Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

Q(β^-)=−10760 *60*; S(n)=11400 *50*; S(p)=2990 *40*; Q(α)=5278.3 *20* 2017Wa10
S(2n)=20379 *20*, S(2p)=3645 *13*, Q(εp)=3739 *27* (2017Wa10).
1973Ea01: ^{164}W produced and identified in ^{147}Sm(^{24}Mg,7n) reaction. Later studies of ^{164}W decay: 1975To05, 1979Ho10, 1994TeZZ.
For theoretical nuclear structure calculations, consult NSR database, for about 10 references. These are listed in the ENSDF dataset as document records.
Additional information 1.

^{164}W Levels

Quasiparticle orbital labeling scheme (2016Jo01):
A: $\nu i_{13/2}$,α=+1/2; first orbital.
B: $\nu i_{13/2}$,α=−1/2; first orbital.
E: $\nu(h_{9/2},f_{7/2})$,α=+1/2; first orbital.
F: $\nu(h_{9/2},f_{7/2})$,α=−1/2; first orbital.
G: $\nu(h_{9/2},f_{7/2})$,α=+1/2; second orbital.
H: $\nu(h_{9/2},f_{7/2})$,α=−1/2; second orbital.
e: $\pi h_{11/2}$,α=+1/2; first orbital.
f: $\pi h_{11/2}$,α=+1/2; first orbital.

Cross Reference (XREF) Flags

A ^{168}Os α decay (2.1 s)
B ^{104}Pd(^{63}Cu,p2nγ)
C ^{106}Cd(^{60}Ni,2pγ)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[#]	0$^+$	6.3 s *2*	ABC	%α=3.8 *12*; %ε+%β^+=96.2 *12* T$_{1/2}$: weighted average of 6.3 s *5* (1973Ea01), 5.5 s *5* (1975To05), 6.4 s *8* (1979Ho10) and 6.44 s *17* (1994TeZZ). %α: average of experimental α branchings of 2.6% *17* (1979Ho10) and 5% *1* (1996Pa01). The calculated r$_0$ parameters are 1.543 for %α=2.6 and 1.588 for %α=5.0. Since both of the r$_0$ values seem to fit the systematics, an unweighted average of %α=3.8 *12* is used here. It should be noted, however, that r$_0$=1.543 fits the r$_0$ systematics better than r$_0$=1.588, thus favoring %α=2.6 *17*.
331.9[#] *5*	2$^+$	18 ps *12*	BC	J$^\pi$: E2 γ to 0$^+$. T$_{1/2}$: mean lifetime τ=26 ps *17* from RDDS method (2017Do06) in ^{92}Mo(^{78}Kr,α2pγ) reaction at 380 MeV using DPUNS differential plunger device and RITU separator at Jyvaskyla accelerator laboratory.
822.4[#] *7*	4$^+$		BC	J$^\pi$: stretched (E2) γ to 0$^+$.
1429.2[#] *8*	6$^+$		BC	
1480.0[&] *10*	(2$^-$)		C	J$^\pi$: γ to 2$^+$, possible bandhead.
1757.6[@] *8*	(5$^-$)		C	J$^\pi$: γ to 4$^+$, possible bandhead.
1823.5[&] *10*	(4$^-$)		C	
2115.1[#] *9*	8$^+$		BC	
2181.4[@] *9*	(7$^-$)		C	
2238.6[&] *9*	(6$^-$)		C	

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Adopted Levels, Gammas (continued)

^{164}W Levels (continued)

E(level)[†]	Jπ[‡]	XREF	E(level)[†]	Jπ[‡]	XREF	E(level)[†]	Jπ[‡]	XREF
2572.6[&] *9*	(8⁻)	C	3830.4[#] *12*	14⁺	BC	6190.2[#] *16*	22⁺	BC
2632.4[@] *9*	(9⁻)	C	3877.4[@] *12*	(15⁻)	C	6466.5[&] *18*	(22⁻)	C
2718.4[&] *10*	(10⁻)	C	4292.6[&] *13*	(16⁻)	C	6778.5[@] *16*	(23⁻)	C
2829.7[#] *10*	10⁺	BC	4338.4[#] *13*	16⁺	BC	6900.6[#] *17*	24⁺	BC
2906.0[@] *10*	(11⁻)	C	4524.6[@] *13*	(17⁻)	C	7282.9[&] *21*	(24⁻)	C
2906.5 *12*	(10⁺)	C	4902.5[#] *14*	18⁺	BC	7600.9[@] *19*	(25⁻)	C
3119.7 *14*	(11⁻)	C	4966.4[&] *14*	(18⁻)	C	7665.2[#] *20*	26⁺	BC
3133.0[&] *11*	(12⁻)	C	5232.2[@] *14*	(19⁻)	C	8122.2[&] *29*	(26⁻)	C
3325.7[@] *11*	(13⁻)	C	5523.9[#] *15*	20⁺	BC	8463.5[#] *22*	28⁺	BC
3438.5[#] *11*	12⁺	BC	5691.0[&] *15*	(20⁻)	C	8468.0?[@] *28*	(27⁻)	C
3673.5[&] *12*	(14⁻)	C	5985.9[@] *15*	(21⁻)	C	9303.6[#] *24*	(30⁺)	BC

[†] From least-squares fit to Eγ values.

[‡] As proposed by 2016Jo01, based on multipolarities and ΔJ^{π} deduced from $\gamma\gamma(\theta)$(DCO) data, and from band associations. Parentheses for some of the levels have been added by evaluators due to lack of strong arguments for J^{π} assignments.

[#] Band(A): g.s. band. Configuration=$\nu i^2_{13/2}$ before the band crossing at $\hbar\omega\approx0.3$ MeV, $\nu i^2_{13/2}\otimes\nu$(AB) after the crossing (2016Jo01).

[@] Band(B): Band based on (5⁻). Configuration=$\nu i_{13/2}\otimes\nu(h_{9/2},f_{7/2})$ before the band crossing at $\hbar\omega\approx0.2$ MeV, $\nu i_{13/2}\otimes\nu(h_{9/2},f_{7/2})$(AE) after the crossing (2016Jo01).

[&] Band(C): Band based on (2⁻). Configuration=$\nu i_{13/2}\otimes\nu(h_{9/2},f_{7/2})$ before the band crossing at $\hbar\omega\approx0.2$ MeV, $\nu i_{13/2}\otimes\nu(h_{9/2},f_{7/2})$(AF) after the crossing (2016Jo01).

γ(^{164}W)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f	Mult.[‡]	α[#]	Comments
331.9	2⁺	331.9 *5*	100	0.0	0⁺	E2	0.0632	B(E2)(W.u.)=138 *+276−55* Mult.: from ΔJ=2, Q (DCO data in both the high-spin reactions) and RUL.
822.4	4⁺	490.4 *5*	100	331.9	2⁺	(E2)		
1429.2	6⁺	606.6 *5*	100	822.4	4⁺	(E2)		
1480.0	(2⁻)	1148.5 *10*	100	331.9	2⁺			
1757.6	(5⁻)	935.3 *5*	100	822.4	4⁺			
1823.5	(4⁻)	343.6 *5*	100 *16*	1480.0	(2⁻)			
		1001.2 *20*	26 *8*	822.4	4⁺			
2115.1	8⁺	686.0 *5*	100	1429.2	6⁺	(E2)		
2181.4	(7⁻)	424.4 *10*	35 *3*	1757.6	(5⁻)			
		751.9 *5*	100 *8*	1429.2	6⁺	D		
2238.6	(6⁻)	415.5 *10*	100 *14*	1823.5	(4⁻)			
		480.9 *10*	96 *14*	1757.6	(5⁻)			
2572.6	(8⁻)	334.0 *5*	100 *9*	2238.6	(6⁻)			
		391.0 *5*	91 *9*	2181.4	(7⁻)			
2632.4	(9⁻)	451.0 *5*	100 *7*	2181.4	(7⁻)			
		517.4 *5*	61 *5*	2115.1	8⁺			
2718.4	(10⁻)	85.8 *20*	<18	2632.4	(9⁻)			
		145.7 *5*	100 *8*	2572.6	(8⁻)	(E2)		
2829.7	10⁺	714.7 *5*	100	2115.1	8⁺	(E2)		
2906.0	(11⁻)	187.4 *5*	69 *5*	2718.4	(10⁻)			
		273.7 *5*	100 *7*	2632.4	(9⁻)	(E2)		

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Adopted Levels, Gammas (continued)

γ(^{164}W) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	Comments
2906.5	(10$^+$)	791.0 *10*	100	2115.1	8$^+$		
3119.7	(11$^-$)	487.3 *10*	100	2632.4	(9$^-$)		
3133.0	(12$^-$)	414.6 *5*	100	2718.4	(10$^-$)		
3325.7	(13$^-$)	419.7 *5*	100	2906.0	(11$^-$)		
3438.5	12$^+$	531.6 *10*	18.4 *19*	2906.5	(10$^+$)	(E2)	
		608.9 *5*	100 *8*	2829.7	10$^+$		
3673.5	(14$^-$)	540.5 *5*	100	3133.0	(12$^-$)		
3830.4	14$^+$	391.9 *5*	100	3438.5	12$^+$	(E2)	
3877.4	(15$^-$)	551.7 *5*	100	3325.7	(13$^-$)		
4292.6	(16$^-$)	619.1 *5*	100	3673.5	(14$^-$)		
4338.4	16$^+$	508.0 *5*	100	3830.4	14$^+$	(E2)	
4524.6	(17$^-$)	647.2 *5*	100	3877.4	(15$^-$)		
4902.5	18$^+$	564.1 *5*	100	4338.4	16$^+$	(E2)	
4966.4	(18$^-$)	673.8 *5*	100	4292.6	(16$^-$)		
5232.2	(19$^-$)	707.6 *5*	100	4524.6	(17$^-$)		
5523.9	20$^+$	621.4 *5*	100	4902.5	18$^+$	(E2)	
5691.0	(20$^-$)	724.6 *5*	100	4966.4	(18$^-$)		
5985.9	(21$^-$)	753.7 *5*	100	5232.2	(19$^-$)		
6190.2	22$^+$	666.3 *5*	100	5523.9	20$^+$	(E2)	
6466.5	(22$^-$)	775.5 *10*	100	5691.0	(20$^-$)		
6778.5	(23$^-$)	792.6 *5*	100	5985.9	(21$^-$)		
6900.6	24$^+$	710.4 *5*	100	6190.2	22$^+$	(E2)	
7282.9	(24$^-$)	816.4 *10*	100	6466.5	(22$^-$)		
7600.9	(25$^-$)	822.4 *10*	100	6778.5	(23$^-$)		
7665.2	26$^+$	764.6 *10*	100	6900.6	24$^+$	(E2)	
8122.2	(26$^-$)	839.3 *20*	100	7282.9	(24$^-$)		
8463.5	28$^+$	798.3 *10*	100	7665.2	26$^+$	(E2)	
8468.0?	(27$^-$)	867.1[@] *20*	100	7600.9	(25$^-$)		
9303.6	(30$^+$)	840.1 *10*	100	8463.5	28$^+$		E_γ: 825.0 in ^{104}Pd(^{63}Cu,p2nγ) (1991Si08) is in disagreement.

† From ^{106}Cd(^{60}Ni,2pγ) (2016Jo01). Values for the g.s. band are also available from ^{104}Pd(^{63}Cu,p2nγ) (1991Si08), which are systematically higher by ≈0.6 keV as compared to those in 2016Jo01.

‡ From DCO data in both the reactions, combined with RUL (for E2 and M2) for low-energy transitions, assuming level half-lives are less than 20 ns, typical resolution time in γγ-coincidence experiments. Mult=Q indicates ΔJ=2 transition, most likely E2, while mult=D indicates ΔJ=1 transition. For the ground-state band, the in-band transitions up to 28$^+$ are assigned (E2) based on DCO values supporting stretched quadrupoles, and lack of evidence for any isomers.

Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Placement of transition in the level scheme is uncertain.

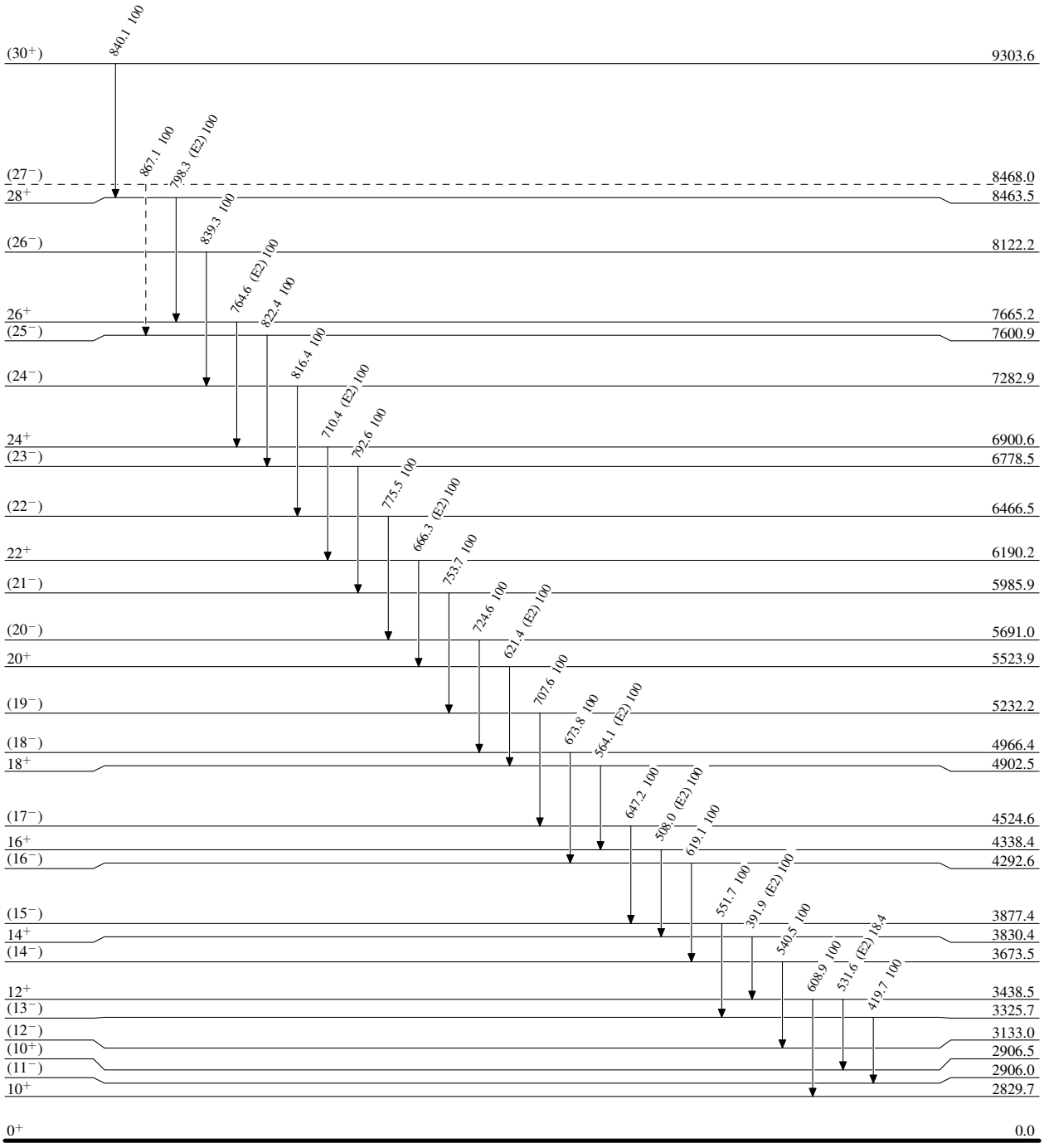
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)

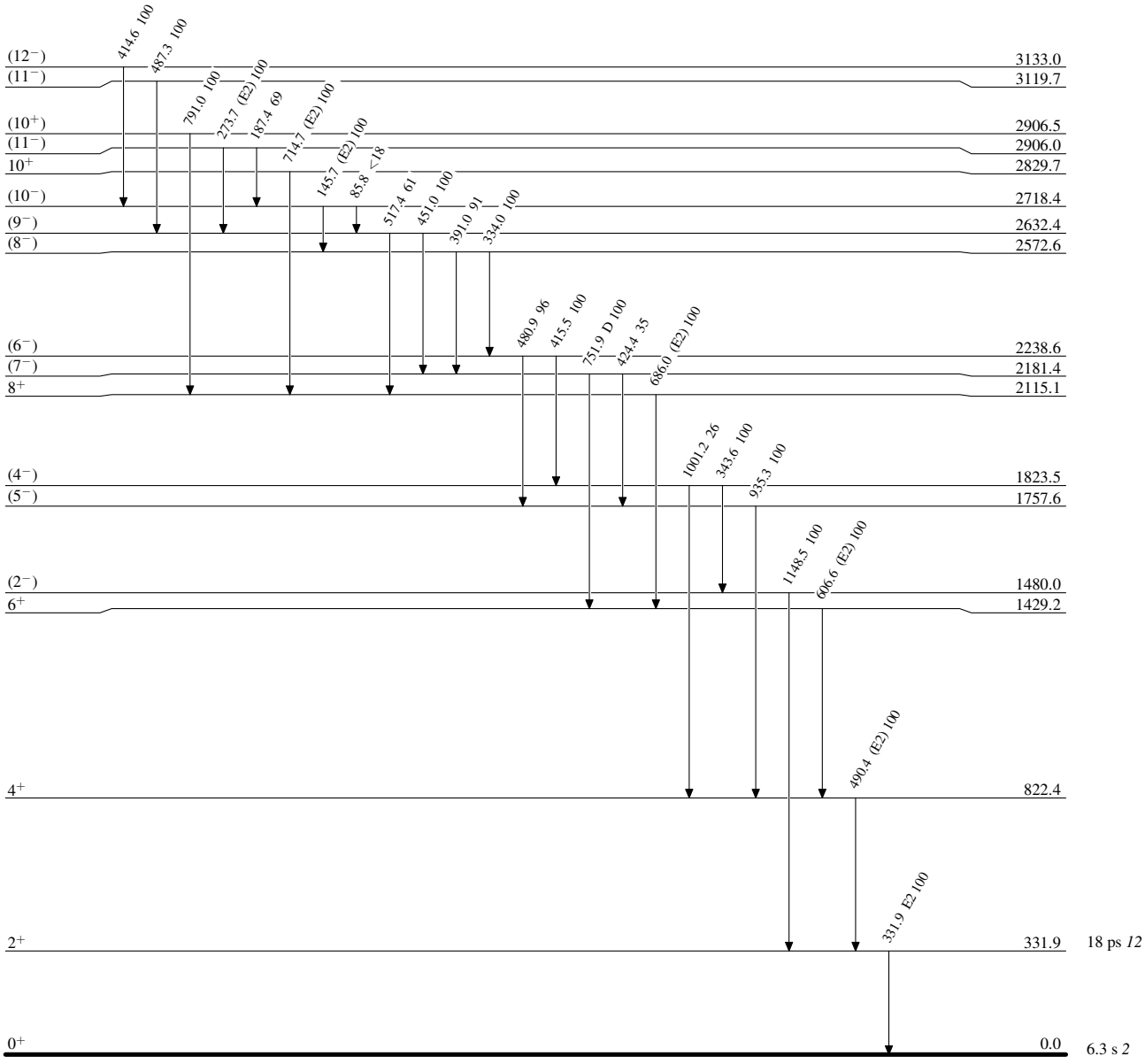


$^{164}_{74}W_{90}$

Adopted Levels, Gammas

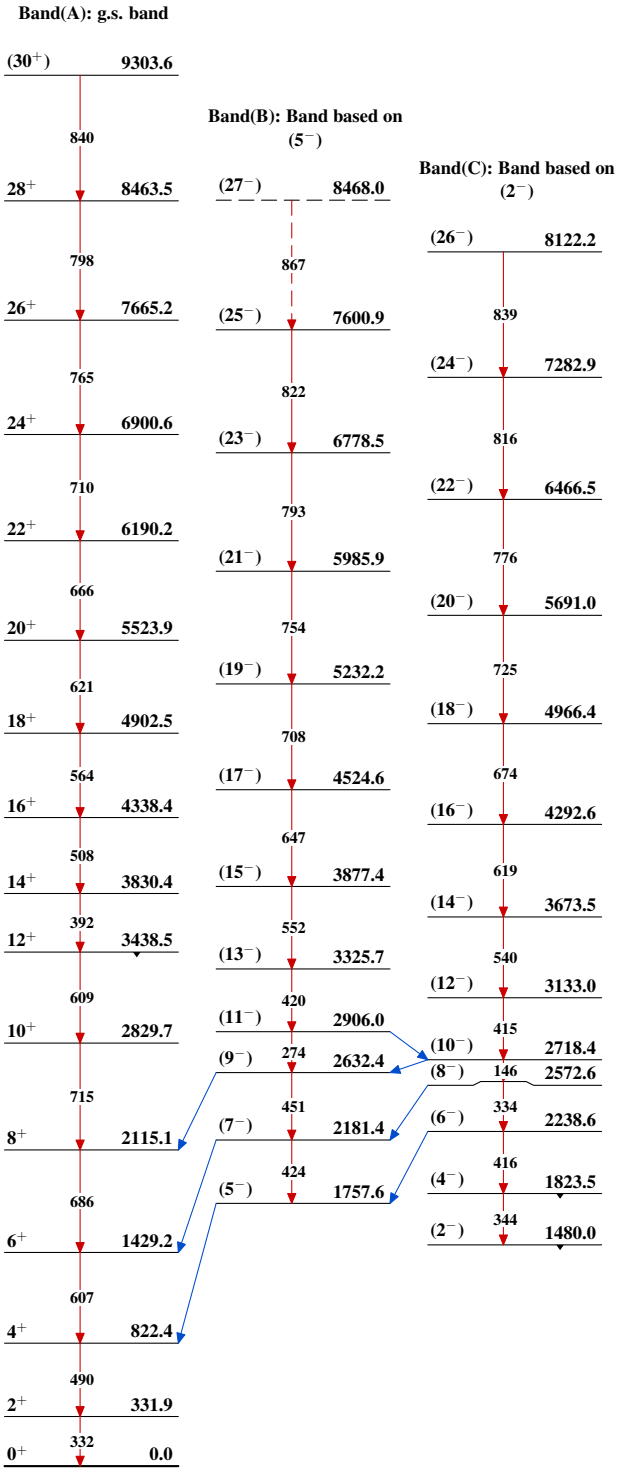
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{164}_{74}W_{90}$

Adopted Levels, Gammas



$^{164}_{74}W_{90}$