Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 199,271 (2025)	1-Sep-2024

Q(β^-)=−11160 *syst*; S(n)=10840 *syst*; S(p)=3670 *90*; Q(α)=−2150 *90* 2021Wa16
ΔQ(β^-)=410, ΔS(n)=310 (syst,2021Wa16).
S(2n)=26900 *310* (syst), S(2p)=6620 *90*, Q(εp)=5500 *90* (2021Wa16).
Production:
^{52}Cr(^{32}S,3n), E=110 MeV; surface barrier p detector, x-ray detector, NaI and Ge(Li) (1977FaZW, 1980HaZG).
^{54}Fe(^{32}S,αn), E=123 MeV; β recoil time-of-flight mass spectrometer, plastic scin (1982De36).
Ni+^{106}Cd, E(^{106}Cd)=60 MeV/A (1994He28).
^{58}Ni+^{32}S, E(^{32}S)=150 MeV; HPGe and Si(Au) (FWHM=60 keV) detectors (1997Hu15, 1999Hu05).
Other: 1965Za02.

From shape of ε-delayed p spectrum, 1999Hu05 deduce Q(ε)-S(p)(^{81}Y)=4.7 MeV *2* (cf. 4.52 MeV *13* (2021Wa16)). See 1984Ha58 and 1997Hu15 for proton spectrum from ^{81}Zr εp decay. The measured β^+ endpoint energy is 6.14 MeV *25* (1982De36); the ^{81}Y level population has not been established.

^{81}Zr Levels

Cross Reference (XREF) Flags

A ^{58}Ni(^{28}Si,αnγ)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0[a]	(3/2$^-$)[#]	5.3[@] s *3*	A	%ε+%β^+=100; %εp=0.12 *2* (1999Hu05) %εp: From 1999Hu05, based on comparison of measured $T_{1/2}$ with partial proton $T_{1/2}$ calculated using statistical model, assuming 24% *8* of delayed protons (1977FaZW, 1980HaZG; p-386γ coin) feed the first 2$^+$ state of ^{80}Sr.
0.0+x[b]	(5/2$^+$)		A	
133.2[d] *3*	(1/2$^+$)	<28 ns	A	$T_{1/2}$: estimated from γ-intensity ratios (2004Ma39).
142.978+x[c] *16*	(7/2$^+$)		A	
167.21[&] *17*	(5/2$^-$)		A	
191.85[e] *19*	(3/2$^+$)	<28 ns	A	$T_{1/2}$: estimated from γ-intensity ratios (2004Ma39).
303.0+x[b] *16*	(9/2$^+$)		A	
369.94[d] *23*	(5/2$^+$)		A	
405.39[a] *17*	(7/2$^-$)		A	
501.22[e] *25*	(7/2$^+$)		A	
697.62[&] *19*	(9/2$^-$)		A	
737.08+x[c] *19*	(11/2$^+$)		A	
832.2[d] *3*	(9/2$^+$)		A	
979.48+x[b] *21*	(13/2$^+$)		A	
1026.9[e] *4*	(11/2$^+$)		A	
1065.06[a] *21*	(11/2$^-$)		A	
1466.63[&] *23*	(13/2$^-$)		A	
1528.2[d] *4*	(13/2$^+$)		A	
1576.24+x[c] *23*	(15/2$^+$)		A	
1769.4[e] *4*	(15/2$^+$)		A	
1865.58+x[b] *25*	(17/2$^+$)		A	
1960.2[a] *3*	(15/2$^-$)		A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{81}Zr Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
2438.2[d] *4*	(17/2+)	A	3635.4[&] *4*	(21/2−)	A	5271.9[e] *12*	(27/2+)	A
2454.3[&] *3*	(17/2−)	A	3797.2+x[c] *11*	(23/2+)	A	5672.2[a] *11*	(27/2−)	A
2615.2+x[c] *3*	(19/2+)	A	3899.9[e] *6*	(23/2+)	A	6244.3[&] *12*	(29/2−)	A
2728.2[e] *5*	(19/2+)	A	4055.1+x[b] *4*	(25/2+)	A	6317.6+x[b] *11*	(33/2+)	A
2930.4+x[b] *4*	(21/2+)	A	4334.2[a] *5*	(23/2−)	A	6835.9?[e] *16*	(31/2+)	A
3069.4[a] *4*	(19/2−)	A	4889.3[&] *6*	(25/2−)	A	7708.6+x[b] *15*	(37/2+)	A
3553.2[d] *11*	(21/2+)	A	5128.6+x[b] *5*	(29/2+)	A			

† From-least squares fit to Eγ.

‡ Based on energy systematics in neighboring N=41 isotones or T_z=1/2 nuclides, and supported by measured ADO and DCO ratios and γ(θ) in ^{58}Ni(^{28}Si,αnγ), except as noted.

From 1999Hu05 and 2005Xu04; leads to consistency between measured p spectrum and statistical model calculations using level densities from backshifted Fermi gas model (1999Hu05), but statistics are too poor to differentiate between several alternative J^π possibilities. See also 2005Xu04. J^π=3/2$^{(-)}$ for ^{79}Sr isotone.

@ Weighted average of 5.3 s *5* (386γ(t)(^{80}Sr), 1997Hu15; see also 1999Hu05), 5.9 s *6* (1977FaZW), 6.3 s *5* (1976HaWO), 5.0 s *2* and 4.8 s *5* (from the decay curves for β events correlated with ^{81}Z implantations and γ(113,175,230)(t), respectively in 2009St04). Others: 15 s *5* from β+(t) for component of A=81 mass spectrum (1982De36); 1997Hu15 suggest that this datum may have been corrupted due to the direct production of 70 s ^{81}Y in the reaction used by 1982De36. $T_{1/2}$=7-15 min from 1965Za02 suggests an erroneous isotopic assignment.

& Band(A): ν 3/2[301], α=+1/2 band (2000Ma04). $g_{9/2}$ proton pair alignment observed at ħω≈0.6 MeV.

[a] Band(a): ν 3/2[301], α=−1/2 band (2000Ma04). See comment on signature partner band.

[b] Band(B): ν 5/2[422], α=+1/2 band (2000Ma04). Very similar to g.s. band in ^{82}Zr; sharp alignment of $g_{9/2}$ proton pair at ħω≈0.6 MeV.

[c] Band(b): ν 5/2[422], α=−1/2 band (2000Ma04). See comment on signature partner band.

[d] Band(C): ν 1/2[431], α=+1/2 band. No alignment observed up to ħω=0.68 MeV. Band parameters: A=27.4, B=+0.8, a=−0.28 (J=1/2, 3/2, 5/2, 7/2).

[e] Band(c): ν 1/2[431], α=−1/2 band. See comment on signature partner band.

Adopted Levels, Gammas (continued)

γ(^{81}Zr)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[#]	Comments
133.2	(1/2$^+$)	133.4 *4*	100	0.0	(3/2$^-$)			α(K)=0.0431 *7*; α(L)=0.00483 *8*; α(M)=0.000834 *14* α(N)=0.0001166 *19*; α(O)=7.59×10^{-6} *12*
142.978+x	(7/2$^+$)	143.0 *2*	100	0.0+x	(5/2$^+$)	(M1)	0.0761 *11*	α(K)=0.0668 *10*; α(L)=0.00771 *11*; α(M)=0.001342 *19* α(N)=0.0001899 *28*; α(O)=1.315×10^{-5} *19* Mult.: D intraband transition.
167.21	(5/2$^-$)	167.2 *2*	100	0.0	(3/2$^-$)			
191.85	(3/2$^+$)	58.7[@]		133.2	(1/2$^+$)			E_γ: Transition expected from coincidence data, but not observed in ^{58}Ni(^{28}Si,αnγ) by 2004Ma39. Eγ from level energy difference.
		191.8 *2*	100	0.0	(3/2$^-$)			
303.0+x	(9/2$^+$)	160.1 *2*	100 *6*	142.978+x	(7/2$^+$)	(M1)	0.0562 *8*	α(K)=0.0494 *7*; α(L)=0.00568 *8*; α(M)=0.000988 *14* α(N)=0.0001399 *20*; α(O)=9.71×10^{-6} *14*
		303.0 *2*	33.0 *21*	0.0+x	(5/2$^+$)			
369.94	(5/2$^+$)	178.0 *2*	89 *22*	191.85	(3/2$^+$)			
		236.8 *2*	100 *22*	133.2	(1/2$^+$)			
405.39	(7/2$^-$)	238.2 *3*	100 *4*	167.21	(5/2$^-$)	(M1)	0.01983 *29*	α(K)=0.01745 *25*; α(L)=0.001984 *29*; α(M)=0.000345 *5* α(N)=4.89×10^{-5} *7*; α(O)=3.42×10^{-6} *5*
		405.4 *2*	36 *4*	0.0	(3/2$^-$)			
501.22	(7/2$^+$)	309.4 *2*	100	191.85	(3/2$^+$)			
697.62	(9/2$^-$)	292.3 *2*	83 *4*	405.39	(7/2$^-$)	(M1)	0.01179 *17*	α(K)=0.01039 *15*; α(L)=0.001174 *17*; α(M)=0.0002039 *29* α(N)=2.89×10^{-5} *4*; α(O)=2.031×10^{-6} *29*
		530.4 *2*	100 *4*	167.21	(5/2$^-$)	(E2)	0.00352 *5*	α(K)=0.00309 *4*; α(L)=0.000358 *5*; α(M)=6.22×10^{-5} *9* α(N)=8.73×10^{-6} *12*; α(O)=5.79×10^{-7} *8*
737.08+x	(11/2$^+$)	434.1 *2*	100 *8*	303.0+x	(9/2$^+$)	D+Q		
		594.1 *2*	27.9 *21*	142.978+x	(7/2$^+$)			
832.2	(9/2$^+$)	331.0 *2*	23 *4*	501.22	(7/2$^+$)			
		462.2 *2*	100 *15*	369.94	(5/2$^+$)			
979.48+x	(13/2$^+$)	242.4 *2*	11.4 *8*	737.08+x	(11/2$^+$)			
		676.4 *2*	100.0 *20*	303.0+x	(9/2$^+$)	(E2)	1.78×10^{-3} *3*	α(K)=0.001563 *22*; α(L)=0.0001778 *25*; α(M)=3.09×10^{-5} *4* α(N)=4.35×10^{-6} *6*; α(O)=2.96×10^{-7} *4*
1026.9	(11/2$^+$)	525.7 *2*	100	501.22	(7/2$^+$)			
1065.06	(11/2$^-$)	367.5 *2*	66 *3*	697.62	(9/2$^-$)	(M1)	0.00669 *9*	α(K)=0.00589 *8*; α(L)=0.000661 *9*; α(M)=0.0001149 *16* α(N)=1.631×10^{-5} *23*; α(O)=1.150×10^{-6} *16*
		659.6 *2*	100 *6*	405.39	(7/2$^-$)	(E2)	1.90×10^{-3} *3*	α(K)=0.001672 *23*; α(L)=0.0001906 *27*; α(M)=3.31×10^{-5} *5* α(N)=4.66×10^{-6} *7*; α(O)=3.16×10^{-7} *4*
1466.63	(13/2$^-$)	401.6 *2*	22.9 *13*	1065.06	(11/2$^-$)	D+Q		
		769.0 *2*	100 *8*	697.62	(9/2$^-$)			
1528.2	(13/2$^+$)	696.0 *2*	100	832.2	(9/2$^+$)			
1576.24+x	(15/2$^+$)	596.8 *2*	46 *4*	979.48+x	(13/2$^+$)			
		839.2 *2*	100 *10*	737.08+x	(11/2$^+$)			

$^{81}_{40}Zr_{41}$-3

Adopted Levels, Gammas (continued)

$\gamma(^{81}Zr)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[#]	Comments
1769.4	(15/2$^+$)	742.5 *2*	100	1026.9	(11/2$^+$)			
1865.58+x	(17/2$^+$)	289.4 *2*	18.7 *13*	1576.24+x	(15/2$^+$)			
		886.0 *2*	100.0 *26*	979.48+x	(13/2$^+$)	(E2)	8.93×10^{-4} *13*	α(K)=0.000787 *11*; α(L)=8.81×10^{-5} *12*; α(M)=1.527×10^{-5} *21* α(N)=2.161×10^{-6} *30*; α(O)=1.497×10^{-7} *21*
1960.2	(15/2$^-$)	493.6 *2*	33 *4*	1466.63	(13/2$^-$)			
		895.1 *2*	100 *13*	1065.06	(11/2$^-$)			
2438.2	(17/2$^+$)	910.0 *2*	100	1528.2	(13/2$^+$)			
2454.3	(17/2$^-$)	987.8 *2*	100	1466.63	(13/2$^-$)			
2615.2+x	(19/2$^+$)	749.6 *2*	60 *16*	1865.58+x	(17/2$^+$)			
		1039.0 *2*	100 *9*	1576.24+x	(15/2$^+$)			
2728.2	(19/2$^+$)	958.8 *2*	100	1769.4	(15/2$^+$)			
2930.4+x	(21/2$^+$)	1064.8 *2*	100	1865.58+x	(17/2$^+$)			
3069.4	(19/2$^-$)	1109.2 *2*	100	1960.2	(15/2$^-$)			
3553.2	(21/2$^+$)	1115 *1*	100	2438.2	(17/2$^+$)			
3635.4	(21/2$^-$)	1181.0 *2*	100	2454.3	(17/2$^-$)			
3797.2+x	(23/2$^+$)	1182	100	2615.2+x	(19/2$^+$)			
3899.9	(23/2$^+$)	1171.7 *4*	100	2728.2	(19/2$^+$)			
4055.1+x	(25/2$^+$)	1124.7 *2*	100	2930.4+x	(21/2$^+$)			
4334.2	(23/2$^-$)	1264.8 *3*	100	3069.4	(19/2$^-$)			
4889.3	(25/2$^-$)	1253.8 *4*	100	3635.4	(21/2$^-$)			
5128.6+x	(29/2$^+$)	1073.5 *2*	100	4055.1+x	(25/2$^+$)			
5271.9	(27/2$^+$)	1372	100	3899.9	(23/2$^+$)			
5672.2	(27/2$^-$)	1338	100	4334.2	(23/2$^-$)			
6244.3	(29/2$^-$)	1355	100	4889.3	(25/2$^-$)			
6317.6+x	(33/2$^+$)	1189	100	5128.6+x	(29/2$^+$)			
6835.9?	(31/2$^+$)	1564[@]	100	5271.9	(27/2$^+$)			
7708.6+x	(37/2$^+$)	1391	100	6317.6+x	(33/2$^+$)			

[†] From data of 2004Ma39 in ^{58}Ni(^{28}Si,αnγ).
[‡] From $\gamma(\theta)$ in ^{58}Ni(^{28}Si,αnγ), assigning $\Delta\pi$=(no) to intraband transitions, except as noted.
[#] Additional information 1.
[@] Placement of transition in the level scheme is uncertain.

$^{81}_{40}Zr_{41}$-4

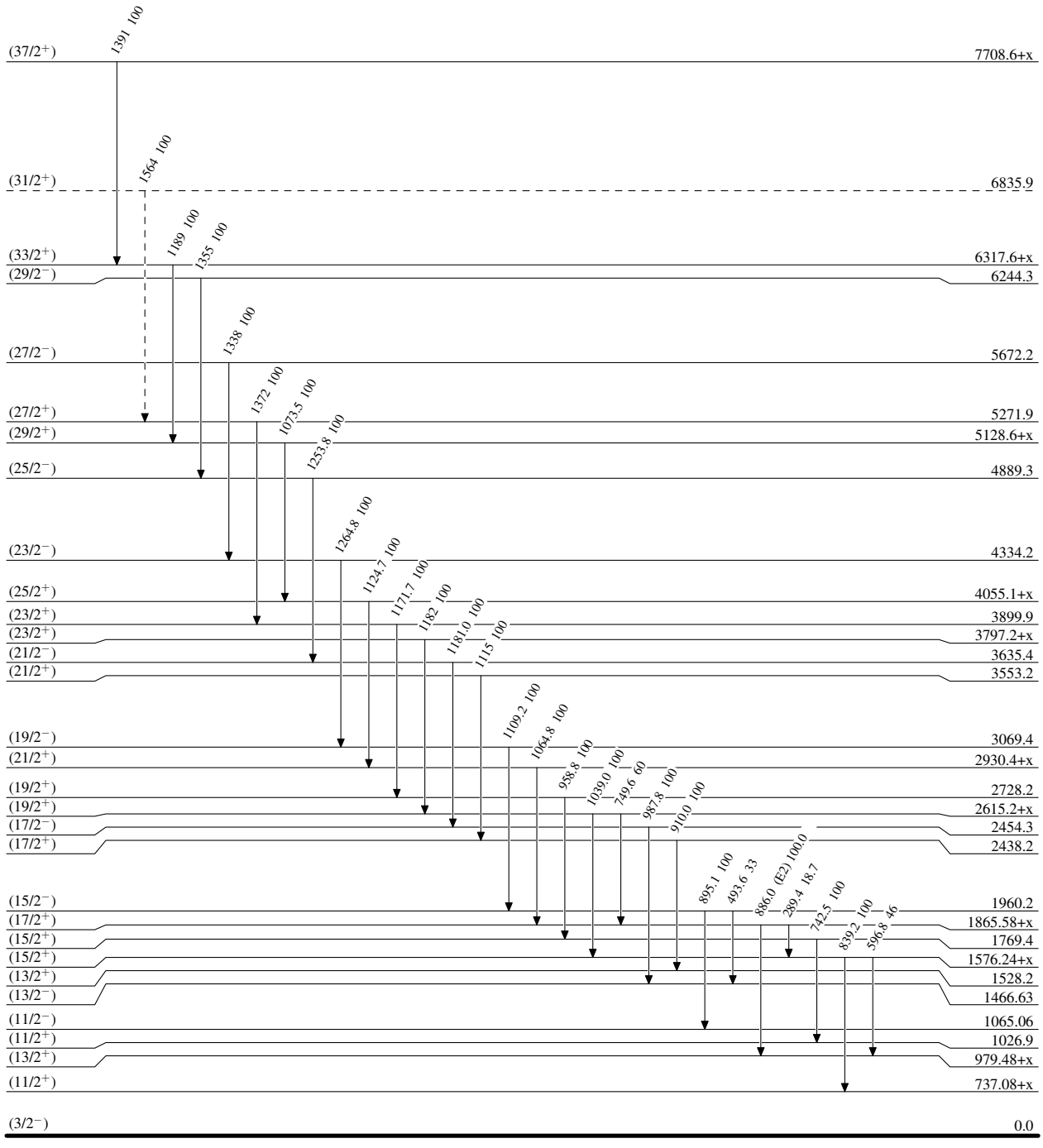
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{81}_{40}Zr_{41}$

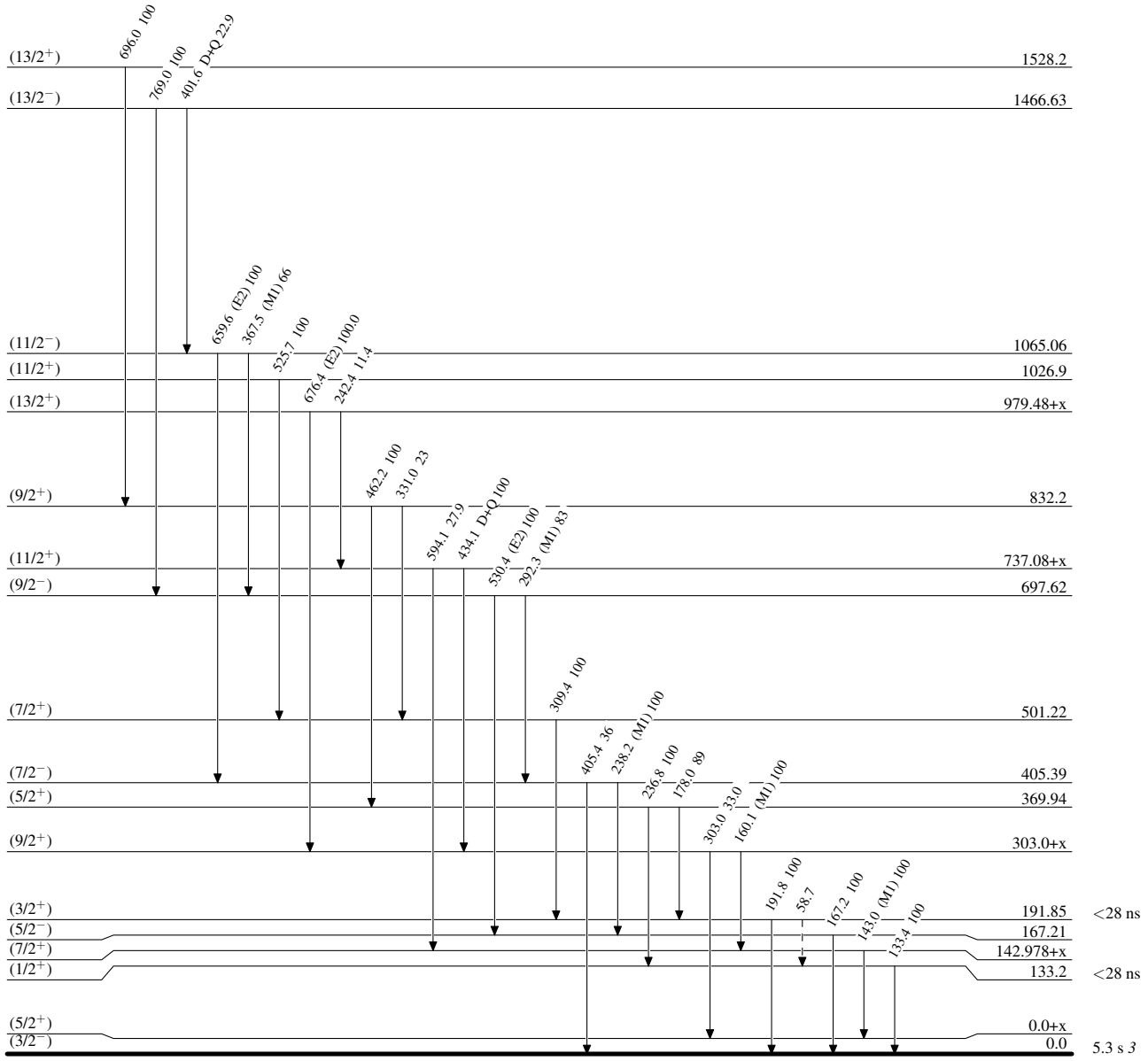
Adopted Levels, Gammas

Legend

Level Scheme (continued)

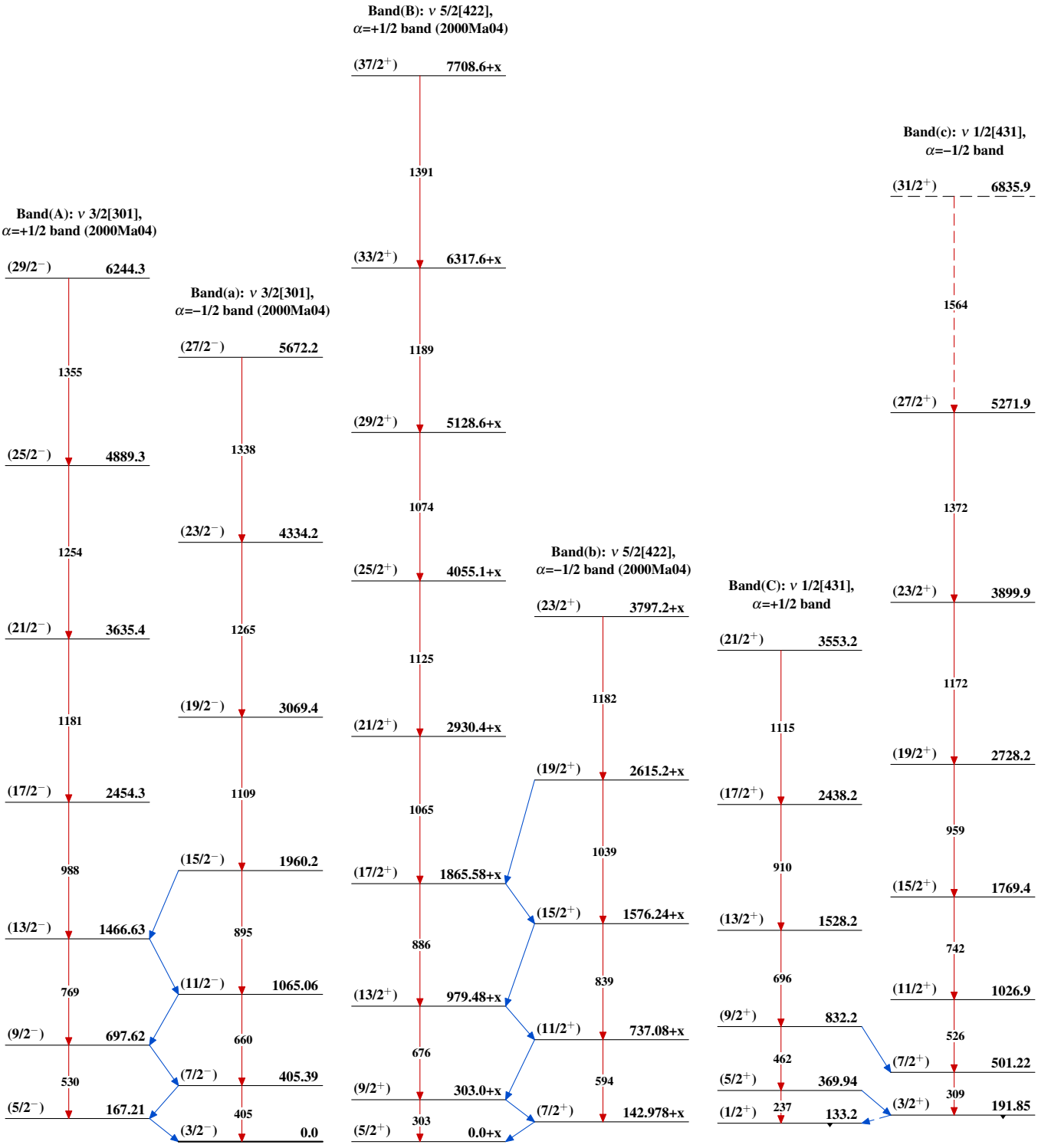
Intensities: Relative photon branching from each level

– – – – – – ► γ Decay (Uncertain)



$^{81}_{40}Zr_{41}$

Adopted Levels, Gammas



$^{81}_{40}Zr_{41}$