^{58}Ni(^{28}Si,αnγ) 2004Ma39,2000Ma04

History

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

2000Ma04, 2004Ma39: E(^{28}Si)=90 MeV; stacked ^{58}Ni foil target; GASP γ detector array (40 Compton-suppressed HPGe detectors, inner ball of 80 BGO scintillators), ISIS Si ball (40 ΔE-E telescopes at center of GASP array); measured Eγ, $\gamma\gamma$ coin, γ-α coin, angular distribution from oriented nuclei ratios ADO =(Iγ(34°)+Iγ(146°))/2Iγ(90°), DCO ratios (2000Ma04, values unstated), $\gamma(\theta)$ (2004Ma39).

^{81}Zr Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0.0[@]	3/2$^-$		
0.0+x[&]	(5/2$^+$)		
133.2[b] 3	(1/2$^+$)	<28 ns	$T_{1/2}$: estimated from γ-intensity ratios (2004Ma39).
142.97+x[a] 16	(7/2$^+$)		
167.21[#] 17	(5/2$^-$)		
191.85[c] 19	(3/2$^+$)	<28 ns	$T_{1/2}$: estimated from γ-intensity ratios (2004Ma39).
303.03+x[&] 16	(9/2$^+$)		
369.94[b] 23	(5/2$^+$)		
405.39[@] 17	(7/2$^-$)		
501.22[c] 25	(7/2$^+$)		
697.62[#] 19	(9/2$^-$)		
737.08+x[a] 19	(11/2$^+$)		
832.2[b] 3	(9/2$^+$)		
979.48+x[&] 21	(13/2$^+$)		
1026.9[c] 4	(11/2$^+$)		
1065.06[@] 21	(11/2$^-$)		
1466.63[#] 23	(13/2$^-$)		
1528.2[b] 4	(13/2$^+$)		
1576.24+x[a] 23	(15/2$^+$)		
1769.4[c] 4	(15/2$^+$)		
1865.58+x[&] 25	(17/2$^+$)		
1960.2[@] 3	(15/2$^-$)		
2438.2[b] 4	(17/2$^+$)		
2454.4[#] 3	(17/2$^-$)		
2615.2+x[a] 3	(19/2$^+$)		
2728.2[c] 5	(19/2$^+$)		
2930.4+x[&] 4	(21/2$^+$)		
3069.4[@] 4	(19/2$^-$)		
3553.2[b] 11	(21/2$^+$)		
3635.4[#] 4	(21/2$^-$)		
3797.2+x[a] 11	(23/2$^+$)		
3899.9[c] 6	(23/2$^+$)		
4055.1+x[&] 4	(25/2$^+$)		
4334.2[@] 5	(23/2$^-$)		
4889.3[#] 6	(25/2$^-$)		
5128.6+x[&] 5	(29/2$^+$)		
5271.9[c] 12	(27/2$^+$)		

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^{58}Ni(^{28}Si,αnγ) 2004Ma39,2000Ma04 (continued)

^{81}Zr Levels (continued)

E(level)[†]	J$^\pi$[‡]
5672.2[@] *11*	(27/2$^-$)
6244.3[#] *12*	(29/2$^-$)
6317.6+x[&] *11*	(33/2$^+$)
6835.9?[c] *16*	(31/2$^+$)
7708.6+x[&] *15*	(37/2$^+$)

[†] From a least-squares fit to Eγ, assigning ΔE$_\gamma$=1 keV to any data for which the authors did not state the uncertainty.

[‡] Authors′ values, based on energy systematics in neighboring N=41 isotones or T$_z$=1/2 nuclides, and supported by measured ADO and DCO ratios; J^π(g.s.)=3/2$^-$ was assumed.

[#] Band(A): 3/2[301] α=+1/2 band.

[@] Band(a): 3/2[301] α=−1/2 band.

[&] Band(B): 5/2[422] α=+1/2 band.

[a] Band(b): 5/2[422] α=−1/2 band.

[b] Band(C): ν 1/2[431], α=+1/2 band.

[c] Band(c): ν 1/2[431], α=−1/2 band.

γ(^{81}Zr)

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡]	Comments
58.7[#]		191.85	(3/2$^+$)	133.2	(1/2$^+$)		E$_\gamma$: transition expected from coincidence data, but not observed by 2004Ma39. Eγ is rounded value from level energy difference.
133.4 *4*	0.9 *5*	133.2	(1/2$^+$)	0.0	3/2$^-$		
143.0 *2*	100 *11*	142.97+x	(7/2$^+$)	0.0+x	(5/2$^+$)	D	A$_2$=−0.19 *11*; A$_4$=+0.06 *21*
160.1 *2*	97 *6*	303.03+x	(9/2$^+$)	142.97+x	(7/2$^+$)	D	A$_2$=−0.24 *12*; A$_4$=−0.22 *21* ADO≈0.70 (2004Ma04).
167.2 *2*	46 *3*	167.21	(5/2$^-$)	0.0	3/2$^-$		A$_2$=+0.01 *10*; A$_4$=+0.02 *17*
178.0 *2*	7.0 *17*	369.94	(5/2$^+$)	191.85	(3/2$^+$)		
191.8 *2*	0.6 *5*	191.85	(3/2$^+$)	0.0	3/2$^-$		
236.8 *2*	7.9 *17*	369.94	(5/2$^+$)	133.2	(1/2$^+$)		
238.2 *3*	50 *2*	405.39	(7/2$^-$)	167.21	(5/2$^-$)	D	A$_2$=−0.18 *11*; A$_4$=−0.07 *18* ADO≈0.70 (2004Ma04).
242.4 *2*	5.8 *4*	979.48+x	(13/2$^+$)	737.08+x	(11/2$^+$)		A$_2$=0.0 *3*; A$_4$=+0.4 *5*
289.4 *2*	7.1 *5*	1865.58+x	(17/2$^+$)	1576.24+x	(15/2$^+$)		
292.3 *2*	19 *1*	697.62	(9/2$^-$)	405.39	(7/2$^-$)	D	A$_2$=−0.36 *23*; A$_4$=−0.3 *4* ADO≈0.70 (2004Ma04).
303.0 *2*	32 *2*	303.03+x	(9/2$^+$)	0.0+x	(5/2$^+$)		
309.4 *2*	10.1 *12*	501.22	(7/2$^+$)	191.85	(3/2$^+$)		
331.0 *2*	1.8 *3*	832.2	(9/2$^+$)	501.22	(7/2$^+$)		
367.5 *2*	11.3 *5*	1065.06	(11/2$^-$)	697.62	(9/2$^-$)	D	A$_2$=−0.27 *20*; A$_4$=−0.1 *3*
401.6 *2*	5.5 *3*	1466.63	(13/2$^-$)	1065.06	(11/2$^-$)	D+Q	A$_2$=−0.6 *3*; A$_4$=−0.1 *3*
405.4 *2*	18 *2*	405.39	(7/2$^-$)	0.0	3/2$^-$		
434.1 *2*	24 *2*	737.08+x	(11/2$^+$)	303.03+x	(9/2$^+$)	D+Q	A$_2$=−0.40 *13*; A$_4$=−0.06 *28* ADO≈0.70 (2004Ma04).
462.2 *2*	7.8 *12*	832.2	(9/2$^+$)	369.94	(5/2$^+$)		
493.6 *2*	5.2 *6*	1960.2	(15/2$^-$)	1466.63	(13/2$^-$)		
525.7 *2*	10.1 *6*	1026.9	(11/2$^+$)	501.22	(7/2$^+$)		
530.4 *2*	23 *1*	697.62	(9/2$^-$)	167.21	(5/2$^-$)	Q	A$_2$=+0.27 *17*; A$_4$=−0.2 *4*
594.1 *2*	6.7 *5*	737.08+x	(11/2$^+$)	142.97+x	(7/2$^+$)		
596.8 *2*	5.2 *5*	1576.24+x	(15/2$^+$)	979.48+x	(13/2$^+$)		
659.6 *2*	17 *1*	1065.06	(11/2$^-$)	405.39	(7/2$^-$)	(Q)	A$_2$=+0.45 *19*; A$_4$=+0.19 *24*

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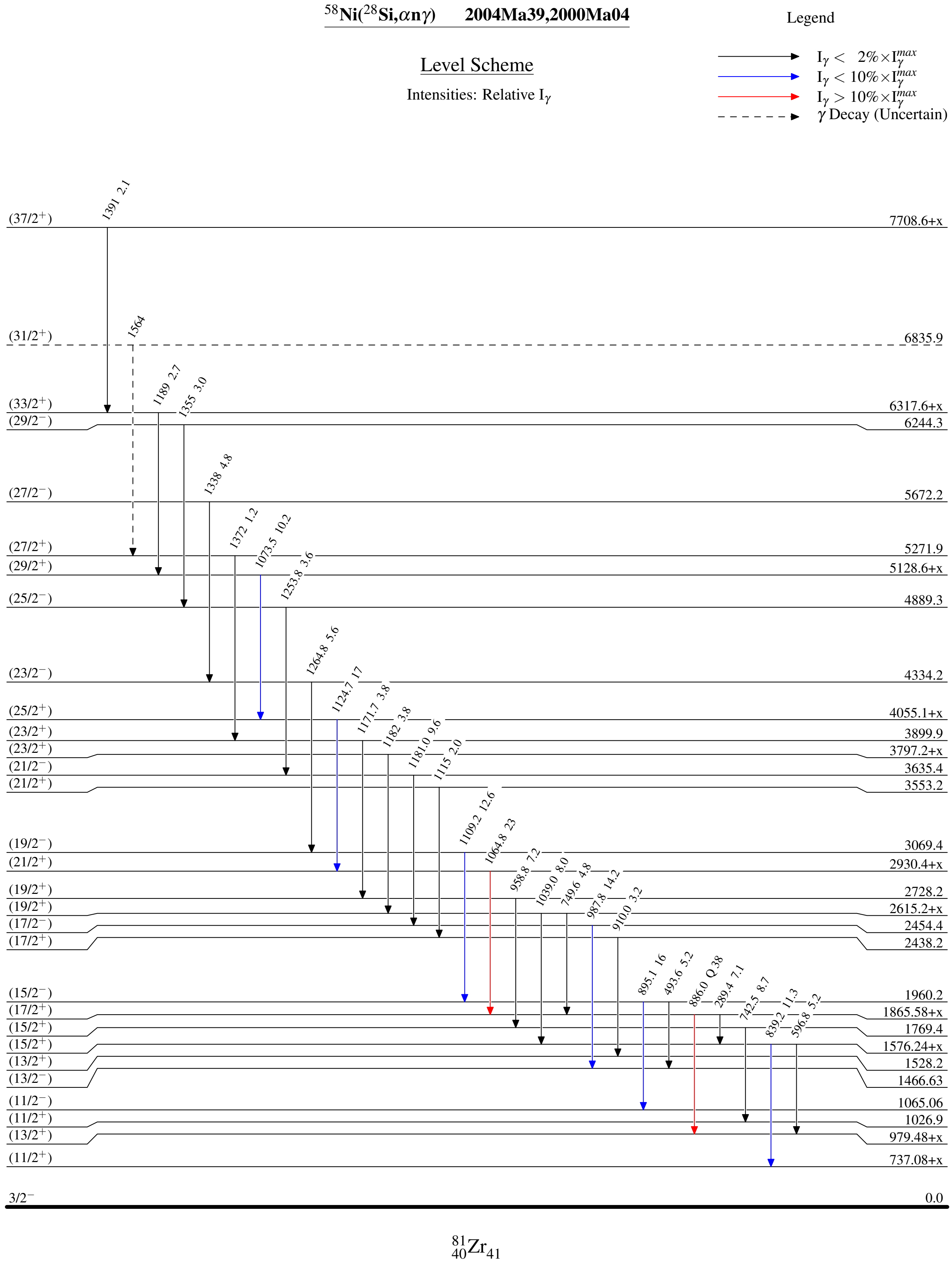
^{58}Ni(^{28}Si,αnγ) 2004Ma39,2000Ma04 (continued)

γ(^{81}Zr) (continued)

E_γ †	I_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	Comments
676.4 *2*	51 *1*	979.48+x	(13/2+)	303.03+x	(9/2+)	Q	A_2=+0.20 *10*; A_4=−0.12 *15* ADO=1.34 (2004Ma04).
696.0 *2*	5.0 *9*	1528.2	(13/2+)	832.2	(9/2+)		
742.5 *2*	8.7 *7*	1769.4	(15/2+)	1026.9	(11/2+)		
749.6 *2*	4.8 *13*	2615.2+x	(19/2+)	1865.58+x	(17/2+)		
769.0 *2*	24 *2*	1466.63	(13/2−)	697.62	(9/2−)		A_2=+0.25 *22*; A_4=0.0 *4*
839.2 *2*	11.3 *11*	1576.24+x	(15/2+)	737.08+x	(11/2+)		
886.0 *2*	38 *1*	1865.58+x	(17/2+)	979.48+x	(13/2+)	Q	A_2=+0.30 *15*; A_4=−0.25 *23*
895.1 *2*	16 *2*	1960.2	(15/2−)	1065.06	(11/2−)		E_γ: 894.5 in 2000Ma04.
910.0 *2*	3.2 *15*	2438.2	(17/2+)	1528.2	(13/2+)		
958.8 *2*	7.2 *9*	2728.2	(19/2+)	1769.4	(15/2+)		
987.8 *2*	14.2 *13*	2454.4	(17/2−)	1466.63	(13/2−)		E_γ: 988.8 in 2000Ma04.
1039.0 *2*	8.0 *7*	2615.2+x	(19/2+)	1576.24+x	(15/2+)		
1064.8 *2*	23 *1*	2930.4+x	(21/2+)	1865.58+x	(17/2+)		A_2=+0.4 *3*; A_4=+0.3 *4* E_γ: 1065.9 in 2000Ma04.
1073.5 *2*	10.2 *4*	5128.6+x	(29/2+)	4055.1+x	(25/2+)		
1109.2 *2*	12.6 *10*	3069.4	(19/2−)	1960.2	(15/2−)		
1115 *1*	2.0 *10*	3553.2	(21/2+)	2438.2	(17/2+)		
1124.7 *2*	17 *1*	4055.1+x	(25/2+)	2930.4+x	(21/2+)		
1171.7 *4*	3.8 *6*	3899.9	(23/2+)	2728.2	(19/2+)		
1181.0 *2*	9.6 *11*	3635.4	(21/2−)	2454.4	(17/2−)		
1182	3.8 *11*	3797.2+x	(23/2+)	2615.2+x	(19/2+)		
1189	2.7 *11*	6317.6+x	(33/2+)	5128.6+x	(29/2+)		
1253.8 *4*	3.6 *6*	4889.3	(25/2−)	3635.4	(21/2−)		
1264.8 *3*	5.6 *6*	4334.2	(23/2−)	3069.4	(19/2−)		
1338	4.8 *11*	5672.2	(27/2−)	4334.2	(23/2−)		
1355	3.0 *1*	6244.3	(29/2−)	4889.3	(25/2−)		
1372	1.2 *9*	5271.9	(27/2+)	3899.9	(23/2+)		
1391	2.1 *6*	7708.6+x	(37/2+)	6317.6+x	(33/2+)		
1564#		6835.9?	(31/2+)	5271.9	(27/2+)		E_γ: from level scheme (fig 1) in 2004Ma39.

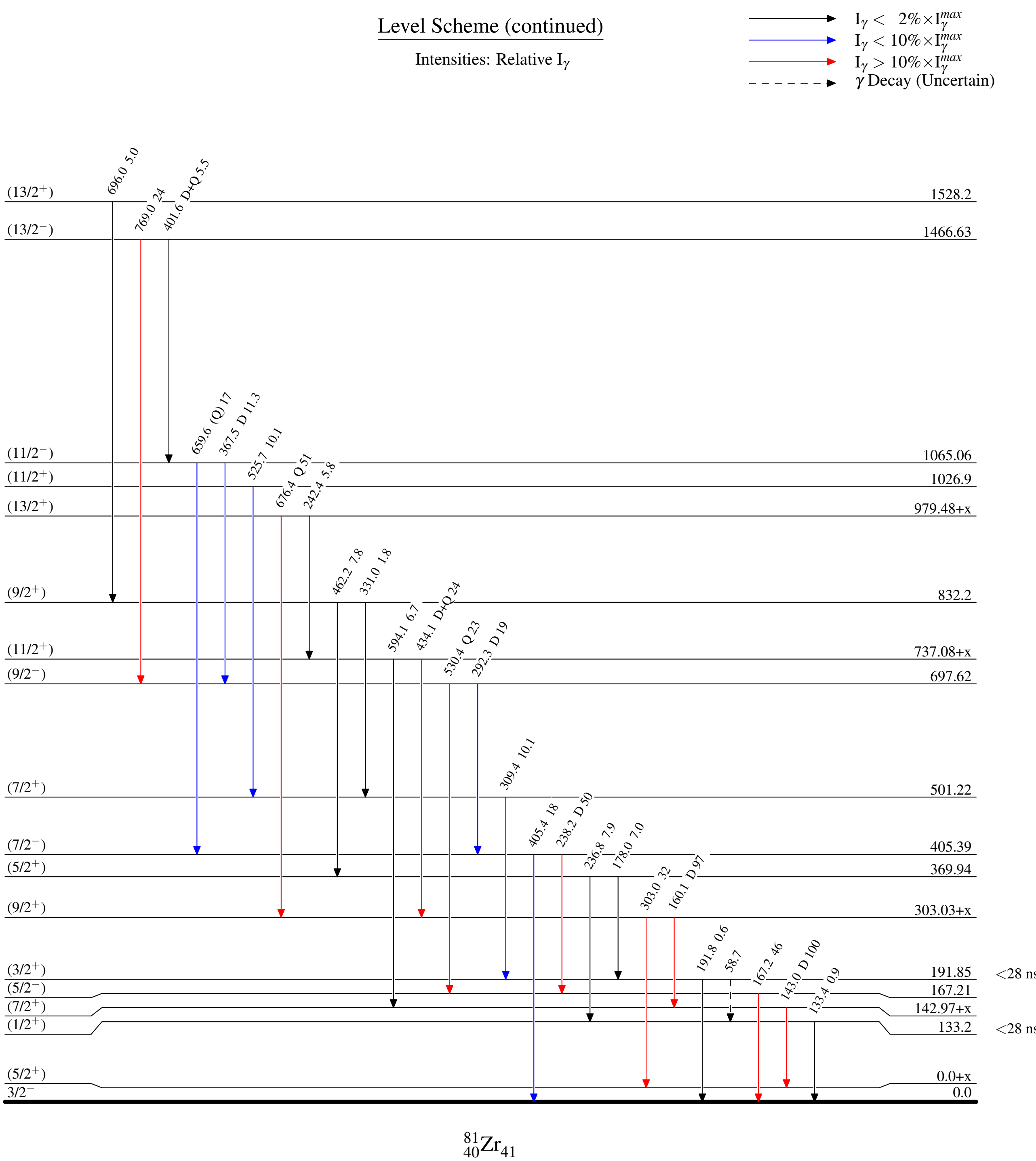
† From 2004Ma39. Eγ data from 2000Ma04 (uncertainty unstated) are consistent unless noted to the contrary.
‡ Based on either measured ADO data reported in 2000Ma04 or A_2, A_4 data reported in 2004Ma39. For ADO, expected values are ≈0.70 and ≈1.34 for pure stretched D and stretched Q (or D, ΔJ=0) transitions, respectively.
# Placement of transition in the level scheme is uncertain.


^{58}Ni(^{28}Si,αnγ) 2004Ma39,2000Ma04
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
γ Decay (Uncertain)
(37/2+) 7708.6+x
(31/2+) 6835.9
(33/2+) 6317.6+x
(29/2−) 6244.3
(27/2−) 5672.2
(27/2+) 5271.9
(29/2+) 5128.6+x
(25/2−) 4889.3
(23/2−) 4334.2
(25/2+) 4055.1+x
(23/2+) 3899.9
(23/2+) 3797.2+x
(21/2−) 3635.4
(21/2+) 3553.2
(19/2−) 3069.4
(21/2+) 2930.4+x
(19/2+) 2728.2
(19/2+) 2615.2+x
(17/2−) 2454.4
(17/2+) 2438.2
(15/2−) 1960.2
(17/2+) 1865.58+x
(15/2+) 1769.4
(15/2+) 1576.24+x
(13/2+) 1528.2
(13/2−) 1466.63
(11/2−) 1065.06
(11/2+) 1026.9
(13/2+) 979.48+x
(11/2+) 737.08+x
3/2− 0.0
1391 2.1
1564
1189 2.7
1355 3.0
1338 4.8
1372 1.2
1073.5 10.2
1253.8 3.6
1264.8 5.6
1124.7 17
1171.7 3.8
1182 3.8
1181.0 9.6
1115 2.0
1109.2 12.6
1064.8 23
958.8 7.2
1039.0 8.0
749.6 4.8
987.8 14.2
910.0 3.2
895.1 16
493.6 5.2
886.0 Q 38
289.4 7.1
742.5 8.7
839.2 11.3
596.8 5.2
$^{81}_{40}$Zr$_{41}$

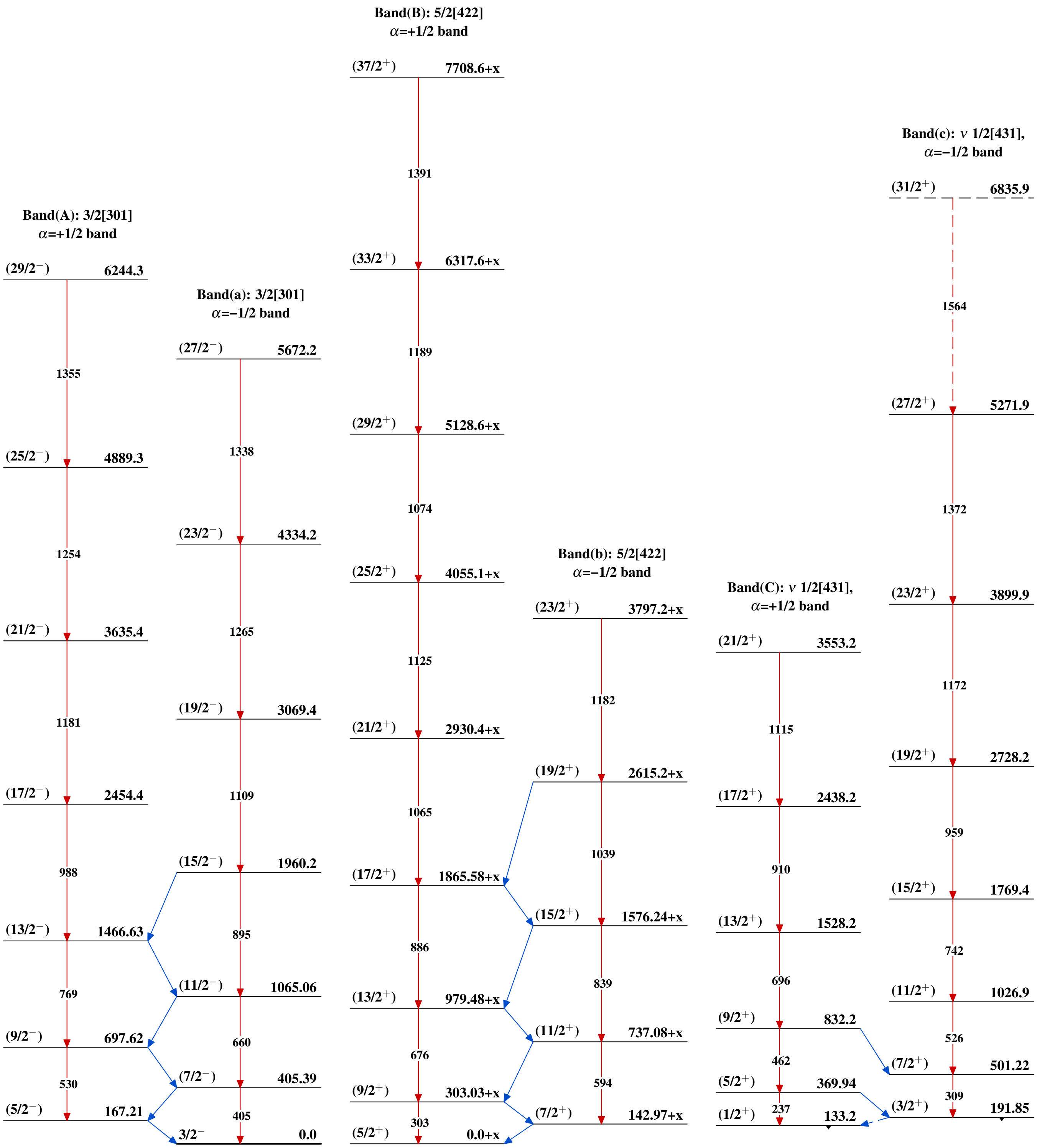
$^{58}Ni(^{28}Si,\alpha n\gamma)$ 2004Ma39,2000Ma04

Level Scheme (continued)

Intensities: Relative I_γ



$^{58}Ni(^{28}Si,\alpha n\gamma)$ 2004Ma39,2000Ma04



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