *14*	100	6739.38+x	(35/2⁻)		
8739.6+x	(41/2⁺)	1523.6 *3*	100	7216.01+x	(37/2⁺)	Q	
8795.4+x	(41/2⁻)	1287.1 *2*	100	7508.2+x	(37/2⁻)		
8960.0+x	(41/2⁺)	1744 *1*	100	7216.01+x	(37/2⁺)		
9366.6+x	(43/2⁻)	1416.6 *2*	100	7950.0+x	(39/2⁻)		
10264.7+x	(45/2⁻)	1469.3 *3*	100	8795.4+x	(41/2⁻)		
10317.8+x	(45/2⁺)	1578.2 *4*	100	8739.6+x	(41/2⁺)		
11010.3+x	(47/2⁻)	1643.7 *3*	100	9366.6+x	(43/2⁻)		

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Adopted Levels, Gammas (continued)

$\gamma(^{85}Nb)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f
11962.5+x	(49/2⁻)	1697.8 *4*	100	10264.7+x	(45/2⁻)
12916.5+x	(51/2⁻)	1906.2 *7*	100	11010.3+x	(47/2⁻)
13906.0+x	(53/2⁻)	1943.5 *12*	100	11962.5+x	(49/2⁻)
15144.6+x?	(55/2⁻)	2228.0 *14*	100	12916.5+x	(51/2⁻)

† 1999Jo01 assign E2 to ΔJ=2, Q transitions and M1 or M1+E2 to ΔJ=1 transitions based on DCO ratios. For other transitions where no DCO ratios are available, 1999Jo01 assign multipolarities from band assignments. The evaluators assign mult=Q to ΔJ=2 transitions and D or D+Q for ΔJ=1 transitions only when DCO data are available.

‡ Dipole moment D_0=0.035 fm *6* for 1156.2γ, 0.034 fm *2* for 1249.8γ and 0.018 fm *7* for 1158.5γ, deduced from γ-ray branching ratios suggest octupole correlations (1999Jo01).

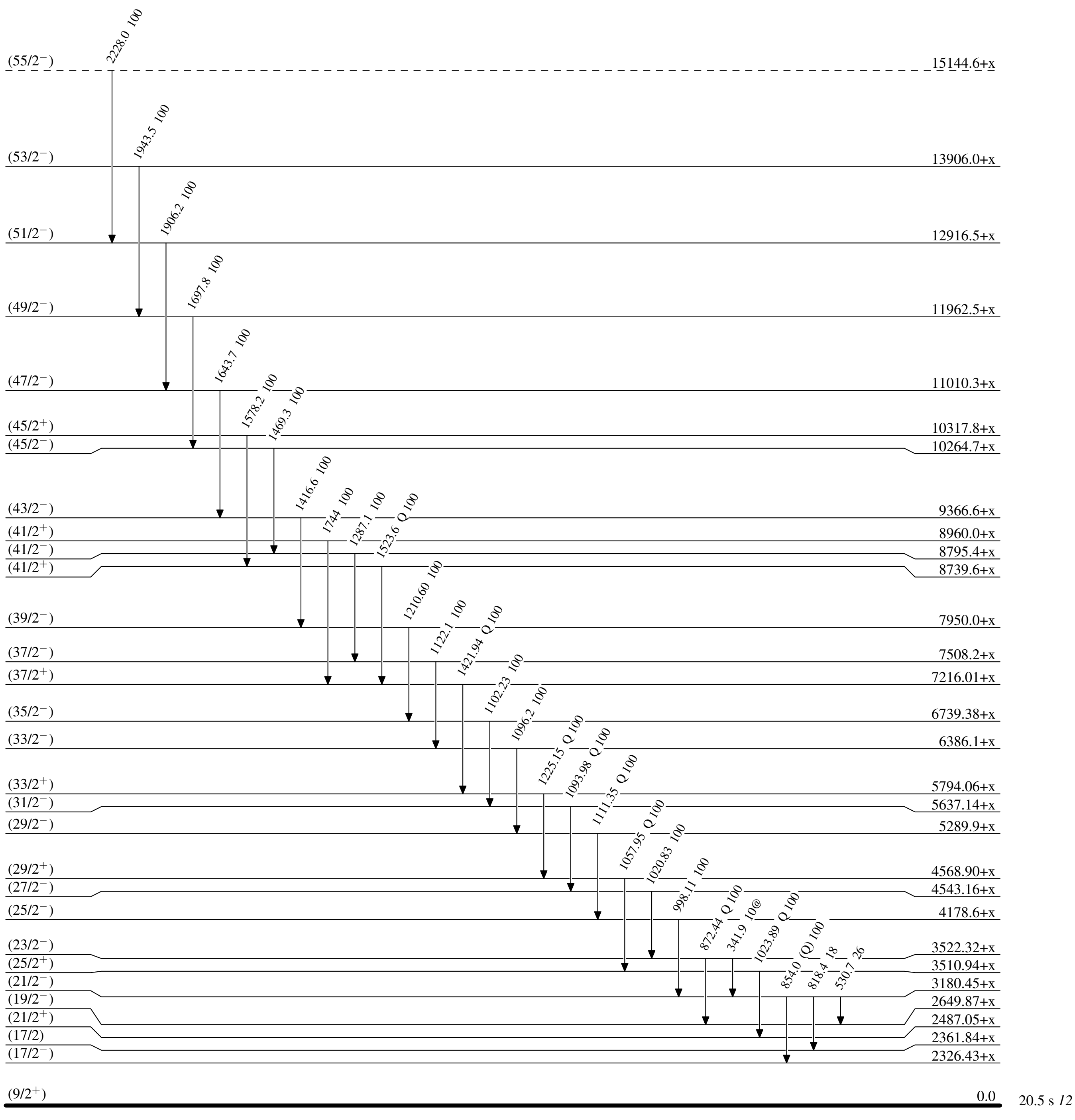
Multiply placed with intensity suitably divided.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

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

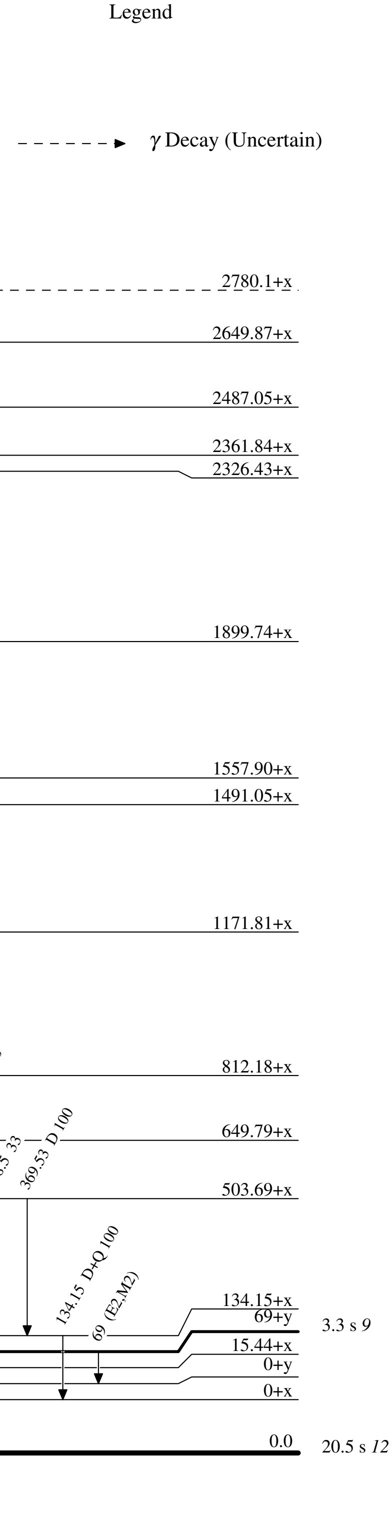


$^{85}_{41}Nb_{44}$

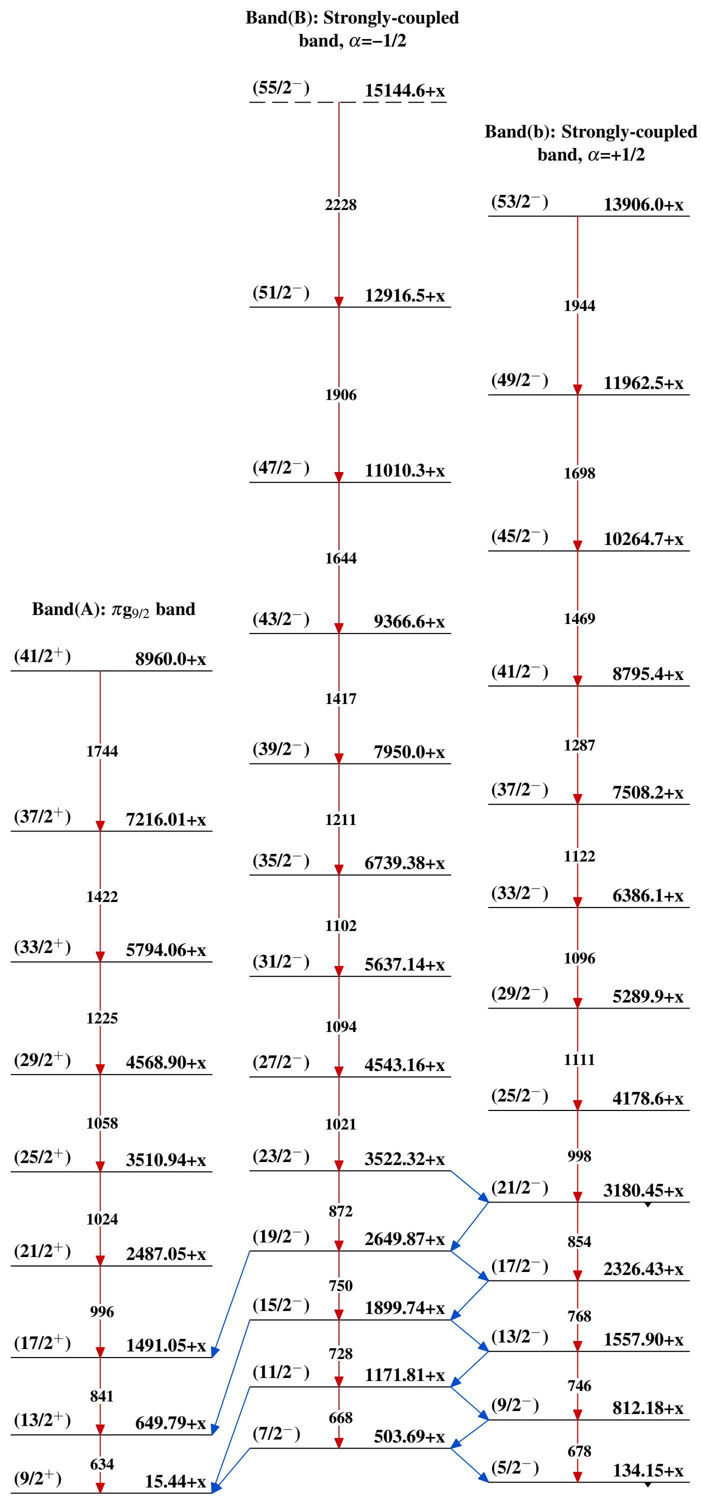
Adopted Levels, Gammas

Level Scheme (continued)

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



Adopted Levels, Gammas



$^{85}_{41}Nb_{44}$