^{26}Mg(^{48}Ca,2α4nγ) 2016Al18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Huang Xiaolong, and Wang Xianghan	NDS 204,1 (2025)	30-Jun-2023

2016Al18: ^{26}Mg(^{48}Ca,2α4nγ) E=275, 290, 320 MeV. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, (^{62}Ni recoils)γ-coin, level lifetimes by DSAM using fragment mass analyzer (FMA) and Gammasphere array with 101 Compton-suppressed HPGe detectors at ATLAS-ANL facility. Target thickness=0.973 mg/cm^2. Deduced high-spin levels, J^π, rotational bands, transition quadrupole moments, deformation, and configurations. Comparison with cranked Nilsson-Strutinsky calculations and systematics for the rotational bands. Comparison of low-spin levels, labeled as ND1 in Fig. 2 of 2016Al18 with Shell model calculations using JUN45 and jj44b effective interactions, based on ^{56}Ni core and $f_{5/2}$, $p_{3/2}$, $p_{1/2}$ and $g_{9/2}$ valence neutron orbitals.

^{62}Ni Levels

E(level)[†]	J^π[‡]	Comments
0.0[#]	0^+	
1172.11[#] 10	2^+	
2335.76[#] 14	4^+	
3178.1 3	4^+	
3276.06 24	4^+	
4015.58[#] 24	6^+	
4157.26 22	5^-	
4178.8 4	6^+	
4643.28[@] 23	7^-	
4860.7 3	6^-	
5688.1 4	8^-	
5745.75[@] 25	(8^-)	
6642.0[@] 3	9^-	
7137.2[&] 5	$8^{(+)}$	J^π: 8^+ or 8^- from $\gamma(\theta)$. Comparison with cranked Nilsson-Strutinsky calculations suggests tentative $8^{(+)}$.
7218.1 6	10^-	
7346.3 4	10^-	
7554.9[@] 3	10^-	
8294.5[&] 6	$10^{(+)}$	
8374.9[@] 4	(11^-)	
8709.1[a] 4	10^-	
8988.8[@] 4	12^-	
9697.8[&] 7	$12^{(+)}$	
9923.9[a] 4	12^-	
11334.3[&] 7	$14^{(+)}$	
11477.6[a] 4	14^-	
13287.5[&] 8	$16^{(+)}$	
13441.4[a] 5	16^-	
15553.6[&] 9	$18^{(+)}$	
15874.5[a] 7	18^-	
18187.0[&] 10	$20^{(+)}$	
18669.3[a] 10	20^-	
21314.6[&] 11	$22^{(+)}$	
21851.4[a] 22	22^-	
25453[a] 5	(24^-)	

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

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^{26}Mg(^{48}Ca,2α4nγ) 2016Al18 (continued)

^{62}Ni Levels (continued)

‡ As given in 2016Al18, based on transition multipolarities from $\gamma(\theta)$ data, decay pattern and band structures.
# Band(A): g.s. band.
@ Seq.(D): γ-cascade based on 7^-.
& Band(B): Band based on $8^{(+)}$. Q(transition)=2.2 eb *+11−8* deduced from best fit to fractional Doppler shifts (Fτ) in DSAM measurements for the 1157.3-, 1403.2-, 1636.5-, 1953.20 and 2266.0-keV γ rays; deduced β_2=0.40 *+17−13* (2016Al18) assuming prolate deformation. Configurations involve $f_{7/2}$ proton holes and $g_{9/2}$ neutrons.
a Band(C): Band based on 10^-. Q(transition)=1.9 eb *+12−7* deduced from best fit to fractional Doppler shifts (Fτ) in DSAM measurements for the 1215.0-, 1553.6-, 1963.8-, 2433.1- and 2794.7-keV γ rays; deduced β_2=0.35 *+19−12* (2016Al18) assuming prolate deformation. Configurations involve $f_{7/2}$ proton holes and $g_{9/2}$ neutrons.

γ(^{62}Ni)

For $\gamma(\theta)$ data, associate positive A_2 value with ΔJ=2, quadrupole transitions and a negative A_2 with ΔJ=1, dipole or mixed transitions.
For $\gamma(\theta)$ data, positive A_2 value indicate ΔJ=2 transitions and a negative A_2 indicate ΔJ=1 transitions.

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.†	Comments
486.0 *1*	61 *3*	4643.28	7^-	4157.26	5^-		A_2=0.0 *1*; A_4=−0.4 *1* E2 in 2016Al18.
613.8 *2*	8.9 *9*	8988.8	12^-	8374.9	(11^-)	D+Q	A_2=−0.5 *2*; A_4=0.0 *2* M1+E2 in 2016Al18.
627.7 *1*	118 *5*	4643.28	7^-	4015.58	6^+	D	A_2=−0.32 *6*; A_4=−0.05 *8* E1 in 2016Al18.
682.4 *4*	2.8 *6*	4860.7	6^-	4178.8	6^+		ΔJ=0 transition. E1 in 2016Al18.
703.4 *2*	25 *2*	4860.7	6^-	4157.26	5^-	D+Q	A_2=−0.23 *6*; A_4=+0.02 *7* M1+E2 in 2016Al18.
820.1 *3*	6 *1*	8374.9	(11^-)	7554.9	10^-	(D+Q)	A_2=−0.05 *8*; A_4=−0.3 *1* M1+E2 in 2016Al18. Evaluators′ note: negative A_4 is inconsistent with ΔJ=1 transition.
827.4 *2*	7 *1*	5688.1	8^-	4860.7	6^-	(Q)	A_2=+0.2 *1*; A_4=−0.2 *2* E2 in 2016Al18.
843.4 *4*	14 *3*	3178.1	4^+	2335.76	4^+	D+Q	A_2=−0.4 *2*; A_4=+0.1 *2* ΔJ=0 transition. M1+E2 in 2016Al18.
881.1 *2*	14 *1*	4157.26	5^-	3276.06	4^+	D	A_2=−0.27 *6*; A_4=−0.01 *8* E1 in 2016Al18.
885.0 *3*	7.1 *9*	5745.75	(8^-)	4860.7	6^-		(E2) in 2016Al18.
896.3 *2*	36 *2*	6642.0	9^-	5745.75	(8^-)	D+Q	A_2=+0.16 *4*; A_4=+0.07 *6* M1+E2 in 2016Al18.
913.0 *2*	24 *2*	7554.9	10^-	6642.0	9^-	D+Q	A_2=+0.25 *7*; A_4=+0.09 *6* M1+E2 in 2016Al18.
935.0 *2*	9.8 *9*	9923.9	12^-	8988.8	12^-	(D+Q)	A_2=+0.13 *3*; A_4=−0.02 *4* M1+E2 in 2016Al18.
1001.4 *5*	3 *1*	4178.8	6^+	3178.1	4^+		A_2=0.0 *2*; A_4=−0.4 *3* E2 in 2016Al18.
x1102.5‡ *1*	76‡ *3*						
1102.5‡ *1*	76‡ *3*	5745.75	(8^-)	4643.28	7^-	(D+Q)	A_2=+0.28 *3*; A_4=−0.11 *4* (M1+E2) in 2016Al18. E_γ,I_γ,Mult.: 1102.5γ is an unresolved doublet. The second component, assigned to ^{62}Ni, was stronger but could not be placed in the level scheme. Evaluators′ note: negative A_4 is inconsistent with ΔJ=1

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^{26}Mg(^{48}Ca,2α4nγ) 2016Al18 (continued)

γ(^{62}Ni) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.†	Comments
							transition. Discrepancy could be due to the second component of unplaced γ.
1154.3 *3*	10 *2*	8709.1	10^-	7554.9	10^-	D+Q	A_2=−0.3 *1*; A_4=+0.1 *2* ΔJ=0 transition. M1+E2 in 2016Al18.
1157.3 *4*	24 *3*	8294.5	$10^{(+)}$	7137.2	$8^{(+)}$	Q	A_2=+0.26 *4*; A_4=−0.16 *5* E2 in 2016Al18.
1163.7 *1*	174 *1*	2335.76	4^+	1172.11	2^+	Q	A_2=+0.13 *2*; A_4=−0.11 *3* E2 in 2016Al18.
1172.1 *1*		1172.11	2^+	0.0	0^+		E_γ: 1172.89 *3* in the Adopted Gammas. E2 in 2016Al18.
1215.0 *3*	7.5 *7*	9923.9	12^-	8709.1	10^-	Q	A_2=+0.19 *5*; A_4=−0.29 *6* E2 in 2016Al18.
1403.2 *2*	20 *2*	9697.8	$12^{(+)}$	8294.5	$10^{(+)}$	Q	A_2=+0.22 *3*; A_4=−0.28 *5* E2 in 2016Al18.
1433.8 *2*	11.4 *9*	8988.8	12^-	7554.9	10^-	Q	A_2=+0.22 *2*; A_4=−0.31 *2* E2 in 2016Al18.
1530.0 *4*	4.6 *8*	7218.1	10^-	5688.1	8^-	(Q)	A_2=+0.4 *1*; A_4=0.0 *1* E2 in 2016Al18.
1553.6 *2*	23 *1*	11477.6	14^-	9923.9	12^-	Q	A_2=+0.17 *3*; A_4=−0.28 *4* E2 in 2016Al18.
1636.5 *3*	15 *1*	11334.3	$14^{(+)}$	9697.8	$12^{(+)}$	(Q)	A_2=+0.08 *5*; A_4=−0.28 *7* E2 in 2016Al18.
1658.4 *3*	3.1 *7*	7346.3	10^-	5688.1	8^-		A_2=−0.1 *2*; A_4=−0.4 *3* E2 in 2016Al18.
1679.8 *3*	88 *5*	4015.58	6^+	2335.76	4^+	Q	A_2=+0.15 *2*; A_4=−0.25 *2* E2 in 2016Al18.
1732.5 *3*	9 *1*	8374.9	(11^-)	6642.0	9^-		(E2) in 2016Al18.
1809.3 *3*	34 *2*	7554.9	10^-	5745.75	(8^-)	(Q)	A_2=+0.20 *5*; A_4=−0.01 *6* E2 in 2016Al18.
1821.4 *3*	46 *3*	4157.26	5^-	2335.76	4^+	D	A_2=−0.21 *4*; A_4=−0.18 *5* Evaluators′ note: A_4 should be zero for pure E1. E1 in 2016Al18.
1953.2 *3*	11.8 *9*	13287.5	$16^{(+)}$	11334.3	$14^{(+)}$	Q	A_2=+0.25 *7*; A_4=−0.17 *9* E2 in 2016Al18.
1963.8 *3*	14 *1*	13441.4	16^-	11477.6	14^-	Q	A_2=+0.16 *5*; A_4=−0.32 *6* E2 in 2016Al18.
1998.1 *3*	23 *2*	6642.0	9^-	4643.28	7^-	Q	A_2=+0.17 *6*; A_4=−0.20 *8* E2 in 2016Al18.
2005.1 *5*	14 *1*	3178.1	4^+	1172.11	2^+	Q	A_2=+0.4 *2*; A_4=−0.4 *2* E2 in 2016Al18.
2103.7 *3*	16 *3*	3276.06	4^+	1172.11	2^+		A_2=+0.1 *1*; A_4=−0.3 *2* E2 in 2016Al18.
2266.0 *4*	4.7 *6*	15553.6	$18^{(+)}$	13287.5	$16^{(+)}$	Q	A_2=+0.21 *7*; A_4=−0.2 *1* E2 in 2016Al18.
2433.1 *5*	6.2 *6*	15874.5	18^-	13441.4	16^-	Q	A_2=+0.12 *6*; A_4=−0.4 *1* E2 in 2016Al18.
2493.9 *4*	13 *2*	7137.2	$8^{(+)}$	4643.28	7^-	D	A_2=−0.29 *8*; A_4=+0.1 *1* (E1) in 2016Al18.
2578.0 *5*	2.3 *4*	9923.9	12^-	7346.3	10^-	(Q)	A_2=+0.38 *7*; A_4=−0.08 *9* E2 in 2016Al18.
2633.4 *5*	1.3 *4*	18187.0	$20^{(+)}$	15553.6	$18^{(+)}$	(Q)	A_2=+0.09 *9*; A_4=−0.4 *1* E2 in 2016Al18.
2794.7 *6*	2.1 *4*	18669.3	20^-	15874.5	18^-	(Q)	A_2=+0.25 *5*; A_4=−0.1 *1* E2 in 2016Al18.
3127.5 *3*	0.7 *3*	21314.6	$22^{(+)}$	18187.0	$20^{(+)}$	(Q)	A_2=+0.1 *1*; A_4=−0.4 *2* E2 in 2016Al18.

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^{26}Mg(^{48}Ca,2α4nγ) 2016Al18 (continued)

γ(^{62}Ni) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.†	Comments
3182 *2*	0.8 *2*	21851.4	22⁻	18669.3	20⁻	(Q)	A_2=+0.6 *3*; A_4=−0.2 *4* E_γ: value listed as >3182 *2* in Table I of 2016Al18. E2 in 2016Al18.
3601 *4*	<0.5	25453	(24⁻)	21851.4	22⁻		(E2) in 2016Al18.

† Based on $\gamma(\theta)$ data in 2016Al18. Evaluators assign mult=Q for ΔJ=2, quadrupole, and D or D+Q for ΔJ=1,0 dipole, as conversion data or linear polarization data to assign electric or magnetic nature are not available. Authors′ assignments as E2 for ΔJ=2, quadrupole, and M1+E2 or E1 for ΔJ=1 or 0 transitions are given in comments.

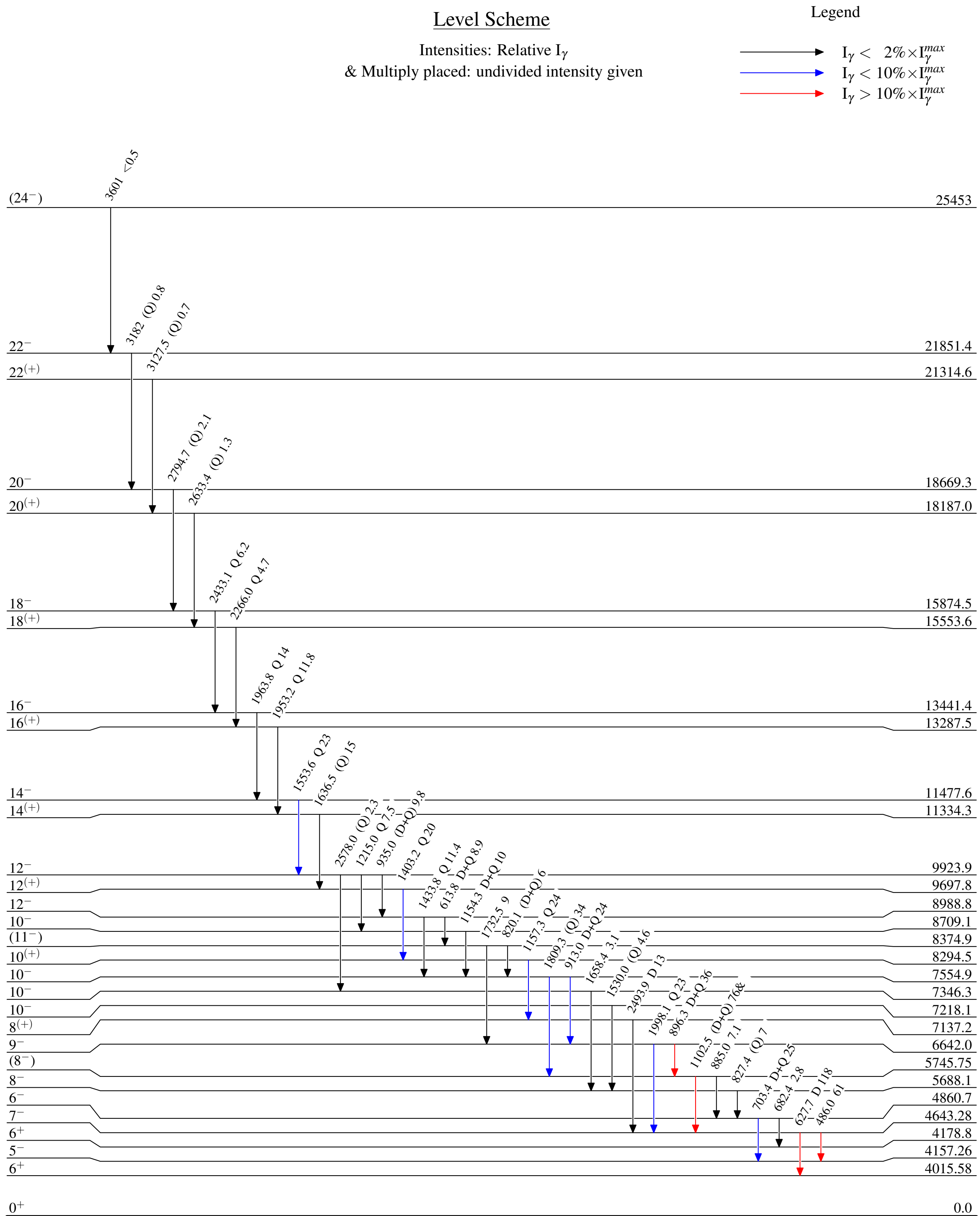
‡ Multiply placed with undivided intensity.

x γ ray not placed in level scheme.

^{26}Mg(^{48}Ca,2α4nγ) 2016Al18

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



$^{62}_{28}Ni_{34}$

^{26}Mg(^{48}Ca,2α4nγ) 2016Al18

Level Scheme (continued)

Intensities: Relative I_γ

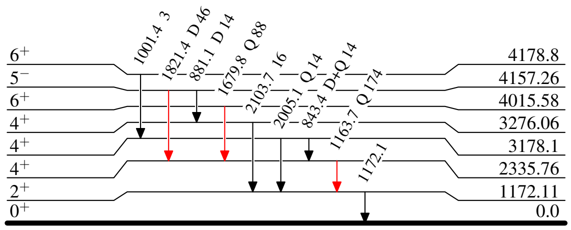
& Multiply placed: undivided intensity given

Legend

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

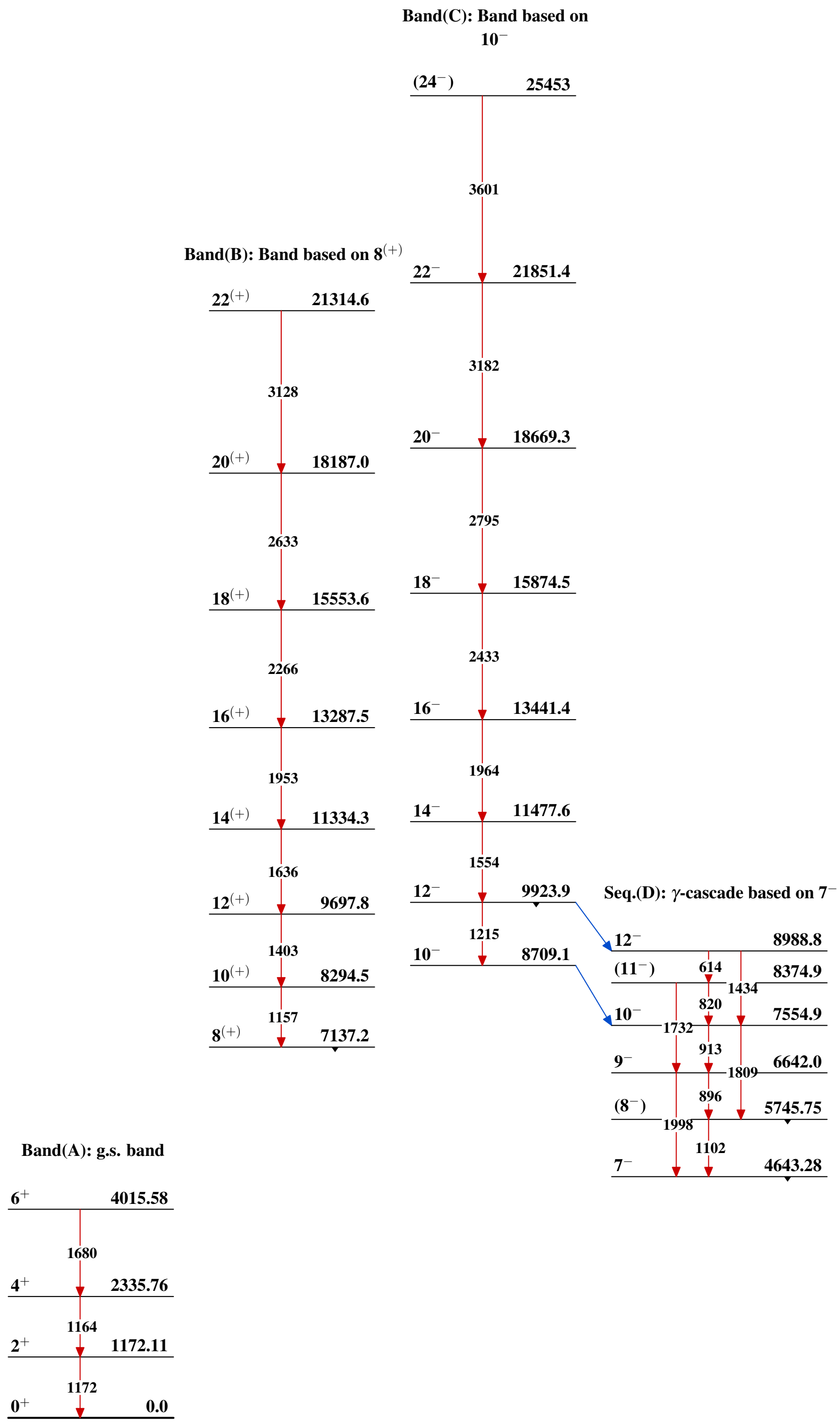
$I_\gamma < 10\% \times I_\gamma^{max}$

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



$^{62}_{28}Ni_{34}$

$^{26}Mg(^{48}Ca,2\alpha4n\gamma)$ 2016Al18



$^{62}_{28}Ni_{34}$