^{26}Mg(^{48}Ca,2α3nγ) 2013Al19

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 196,17 (2024)	30-Sep-2023

Adapted from the XUNDL dataset for 2013Al19 compiled by D. Symochko (IKP, TU, Darmstadt) and B. Singh (McMaster), on January 5, 2014.

2013Al19: E=275, 290 and 320 MeV ^{48}Ca beams were provided by the ATLAS accelerator at ANL. Target was 0.973 mg/cm^2 self-supporting ^{26}Mg. Reaction products were analyzed by Argonne Fragment Mass Analyzer (FMA). γ rays were detected with Gammasphere array consisting of 101 Compton-suppressed Ge detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$, Doppler-shift attenuation. Deduced levels, J, π, band assignments, deformation parameter, γ-ray multipolarities. Comparison with shell model and with cranked Nilsson-Strutinsky calculations.

^{63}Ni Levels

Configurations are listed in terms of valence holes or particles: [$p_1(\pm)p_2,n_1(\pm)n_2$], where p_1, n_1=number of proton or neutron holes in $1f_{7/2}$ orbital; p_2, n_2=number of neutron or proton particles in $1g_{9/2}$ orbital, relative to a closed ^{56}Ni core. The ($\pm$) notation refers to α=+1/2 and α=−1/2 signature.

E(level)[†]	J$^\pi$[‡]	Comments
87.22	5/2$^-$	Additional information 1. E(level),J$^\pi$: from Adopted Levels.
1291.93[#] *10*	9/2$^+$	
2183.46[#] *14*	11/2$^+$	
2813.59[#] *17*	13/2$^+$	
3650.41[#] *19*	15/2$^+$	
4323.25[#] *21*	17/2$^+$	
4569.17 *23*	15/2$^+$	
4870.8[@] *6*	17/2$^+$	
5290.36[&] *29*	(17/2$^+$)	J$^\pi$: 967$\gamma(\theta)$ gives (17/2,19/2,21/2); tentative assignment of 17/2$^+$ is from the comparison with cranked Nilsson-Strutinsky model calculations by authors.
5539.20 *25*	19/2$^+$	
6298.51 *27*	21/2$^-$	
6501.9[&] *4*	(21/2$^+$)	
6573.26[@] *29*	21/2$^+$	
7487.52 *34*	25/2$^-$	
8019.1[&] *4*	(25/2$^+$)	
8264.2[@] *4*	25/2$^+$	
9843.5[&] *5*	(29/2$^+$)	
10045.0[@] *4*	29/2$^+$	
11945.0[&] *5*	(33/2$^+$)	
11962.9[@] *5*	33/2$^+$	
14050.6[@] *6*	37/2$^+$	
14169.4[&] *6*	(37/2$^+$)	
16196.7[&] *6*	(41/2$^+$)	
16292.5[@] *8*	41/2$^+$	
18336.3[&] *7*	(45/2$^+$)	
18771.4[@] *22*	45/2$^+$	
20941.7[&] *8*	(49/2$^+$)	
21407.6[@] *25*	49/2$^+$	

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$^{26}Mg(^{48}Ca,2\alpha 3n\gamma)$ 2013Al19 (continued)

^{63}Ni Levels (continued)

E(level)[†]	J^{π}[‡]	Comments
23885.4[&] *15*	(53/2$^+$)	
24499.1[@] *31*	(53/2$^+$)	
27222.9[&] *20*	(57/2$^+$)	
x[a]	J≈(25/2$^-$)	Additional information 2. E(level),J^{π}: x≈12.7 MeV and J^{π}≈25/2$^-$ estimated from comparison of energies and spins of observed bands in Fig. 6 in 2013Al19.
621.6+x[a] *4*	J+2	
1600.4+x[a] *5*	J+4	
2901.9+x[a] *6*	J+6	
4541.2+x[a] *8*	J+8	
6478.8+x[a] *9*	J+10	
8766.9+x[a] *13*	J+12	
11475.0+x[a] *19*	J+14	
14550.6+x[a] *24*	J+16	

† From least-squares fit to γ-ray energies, unless otherwise noted.
‡ From 2013Al19 based on known assignments of low-lying levels, measured $\gamma\gamma(\theta)$, band assignments and decay pattern. When considered in Adopted Levels, the firm assignments for high-spin states from this dataset will be placed in parentheses if there are no strong supporting arguments. For yrast levels, it is assumed spin ascends as energy increases.
# Band(A): Band based on 1292, 9/2$^+$ level.
@ Band(B): Band based on 4871, 17/2$^+$ level. Q(transition)=2.4 *+17−12* (deduced β_2=0.43 *+25−20*). Proposed configuration=[31,0$^{(-)}$2].
& Band(C): Band based on 5291, (17/2$^+$) level. Q(transition)=1.9 *+13−12* (deduced β_2=0.35 *+20−21*). Proposed configuration=[31,0$^{(+)}$2]. Band crossing at $\hbar\omega$≈1.1 MeV by configuration=[2(−1)1,0$^{(+)}$2] which results in backbending.
a Band(D): Band based on J (25/2$^-$). Band feeds mostly 21/2$^-$ state at 6299 level. Direct transition to 21/2$^-$ and thus yrast character of the band is in contradiction with measured relative intensities of three bands.

$\gamma(^{63}$Ni)

Angular correlation ratio $R_{AC}=I\gamma(\theta_{0°})/I\gamma(\theta_{90°})$, with $I\gamma(\theta)$ obtained by gating on a stretched-quadrupole transitions at any angle. Expected R_{AC} values are >1 for stretched Q-Q sequence, and <1 for stretched Q-D sequence (2013Al19).

E_γ[#]	I_γ[#]	E_i(level)	J^{π}_i	E_f	J^{π}_f	Mult.[@]	Comments
621.6 *4*	7.6 *17*	621.6+x	J+2	x	J≈(25/2$^-$)	Q	R_{AC}=1.32 *15*.
630.1 *1*	100.0 *34*	2813.59	13/2$^+$	2183.46	11/2$^+$	D+Q[a]	A_2=−0.07 *3*; A_4=−0.07 *4* R_{AC}=1.07 *3*.
672.8 *1*	60.5 *25*	4323.25	17/2$^+$	3650.41	15/2$^+$	D+Q	A_2=−0.13 *1*; A_4=+0.01 *1* R_{AC}=0.93 *4*.
759.3 *1*	44.4 *10*	6298.51	21/2$^-$	5539.20	19/2$^+$	D	A_2=−0.21 *1*; A_4=+0.02 *2* R_{AC}=0.75 *9*.
836.8 *1*	71.1 *27*	3650.41	15/2$^+$	2813.59	13/2$^+$	D+Q[a]	A_2=+0.03 *2*; A_4=−0.21 *3* R_{AC}=1.24 *5*.
891.5 *1*	93.6 *28*	2183.46	11/2$^+$	1291.93	9/2$^+$	D+Q[a]	A_2=+0.15 *1*; A_4=−0.14 *1* R_{AC}=1.24 *6*.
919.9[‡] *2*	26.3 *12*	4569.17	15/2$^+$	3650.41	15/2$^+$	D+Q	A_2=+0.06 *5* E_γ: very poor fit and omitted in the fitting; level-energy difference=918.75. R_{AC}=1.12 *18*.

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^{26}Mg(^{48}Ca,2α3nγ) 2013Al19 (continued)

γ(^{63}Ni) (continued)

E_γ[#]	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	Comments
967.1 *2*	16.1 *31*	5290.36	(17/2$^+$)	4323.25	17/2$^+$		A_2=+0.14 *6* R_{AC}=1.43 *21*. Mult.: Stretched Q from R_{AC} seems inconsistent with ΔJ=0.
969.7 *3*	19.9 *18*	5539.20	19/2$^+$	4569.17	15/2$^+$	Q	A_2=+0.15 *2*; A_4=−0.19 *3* R_{AC}=1.09 *11*.
978.8 *3*	8.7 *17*	1600.4+x	J+4	621.6+x	J+2	Q	A_2=+0.22 *6*; A_4=−0.21 *8* R_{AC}=1.37 *12*.
1189.0 *2*	39.2 *12*	7487.52	25/2$^-$	6298.51	21/2$^-$	Q	A_2=+0.04 *4*; A_4=−0.22 *6* R_{AC}=1.48 *13*.
1204.7 *1*		1291.93	9/2$^+$	87.22	5/2$^-$	O+Q	A_2=+0.39 *1*; A_4=−0.07 *3* R_{AC}=1.33 *7*.
1211.5 *2*	36.2 *31*	6501.9	(21/2$^+$)	5290.36	(17/2$^+$)	Q[&]	A_2=+0.09 *8*; A_4=+0.33 *10* R_{AC}=1.50 *11*.
1301.5 *3*	9.4 *16*	2901.9+x	J+6	1600.4+x	J+4	Q	A_2=+0.45 *12* R_{AC}=1.11 *8*.
1467.6[†] *3*	23.7 *27*	3650.41	15/2$^+$	2183.46	11/2$^+$	Q	A_2=+0.21 *5*; A_4=−0.23 *6* E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=1466.94. R_{AC}=1.27 *7*.
1510.8[†] *3*	24.8 *18*	4323.25	17/2$^+$	2813.59	13/2$^+$	Q	A_2=0.00 *28* E_γ: uncertainty multiplied by a factor of 3 in the fitting; level-energy difference=1509.64. R_{AC}=0.81 *7*.
1517.2 *2*	33.1 *44*	8019.1	(25/2$^+$)	6501.9	(21/2$^+$)	Q	A_2=+0.11 *6*; A_4=−0.40 *8* R_{AC}=1.50 *7*.
1521.9 *4*	40.0 *23*	2813.59	13/2$^+$	1291.93	9/2$^+$	Q	A_2=+0.17 *1*; A_4=−0.19 *2* R_{AC}=0.96 *7*.
1639.2 *5*	5.5 *15*	4541.2+x	J+8	2901.9+x	J+6	Q	A_2=+0.47 *12*; A_4=−0.30 *15* R_{AC}=1.55 *13*.
1690.9 *2*	21.4 *35*	8264.2	25/2$^+$	6573.26	21/2$^+$	Q	A_2=+0.15 *8*; A_4=−0.22 *11* R_{AC}=1.31 *8*.
1703.5[†] *4*	7.4 *15*	6573.26	21/2$^+$	4870.8	17/2$^+$	Q	A_2=+0.02 *8*; A_4=0.00 *11* E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=1702.4. E_γ: level-energy difference=1702.6. R_{AC}=1.72 *15*.
1755.4 *2*	37.5 *12*	4569.17	15/2$^+$	2813.59	13/2$^+$	D+Q[a]	A_2=+0.07 *3*; A_4=−0.14 *4* R_{AC}=1.59 *12*.
1780.8 *2*	20.9 *33*	10045.0	29/2$^+$	8264.2	25/2$^+$	Q	A_2=+0.18 *2*; A_4=−0.27 *3* R_{AC}=1.52 *9*.
1824.4 *2*	26.4 *24*	9843.5	(29/2$^+$)	8019.1	(25/2$^+$)	Q	A_2=+0.15 *20* R_{AC}=1.51 *10*.
1888.9 *2*	38.1 *16*	5539.20	19/2$^+$	3650.41	15/2$^+$	Q	A_2=+0.04 *2*; A_4=−0.19 *3* R_{AC}=1.21 *7*.
1917.9 *2*	17.4 *26*	11962.9	33/2$^+$	10045.0	29/2$^+$	Q[&]	A_2=+0.10 *6*; A_4=+0.18 *9* R_{AC}=1.01 *8*.
1937.6 *5*	5.0 *13*	6478.8+x	J+10	4541.2+x	J+8	Q	A_2=0.00 *13*; A_4=−0.53 *18* R_{AC}=1.46 *12*.
2027.3 *2*	13.3 *17*	16196.7	(41/2$^+$)	14169.4	(37/2$^+$)	Q	A_2=+0.23 *9*; A_4=−0.55 *12* R_{AC}=1.21 *19*.
2058.3[†] *4*	11.7 *16*	4870.8	17/2$^+$	2813.59	13/2$^+$	Q	A_2=+0.41 *12*; A_4=−0.15 *15*

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^{26}Mg(^{48}Ca,2α3nγ) **2013Al19 (continued)**

γ(^{63}Ni) (continued)

E_γ[#]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
							E_γ: uncertainty multiplied by a factor of 2 in the fitting; level-energy difference=2057.2. E_γ: level-energy difference=2057.4. R_{AC}=1.13 *19*.
2087.6 *3*	16.1 *22*	14050.6	37/2$^+$	11962.9	33/2$^+$	Q	A_2=+0.12 *4*; A_4=−0.32 *6* R_{AC}=1.37 *14*.
2101.4 *2*	23.5 *22*	11945.0	(33/2$^+$)	9843.5	(29/2$^+$)	Q	A_2=+0.47 *22*; A_4=−0.43 *28* R_{AC}=1.76 *15*.
2139.5 *3*	8.9 *13*	18336.3	(45/2$^+$)	16196.7	(41/2$^+$)	Q	A_2=+0.53 *42* R_{AC}=1.66 *29*.
2224.4 *3*	12.4 *20*	14169.4	(37/2$^+$)	11945.0	(33/2$^+$)	Q	R_{AC}=1.52 *23*.
2241.9 *5*	16.8 *31*	16292.5	41/2$^+$	14050.6	37/2$^+$	Q	R_{AC}=1.24 *18*.
2249.9 *2*	16.8 *31*	6573.26	21/2$^+$	4323.25	17/2$^+$	Q	A_2=+0.31 *4*; A_4=−0.13 *5* R_{AC}=1.21 *13*.
2288.1 *9*	2.2 *11*	8766.9+x	J+12	6478.8+x	J+10	Q	A_2=+0.36 *15*; A_4=−0.31 *20* R_{AC}=1.38 *26*.
2385.7 *5*	4.4 *12*	4569.17	15/2$^+$	2183.46	11/2$^+$	Q	
2478.8 *21*	1.1 *11*	18771.4	45/2$^+$	16292.5	41/2$^+$	Q	A_2=+0.49 *9*; A_4=−0.06 *12* R_{AC}=2.25 *39*.
2605.4 *4*	6.5 *13*	20941.7	(49/2$^+$)	18336.3	(45/2$^+$)	Q	A_2=+0.55 *22* R_{AC}=0.94 *14*.
2636.2 *12*	1.7 *11*	21407.6	49/2$^+$	18771.4	45/2$^+$	Q	A_2=+0.57 *34* R_{AC}=1.95 *24*.
2708.0 *14*	1.3 *9*	11475.0+x	J+14	8766.9+x	J+12	Q	R_{AC}=1.56 *27*.
2943.6 *12*	1.5 *9*	23885.4	(53/2$^+$)	20941.7	(49/2$^+$)	Q	R_{AC}=1.02 *18*.
3075.5 *14*	<0.5	14550.6+x	J+16	11475.0+x	J+14		
3091.4 *18*	<0.5	24499.1	(53/2$^+$)	21407.6	49/2$^+$		
3337.4 *13*	<0.5	27222.9	(57/2$^+$)	23885.4	(53/2$^+$)		

[†] Poor fit; uncertainty multiplied by a factor in the fitting.
[‡] Very poor fit and omitted in the fitting.
[#] From 2013Al19, unless otherwise noted.
[@] Deduced based on $\gamma(\theta)$ and $\gamma\gamma(\theta)$ data in 2013Al19. Due to no supporting data for magnetic and electric characters of transitions in 2013Al19, the evaluator has replaced E3 with O, E2 and M2 with Q, E1 and M1 with D.
[&] Positive A_4 is inconsistent with ΔJ=2, quadrupole transition. A_4 should be negative.
[a] Negative A_4 is inconsistent with ΔJ=1, D+Q transition. A_4 should be positive.

^{26}Mg(^{48}Ca,2α3nγ) 2013Al19

Level Scheme

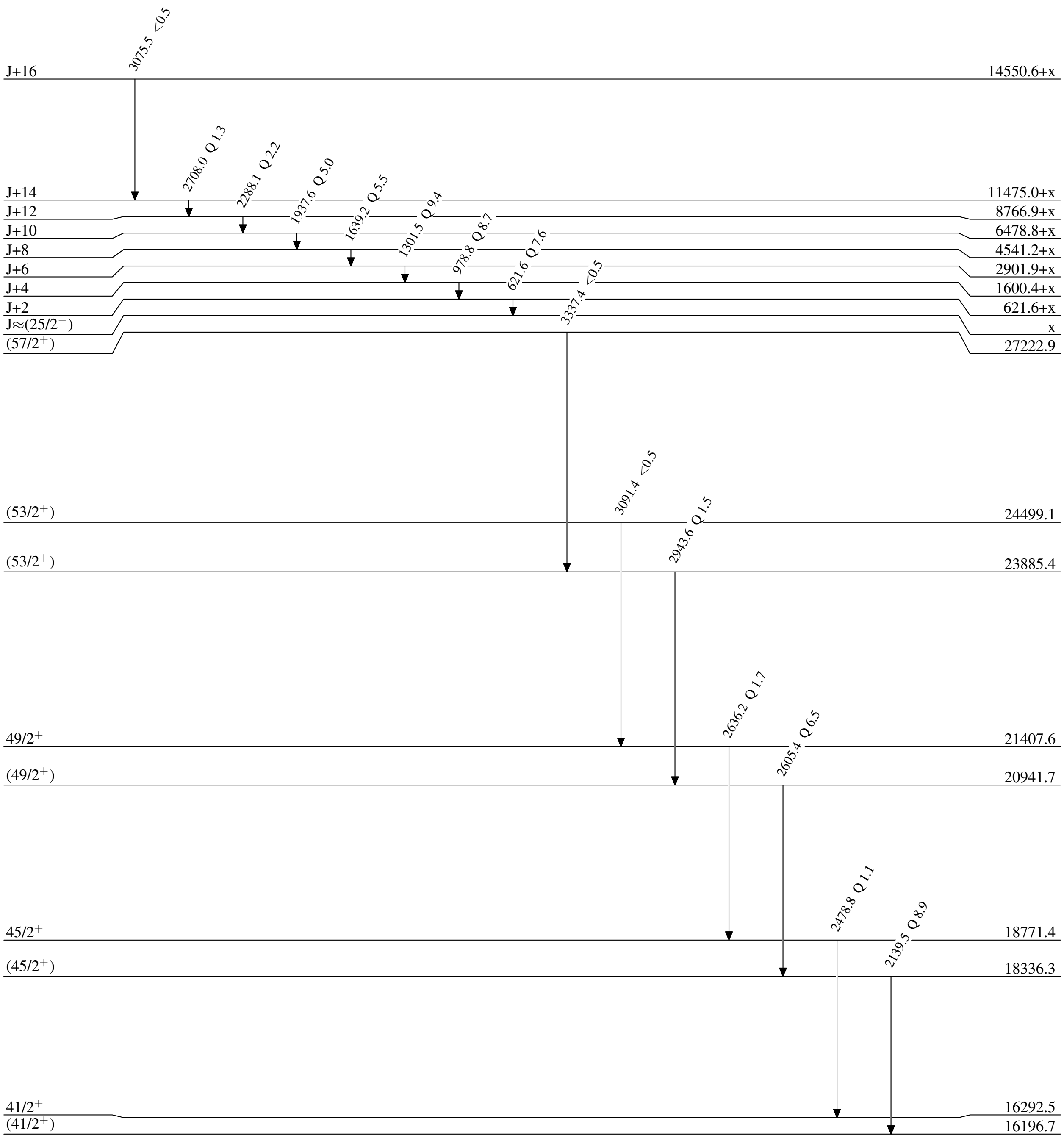
Intensities: Relative I_γ

Legend

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

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

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

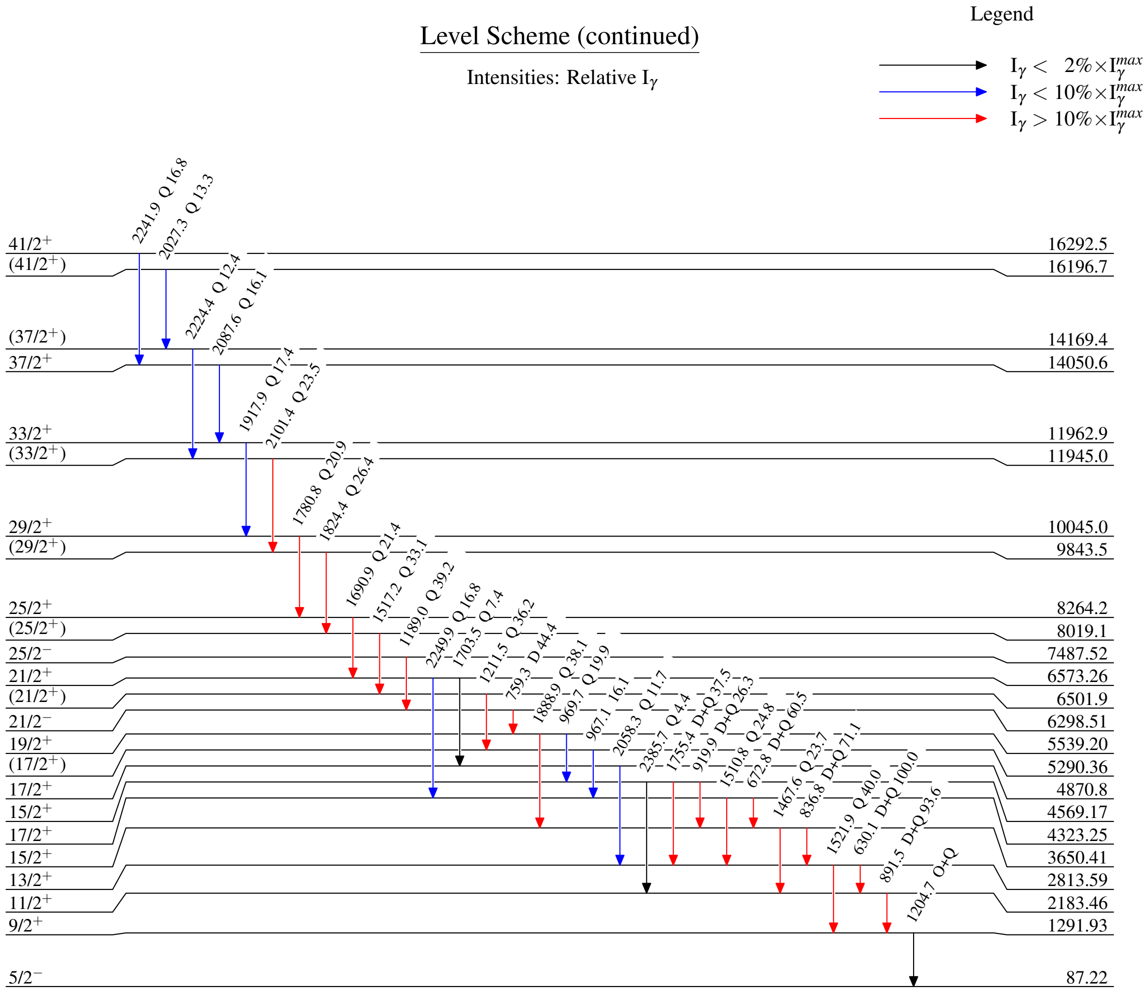


$^{63}_{28}Ni_{35}$

^{26}Mg(^{48}Ca,2α3nγ) 2013Al19

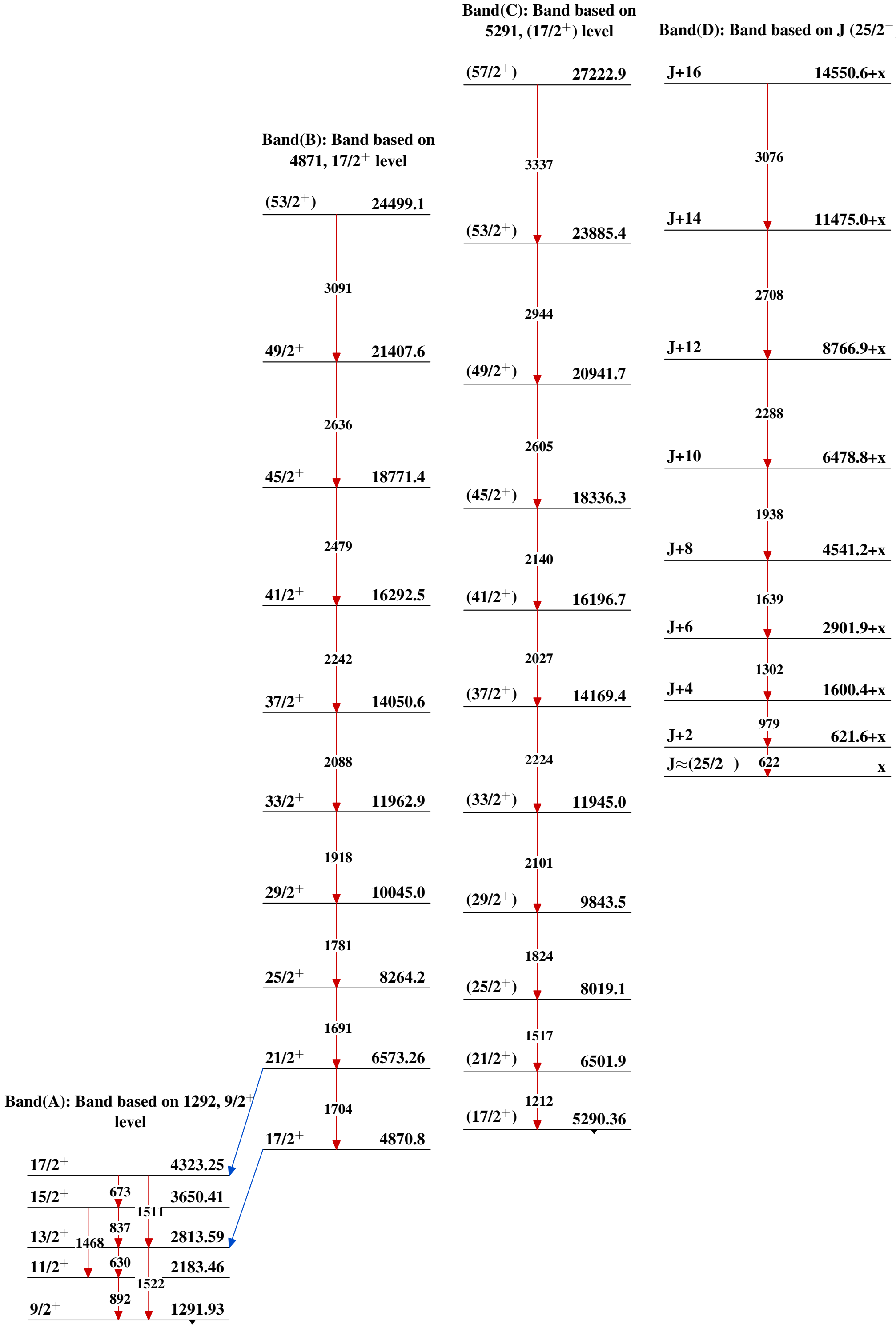
Level Scheme (continued)

Intensities: Relative I_γ



$^{63}_{28}Ni_{35}$

$^{26}Mg(^{48}Ca,2\alpha 3n\gamma)$ 2013Al19



$^{63}_{28}Ni_{35}$