^{58}Ni(^{40}Ca,α3pγ) **1993Ar01,2000Id01,2003La24**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 114, 1293 (2013)	1-Sep-2013

Additional information 1.

Other: 1983Ko43.

1993Ar01: E=180, 187 MeV; 99.7% ^{58}Ni targets; 15 HPGe detectors (NORDBALL array), θ=79°, 101°, 143°; measured Eγ, Iγ, γ anisotropy ratio, $T_{1/2}$. See also 1993Ar07.

2000Id01: E=185 MeV. Measured Eγ, Iγ, γγ, particle-γ coin, lifetimes using GAMMASPHERE array. In one experiment this array comprised 94 escape-suppressed Ge detectors and the MICROBALL with 95 CsI counters. In a second experiment, the array consisted of 88 escape-suppressed Ge detectors, 95 element CsI detectors, 20 neutron detectors and FMA recoil separator. Deduced a superdeformed structure with 11 transitions.

2003La24: E=185 MeV. Measured Eγ, Iγ, γγ, particle-γ coin, Gammasphere array with 102 Compton-suppressed Ge detectors and Microball array of CsI(Tl) detectors.

1983Ko43: E=140-135 MeV; 99.7% ^{58}Ni targets, Pb backed: Ge(Li) detectors (θ=0° and 90°); measured γγ(t), γ anisotropy, excit.

^{91}Tc Levels

E(level)†	Jπ‡	$T_{1/2}$#
0	(9/2)$^+$	
394.6 *8*	(7/2$^+$)	
892.9 *7*	(13/2$^+$)	
1097.0 *7*	(11/2$^+$)	
1532.6 *7*	(9/2$^-$)&	
1821.1 *10*	(17/2$^+$)	
1942.5 *8*	(13/2$^-$)	
2044.5 *9*	(15/2$^+$)	
2136.6 *13*	(21/2$^+$)	2.0 ns *3*
2152.5 *10*	(17/2$^-$)	0.8 ns *2*
2766.9 *14*	(23/2$^+$)	
2979.7 *13*	(21/2$^-$)	
3134.8 *15*	(25/2$^+$)	
3344.5 *14*	(25/2$^+$)	
3803.1 *14*	(25/2$^-$)	
4078.8 *14*	(25/2$^-$)	
4118.4 *16*	(27/2$^+$)	
4353.5 *15*	(29/2$^+$)	
4593.3 *15*	(27/2$^-$)	
4701.6 *16*	(29/2$^-$)	
4748.5 *16*	(29/2$^+$)	
4933.8 *17*	(29/2$^-$)	
5076.0 *17*	(31/2$^-$)	
5089.3 *16*	(31/2$^+$)	
5266.7 *17*	(33/2$^+$)	
5382.2 *17*	($^+$)	
5565.0 *19*	(33/2$^-$)	
5931.5 *18*	(35/2$^+$)	
6156.7 *19*	(35/2$^-$)	
6190.7 *16*	(33/2$^+$)	
6449.9 *18*	(37/2$^+$)	
6613.3 *20*	(37/2$^-$)	
6841.2 *18*	(35/2$^+$)	
7290.7 *18*	(37/2$^+$)	
7502.4 *22*	(39/2$^-$)	
7666.4 *17*	(37/2$^+$)	

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^{58}Ni(^{40}Ca,α3pγ) 1993Ar01,2000Id01,2003La24 (continued)

^{91}Tc Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	Comments
7713.6 *22*	(41/2$^-$)	
8139.2 *18*	(39/2$^+$)	
8274.8 *22*	(39/2$^+$)	
8390.8 *21*	(41/2$^+$)	
8833.8 *18*	(41/2$^+$)	
9006.7 *20*	(41/2$^+$)	
9297.0 *19*	(43/2$^+$)	
9714.7 *24*	(45/2$^-$)	
10164.6 *23*	(43/2$^+$,45/2$^+$)	
10385.4 *24*	(43/2$^-$,45/2$^-$)	
10502.4 *21*	(47/2$^+$)	
10840.9 *24*	(43/2$^-$,45/2$^-$)	
12170 *3*	(47/2$^-$,49/2$^-$)	
12224.5 *25*	(45/2$^+$,47/2$^+$)	
x[@b]	J≈(51/2)[a]	Additional information 2.
1348.4+x[@] *3*	J+2	
2807.9+x[@] *3*	J+4	
4377.7+x[@] *4*	J+6	
6059.7+x[@] *4*	J+8	
7852.3+x[@] *4*	J+10	
9756.2+x[@] *5*	J+12	
11771.0+x[@] *5*	J+14	
13890.3+x[@] *5*	J+16	
16114.4+x[@] *6*	J+18	
18440.4+x[@] *7*	J+20	
20861.9+x[@] *8*	J+22	

[†] From least-squares fit to Eγ, assuming ΔE_{γ}=1 keV for all transitions.

[‡] Authors' values from 1993Ar01, based on measured γ anisotropy ratios and observed γ cascade patterns. They assume that $J_i \geq J_f$ and that crossover transitions are E2.

[#] From $\gamma\gamma$(t) (1993Ar01).

[@] Band(A): SD band (2000Id01,2003La24). Q(intrinsic)=6.7 *+13−8* (2003La24), 8.1 *+19−14* (2000Id01). Percent population≈1% of the reaction channel. Configuration: comparison of experimental moments of inertia with calculations shows that it is not $\pi5^1\nu5^2$ As proposed for ^{89}Tc. These calculations seem to agree with $\pi5^2\nu5^4$ (2000Id01). 2003La24 propose $\nu5^3\pi5^2$ or $\nu5^4\pi5^2$.

[&] Differs from adopted value of (11/2$^+$).

[a] From coincidence observation of SD band transitions with 1206γ from 10502, (47/2$^+$) level and assuming an average spin cost of 2 units of spin to connect to the (47/2$^+$) level.

[b] No connecting transitions to normal deformed structures have been found.

γ(^{91}Tc)

E$_{\gamma}$[‡]	I$_{\gamma}$[‡]	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Mult.[†]	Comments
108.3	33.7 *3*	2152.5	(17/2$^-$)	2044.5	(15/2$^+$)	D	R: 0.89 *2*.
142.2	33.8 *3*	5076.0	(31/2$^-$)	4933.8	(29/2$^-$)	D	R: 0.86 *1*.
177.6	20.8 *2*	5266.7	(33/2$^+$)	5089.3	(31/2$^+$)	D	R: 0.87 *2*.
204.1	3.5 *1*	1097.0	(11/2$^+$)	892.9	(13/2$^+$)		R: 1.04 *6*.
209.7	<28.8	3344.5	(25/2$^+$)	3134.8	(25/2$^+$)		I(209.7γ+209.8γ)=28.1 *7* (1993Ar01).

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$^{58}Ni(^{40}Ca,\alpha 3p\gamma)$ 1993Ar01,2000Id01,2003La24 (continued)

$\gamma(^{91}Tc)$ (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
209.8	<28.8	2152.5	(17/2⁻)	1942.5	(13/2⁻)	Q	R: 1.22 4. I(209.7γ+209.8γ)=28.1 7 (1993Ar01).
211.1	12.7 7	7713.6	(41/2⁻)	7502.4	(39/2⁻)	D	R: 0.98 5.
223.5	7.6 2	2044.5	(15/2⁺)	1821.1	(17/2⁺)		R: 1.05 3.
235.0	15.6 2	4353.5	(29/2⁺)	4118.4	(27/2⁺)	D	R: 0.94 2.
275.7	7.7 2	4078.8	(25/2⁻)	3803.1	(25/2⁻)	[#]	R: 1.62 5. interpreted As D, ΔJ=0.
289.9	2.0 1	9297.0	(43/2⁺)	9006.7	(41/2⁺)		R: 0.48 4.
315.5	67.4 4	2136.6	(21/2⁺)	1821.1	(17/2⁺)	Q[#]	R: 1.66 2.
331.2	9.6 2	2152.5	(17/2⁻)	1821.1	(17/2⁺)	[#]	R: 1.40 3; interpreted a D, ΔJ=0.
340.5	<33.6	4933.8	(29/2⁻)	4593.3	(27/2⁻)	D	R: 0.92 1. I(340.5γ+340.8γ)=33.3 3 (1993Ar01).
340.8	<33.6	5089.3	(31/2⁺)	4748.5	(29/2⁺)		I(340.5γ+340.8γ)=33.3 3 (1993Ar01).
368.0	36.5 3	3134.8	(25/2⁺)	2766.9	(23/2⁺)	D	R: 0.89 1.
374.5	20.0 2	5076.0	(31/2⁻)	4701.6	(29/2⁻)	D	R: 0.92 2.
394.5	4.3 2	394.6	(7/2⁺)	0	(9/2)⁺		R: 0.79 4.
410.1	8.0 2	1942.5	(13/2⁻)	1532.6	(9/2⁻)		R: 1.05 3.
449.3	8.6 2	7290.7	(37/2⁺)	6841.2	(35/2⁺)		R: 1.15 3.
456.4	34.0 3	6613.3	(37/2⁻)	6156.7	(35/2⁻)	D	R: 0.83 1.
463.4	20.0 3	9297.0	(43/2⁺)	8833.8	(41/2⁺)		R: 0.78 2.
472.8	4.4 2	8139.2	(39/2⁺)	7666.4	(37/2⁺)		R: 0.60 3.
488.8	22.5 3	5565.0	(33/2⁻)	5076.0	(31/2⁻)		R: 0.79 2.
514.3	10.5 2	4593.3	(27/2⁻)	4078.8	(25/2⁻)	[#]	R: 1.52 4; suggests Q multipolarity, but adopted value is (M1+(E2)).
518.4	15.3 3	6449.9	(37/2⁺)	5931.5	(35/2⁺)		R: 0.68 2.
559.0	2.3 1	8833.8	(41/2⁺)	8274.8	(39/2⁺)		R: 1.17 5.
577.5	17.2 3	3344.5	(25/2⁺)	2766.9	(23/2⁺)		R: 0.79 2.
591.3	17.8 2	6156.7	(35/2⁻)	5565.0	(33/2⁻)	D	R: 0.86 2.
630.0	<59.6	4748.5	(29/2⁺)	4118.4	(27/2⁺)		I(630.0γ+630.1γ)=59.2 4 (1993Ar01).
630.1	<59.6	2766.9	(23/2⁺)	2136.6	(21/2⁺)	D	R: 0.85 1. I(630.0γ+630.1γ)=59.2 4 (1993Ar01).
650.2	4.5 2	6841.2	(35/2⁺)	6190.7	(33/2⁺)	D	R: 0.90 5.
665.1	24.3 3	5931.5	(35/2⁺)	5266.7	(33/2⁺)		R: 0.68 2.
694.3	13.8 2	8833.8	(41/2⁺)	8139.2	(39/2⁺)		R: 0.62 2.
735.7	18.7 3	5089.3	(31/2⁺)	4353.5	(29/2⁺)	D	R: 0.83 2.
773.7	17.9 2	4118.4	(27/2⁺)	3344.5	(25/2⁺)	D	R: 0.88 2.
790.3	20.7 3	4593.3	(27/2⁻)	3803.1	(25/2⁻)	D	R: 0.84 2.
808.1	2.5 2	6190.7	(33/2⁺)	5382.2	(⁺)		R: 0.52 6.
823.5	51.1 4	3803.1	(25/2⁻)	2979.7	(21/2⁻)	Q[#]	R: 1.70 2.
827.3	53.3 4	2979.7	(21/2⁻)	2152.5	(17/2⁻)	Q[#]	R: 1.70 2.
845.8	8.2 2	1942.5	(13/2⁻)	1097.0	(11/2⁺)		R: 0.92 4.
848.2	4.4 2	8139.2	(39/2⁺)	7290.7	(37/2⁺)		R: 0.67 5.
888.9	17.2 2	7502.4	(39/2⁻)	6613.3	(37/2⁻)		R: 0.68 2.
892.6	100.0 5	892.9	(13/2⁺)	0	(9/2)⁺	Q[#]	R: 1.51 2.
898.5	18.1 2	4701.6	(29/2⁻)	3803.1	(25/2⁻)	Q[#]	R: 2.09 5.
913.3	28.2 3	5266.7	(33/2⁺)	4353.5	(29/2⁺)	Q[#]	R: 1.71 3.
924.0	<85.0	6190.7	(33/2⁺)	5266.7	(33/2⁺)		I(928γ+924γ)=84.6 4 (1993Ar01).
928.1	<85.0	1821.1	(17/2⁺)	892.9	(13/2⁺)	Q	R: 1.58 2. I(928γ+924γ)=84.6 4 (1993Ar01).
947.5	6.3 2	2044.5	(15/2⁺)	1097.0	(11/2⁺)	Q[#]	R: 1.41 5.
1009.1	3.3 1	4353.5	(29/2⁺)	3344.5	(25/2⁺)	Q[#]	R: 1.31 8.
1028.3	3.5 1	5382.2	(⁺)	4353.5	(29/2⁺)		R: 0.78 5.
1036.2	1.5 1	3803.1	(25/2⁻)	2766.9	(23/2⁺)		R: 0.48 6.
1048.6	<4.5	6613.3	(37/2⁻)	5565.0	(33/2⁻)		R: 1.02 5; consistent with D multipolarity, but level scheme

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^{58}Ni(^{40}Ca,α3pγ) 1993Ar01,2000Id01,2003La24 (continued)

γ(^{91}Tc) (continued)

E_γ [‡]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [†]	Comments
							implies ΔJ=2.. I(1048.6γ+1049.1γ)=4.3 *2* (1993Ar01).
1049.1	<4.5	1942.5	(13/2⁻)	892.9	(13/2⁺)		I(1048.6γ+1049.1γ)=4.3 *2* (1993Ar01).
1080.8	21.0 *3*	6156.7	(35/2⁻)	5076.0	(31/2⁻)	Q[#]	R: 1.73 *4*.
1097.1	15.5 *3*	1097.0	(11/2⁺)	0	(9/2)⁺	D	R: 0.83 *3*.
1099.0	<10.5	4078.8	(25/2⁻)	2979.7	(21/2⁻)		I(1099.0γ+1100.3γ+1101.2γ)=10.3 *2* (1993Ar01).
1100.3	<10.5	7713.6	(41/2⁻)	6613.3	(37/2⁻)	Q	R: 1.30 *5*. I(1099.0γ+1100.3γ+1101.2γ)=10.3 *2* (1993Ar01).
1101.2	<10.5	6190.7	(33/2⁺)	5089.3	(31/2⁺)		I(1099.0γ+1100.3γ+1101.2γ)=10.3 *2* (1993Ar01).
1137.9	2.2 *1*	1532.6	(9/2⁻)	394.6	(7/2⁺)	Q[#]	R: 1.61 *13*.
1151.9	9.2 *2*	2044.5	(15/2⁺)	892.9	(13/2⁺)		R: 0.54 *2*.
1158.0	0.9 *1*	9297.0	(43/2⁺)	8139.2	(39/2⁺)		R: 0.95 *13*; low for ΔJ=2 transition required by level scheme.
1205.4	14.2 *3*	10502.4	(47/2⁺)	9297.0	(43/2⁺)	Q[#]	R: 1.74 *5*.
1208.0	6.3 *2*	3344.5	(25/2⁺)	2136.6	(21/2⁺)	Q	R: 1.25 *7*.
1218.5	35.9 *4*	4353.5	(29/2⁺)	3134.8	(25/2⁺)	Q[#]	R: 1.66 *3*.
1298.0	2.9 *2*	8139.2	(39/2⁺)	6841.2	(35/2⁺)		R: 0.94 *8*. consistent with D, but level scheme implies ΔJ=2.
1348.4 *3*	0.25 *3*	1348.4+x	J+2	x	J≈(51/2)		other Eγ: 1349.9 *5* (2000Id01).
1351.7[@]	0.9 *1*	4118.4	(27/2⁺)	2766.9	(23/2⁺)	Q	R: 1.4 *3*.
1359.1	4.1 *2*	7290.7	(37/2⁺)	5931.5	(35/2⁺)		R: 0.76 *5*.
1459.51 *4*	0.99 *5*	2807.9+x	J+4	1348.4+x	J+2		other Eγ: 1459.6 *4* (2000Id01).
1475.6	2.4 *1*	7666.4	(37/2⁺)	6190.7	(33/2⁺)	(Q)	R: 1.21 *10*.
1532.8	4.6 *2*	1532.6	(9/2⁻)	0	(9/2)⁺		R: 0.68 *5*.
1543.1	0.6 *1*	8833.8	(41/2⁺)	7290.7	(37/2⁺)		
1569.75 *17*	1.00 *5*	4377.7+x	J+6	2807.9+x	J+4		other Eγ: 1569.7 *4* (2000Id01).
1613.8	2.0 *1*	4748.5	(29/2⁺)	3134.8	(25/2⁺)		R: 1.11 *11*.
1681.97 *13*	1.05 *5*	6059.7+x	J+8	4377.7+x	J+6		other Eγ: 1681.7 *4* (2000Id01).
1689.2	1.9 *2*	8139.2	(39/2⁺)	6449.9	(37/2⁺)	D	R: 0.86 *12*.
1773.8	1.8 *1*	10164.6	(43/2⁺,45/2⁺)	8390.8	(41/2⁺)		R: 0.74 *9*; very low for adopted E2 multipolarity.
1792.63 *13*	0.93 *5*	7852.3+x	J+10	6059.7+x	J+8		other Eγ: 1792.1 *4* (2000Id01).
1824.8	1.4 *1*	8274.8	(39/2⁺)	6449.9	(37/2⁺)		R: 0.47 *8*.
1837.6	2.6 *2*	6190.7	(33/2⁺)	4353.5	(29/2⁺)		
1903.79 *16*	1.00 *5*	9756.2+x	J+12	7852.3+x	J+10		other Eγ: 1903.1 *4* (2000Id01).
1940.8	4.3 *2*	8390.8	(41/2⁺)	6449.9	(37/2⁺)		R: 1.15 *7*.
2001.1	2.9 *2*	9714.7	(45/2⁻)	7713.6	(41/2⁻)		
2014.84 *17*	0.95 *5*	11771.0+x	J+14	9756.2+x	J+12		other Eγ: 2013.3 *4* (2000Id01).
2059.9	0.7 *1*	12224.5	(45/2⁺,47/2⁺)	10164.6	(43/2⁺,45/2⁺)		
2119.26 *17*	0.89 *5*	13890.3+x	J+16	11771.0+x	J+14		other Eγ: 2118.2 *4* (2000Id01).
2208.0	3.9 *2*	8139.2	(39/2⁺)	5931.5	(35/2⁺)	Q	R: 1.28 *10*.
2224.1 *3*	0.61 *4*	16114.4+x	J+18	13890.3+x	J+16		other Eγ: 2221.3 *5* (2000Id01).
2325.9 *3*	0.37 *3*	18440.4+x	J+20	16114.4+x	J+18		other Eγ: 2323.9 *5* (2000Id01).
2384.3	1.1 *1*	8833.8	(41/2⁺)	6449.9	(37/2⁺)	Q[#]	R: 1.41 *21*.
2399.8	1.6 *1*	7666.4	(37/2⁺)	5266.7	(33/2⁺)	Q[#]	R: 1.69 *19*.
2421.5 *3*	0.21 *3*	20861.9+x	J+22	18440.4+x	J+20		other Eγ: 2423.6 *6* (2000Id01).
2455.5		12170	(47/2⁻,49/2⁻)	9714.7	(45/2⁻)		
2556.3	0.6 *1*	9006.7	(41/2⁺)	6449.9	(37/2⁺)	Q[#]	R: 1.7 *3*.

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^{58}Ni(^{40}Ca,α3pγ) 1993Ar01,2000Id01,2003La24 (continued)

γ(^{91}Tc) (continued)

Eγ‡	Iγ‡	E_i(level)	J_i^π	E_f	J_f^π	Comments
2671.8	0.5 *2*	10385.4	(43/2⁻,45/2⁻)	7713.6	(41/2⁻)	
3127.3	0.5 *1*	10840.9	(43/2⁻,45/2⁻)	7713.6	(41/2⁻)	R: 0.82 *21*.

† 1993Ar01 measured γ anisotropy ratio R defined as R=[2I_γ(143°)/(Iγ(79°)+Iγ(101°))]. These data are given in comments on the respective transitions. Known stretched Q (or D, ΔJ=0) transitions exhibit ratios of 1.2 to 2.1, stretched D transitions≈0.9 (see fig 4 of 1993Ar01).

‡ From thick target data taken at E(^{40}Ca)=187 MeV (1993Ar01), except for SD band transitions. ΔE_γ=0.2-1.0 keV, depending on transition energy and intensity. The data for SD band transitions are from 20003La24. Values from 2000Id01 are in general agreement but some differ by 1-3 keV. The intensities for the SD bands are relative intensities within the band and have been read from inset "a" in figure 1 of 2000Id01.

Stretched Q (or D, ΔJ=0) transition based on γ anisotropy ratio from 1993Ar01.

@ Placement of transition in the level scheme is uncertain.

$^{58}Ni(^{40}Ca,\alpha 3p\gamma)$ 1993Ar01,2000Id01,2003La24

Legend

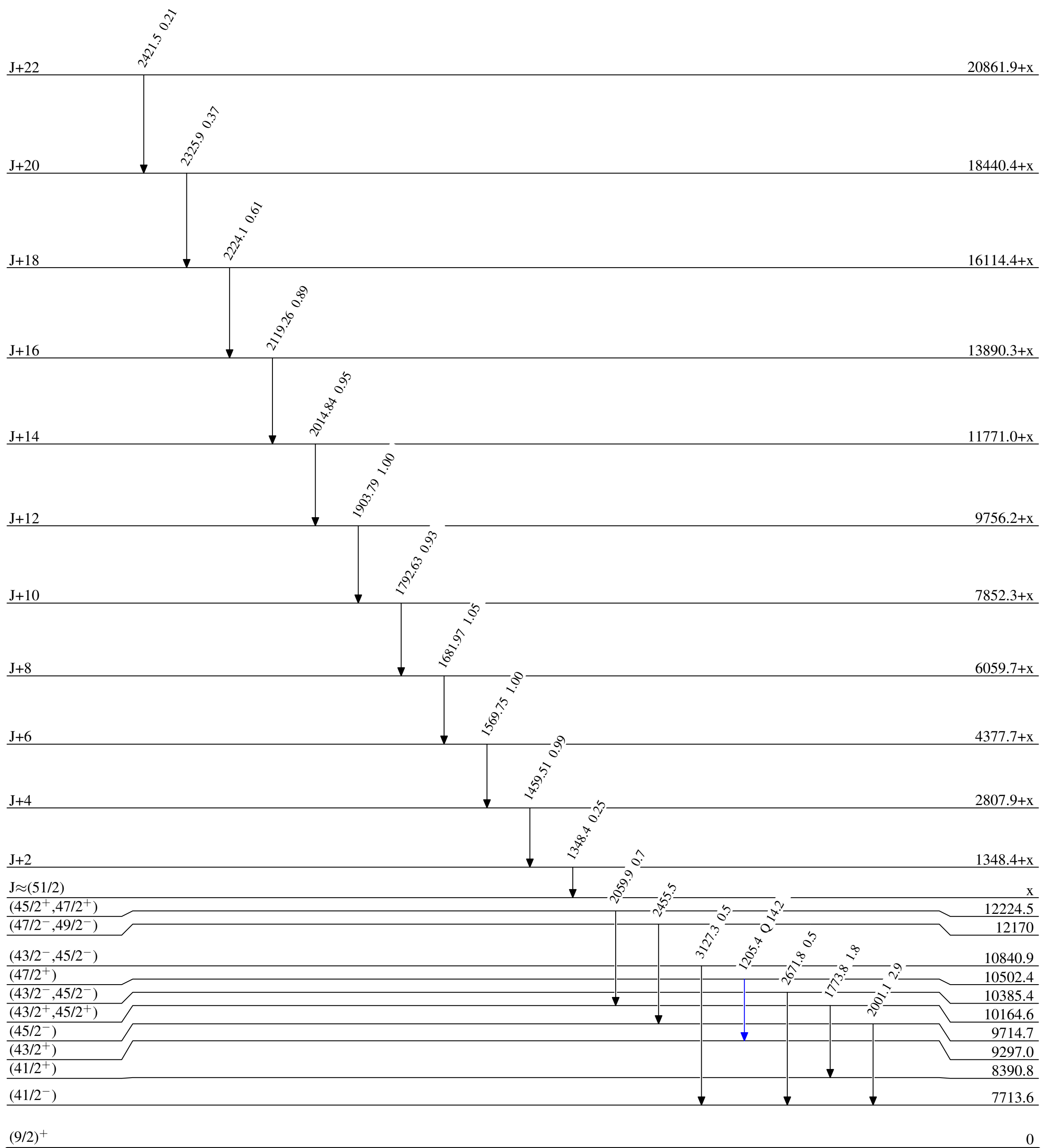
$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

Level Scheme

Intensities: Relative I_γ

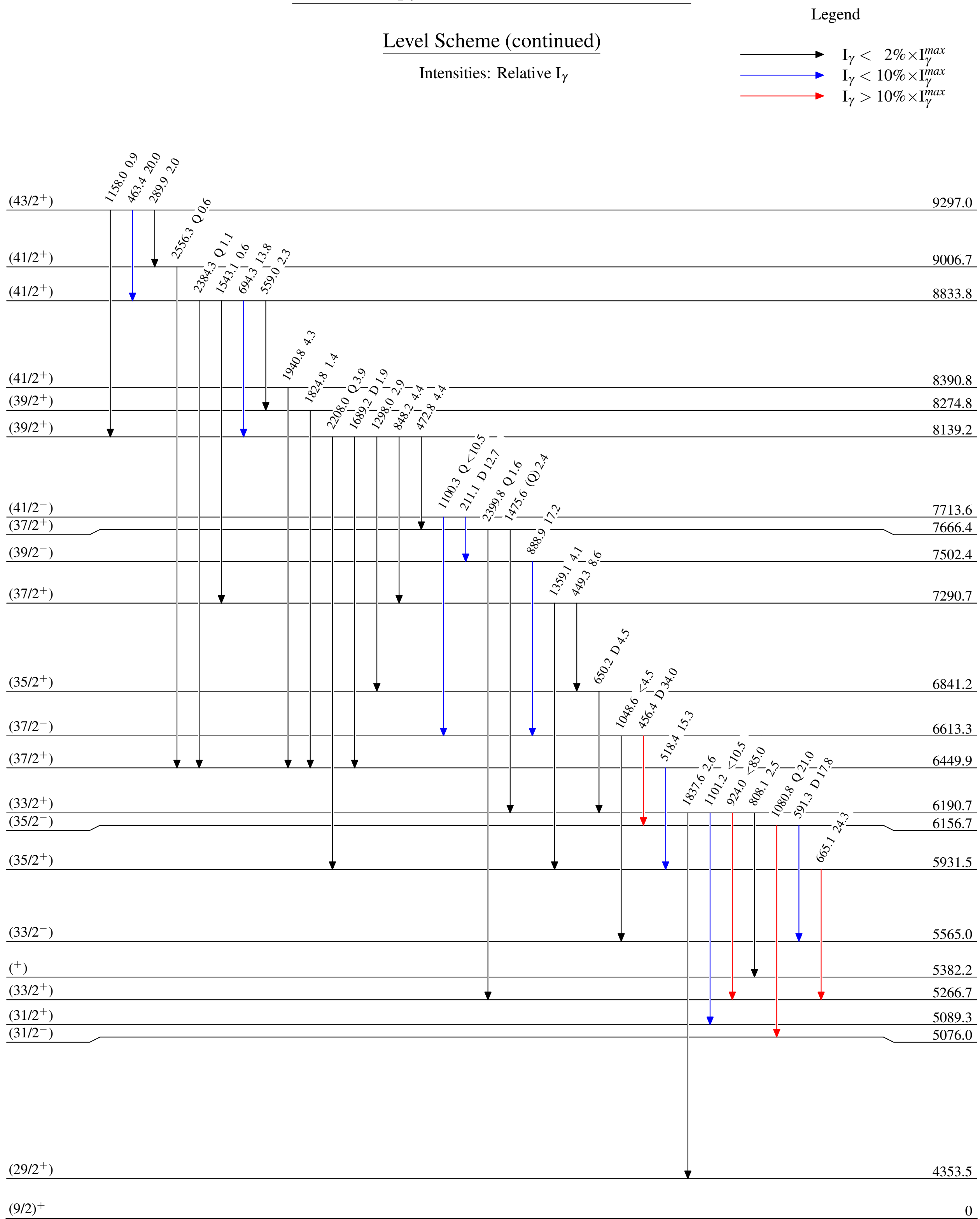


$^{91}_{43}Tc_{48}$

^{58}Ni(^{40}Ca,α3pγ) 1993Ar01,2000Id01,2003La24

Level Scheme (continued)

Intensities: Relative I_γ



$^{91}_{43}Tc_{48}$

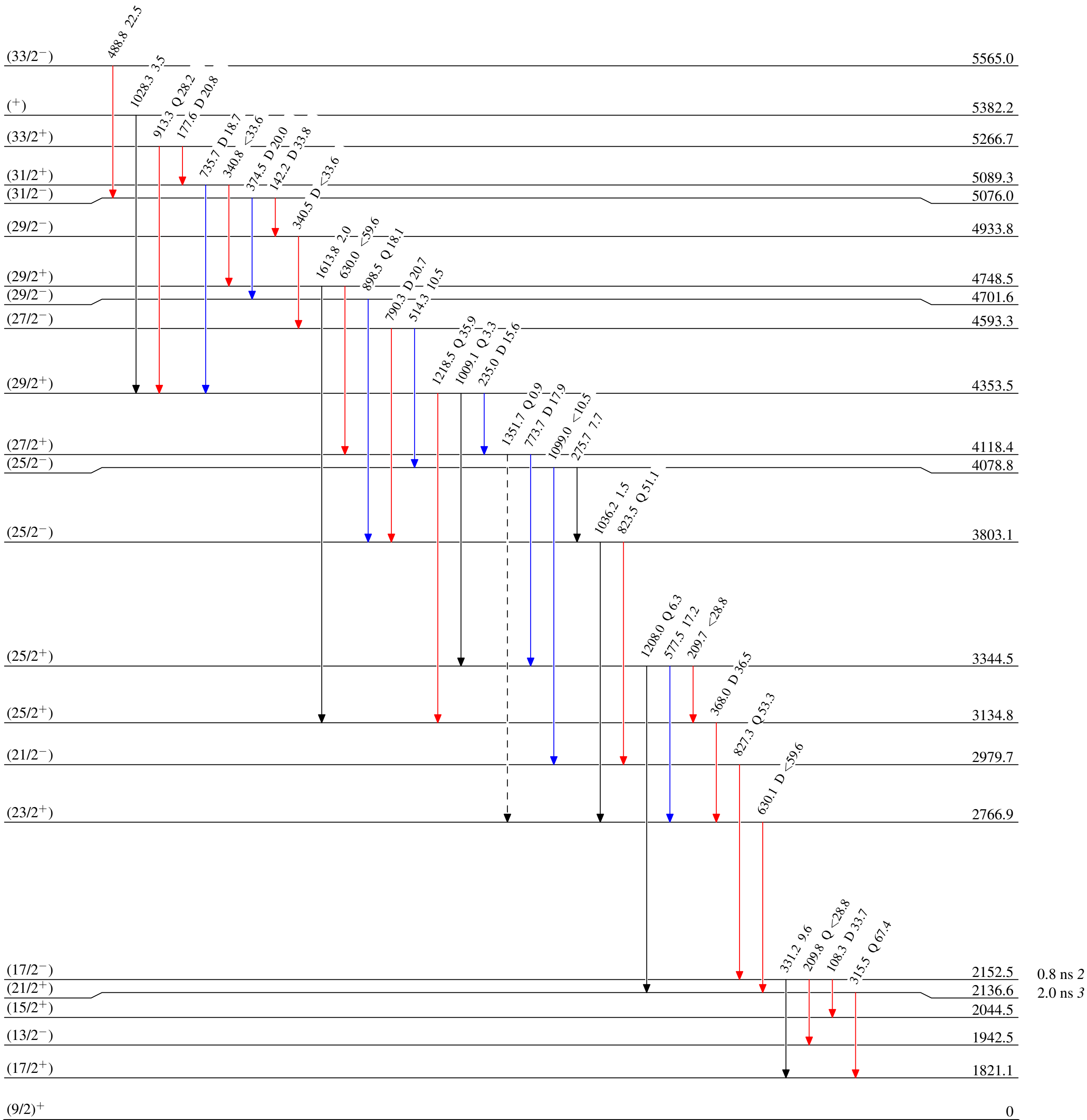
$^{58}Ni(^{40}Ca,\alpha 3p\gamma)$ 1993Ar01,2000Id01,2003La24

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)



$^{91}_{43}Tc_{48}$

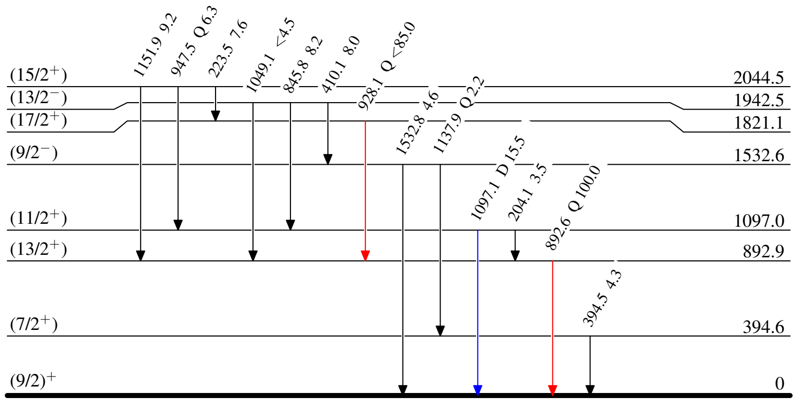
^{58}Ni(^{40}Ca,α3pγ) 1993Ar01,2000Id01,2003La24

Level Scheme (continued)

Intensities: Relative I_γ

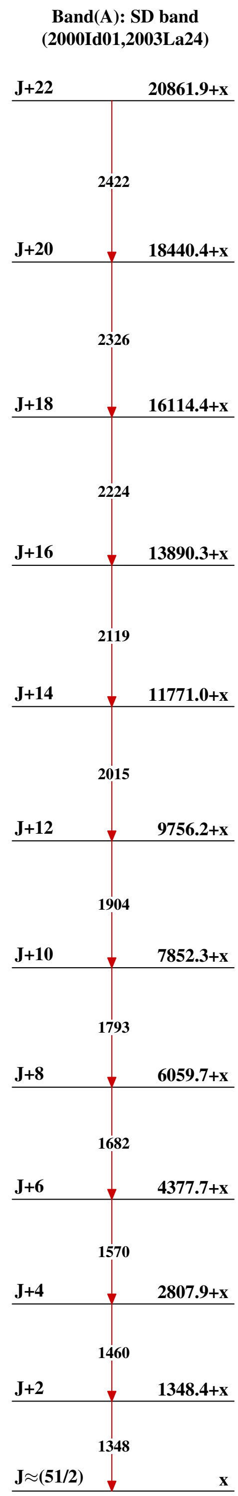
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{91}_{43}Tc_{48}$

$^{58}Ni(^{40}Ca,\alpha 3p\gamma)$ 1993Ar01,2000Id01,2003La24



$^{91}_{43}Tc_{48}$