

$^{24}\text{Mg}(^{16}\text{O},\alpha p\gamma)$ 2007De14,1976Va24

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Lijie Sun and Jun Chen		NDS 211,1 (2026)	30-Sep-2025

Also includes data from $^{25}\text{Mg}(^{16}\text{O},\alpha p n\gamma)$ in 1976Ke02 and $^{27}\text{Al}(^{16}\text{O},2\alpha\gamma)$ in 1991Ja11.

2007De14: E=70 MeV ^{16}O beam was produced from the XTU-Tandem accelerator at Legnaro National Laboratory. Target was a $400\ \mu\text{g}/\text{cm}^2$ self-supporting target of ^{24}Mg . γ rays were detected with the GASP spectrometer of 40 Compton-suppressed HPGe detectors and a multiplicity filter of 80 BGO scintillators and charged particles were detected with the 4π array ISIS. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(\theta)$ (ADO), particle- γ -coin. Deduced levels, J, π , band structures, γ -ray multipolarities.

1976Va24: E=38 and 45 MeV ^{16}O beams were produced at Fysisch laboratorium in the Netherlands. Targets were $300\ \mu\text{g}/\text{cm}^2$ ^{24}Mg enriched to 99.94% evaporated onto $30\ \mu\text{m}$ Au backings. γ rays were detected with a Ge(Li)-NaI(Tl) Compton-suppression spectrometer and a three-Ge(Li) Compton polarimeter. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma(\text{lin pol})$. Deduced levels, J, π , γ -ray multipolarities and mixing ratios.

1974Va13: E=36 MeV ^{16}O beam was produced at Fysisch laboratorium in the Netherlands. Targets were 100 and $300\ \mu\text{g}/\text{cm}^2$ Mg on $1\ \mu\text{m}$ Ni backings. γ rays were detected with Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, recoil distances. Deduced the half-life for the level at 3.16 MeV.

1982Ra25: E=40-51 MeV ^{16}O beams were produced at the Argonne National Laboratory. Target was $50\ \mu\text{g}/\text{cm}^2$ layer of ^{24}Mg (>99.9%) evaporated onto a $50\ \mu\text{g}$ Au backing. γ rays were detected with a Ge(Li) detector. Measured γ -ray yields.

Other reactions:

1991Ja11: $^{27}\text{Al}(^{16}\text{O},2\alpha\gamma)$ E=60 MeV ^{16}O beam was produced from the 14 UD-Pelletron at TIFR. Target was $350\ \mu\text{g}/\text{cm}^2$ Al evaporated onto a $1.8\ \text{mg}/\text{cm}^2$ thick Ta backing. γ rays were detected with Ge(Li) detector. Measured $E\gamma$, recoil distances. Deduced $T_{1/2}$ for the levels of 3162 and 8844 keV.

1976Ke02: $^{25}\text{Mg}(^{16}\text{O},\alpha p n\gamma)$ E=43 and 50 MeV ^{16}O beams were produced at the Institut fur Kernphysik in Germany. The target was $150\ \mu\text{g}/\text{cm}^2$ enriched ^{25}Mg (99.2%) evaporated onto a Au backing. γ rays were detected with two true coaxial Ge(Li) detectors of $45\ \text{cm}^3$. Measured $E\gamma$, $I\gamma$, Doppler-shift recoil distances. Deduced $T_{1/2}$ for the level of 3162 keV.

1989De02: $^{27}\text{Al}(^{16}\text{O},\text{X})$ E=140 MeV ^{16}O from the Stony Brook LINAC facility. Measured particle-particle correlations.

1986Br26: $^{27}\text{Al}(^{16}\text{O},\text{X})$ E=65 MeV ^{16}O from the Pelletron Laboratory at the Universidade de Sao Paulo, Brazil. Measured σ .

1979Ta03: $^{27}\text{Al}(^{16}\text{O},\text{X})$ E=50, 60, and 70 MeV ^{16}O from the NBI super FN tandem. Measured particle-particle angular correlations.

2001Pi10: $^{12}\text{C}(^{32}\text{S},\text{X})$ E=19.5 MeV/nucleon ^{32}S beam from the superconducting cyclotron of the Laboratori Nazionali del Sud in Catania. Measured σ .

 ^{35}Cl Levels

Band assignments are from 2007De14.

E(level) ^{†‡}	J π [#]	$T_{1/2}$	Comments
0	3/2 ⁺		
1219.0 10			
1763.3 2	5/2 ⁺		
2645.9 3	7/2 ⁺		
3001.9 10	5/2 ⁺		
3162.9 [@] 3	7/2 ⁻	31.0 ps 6	Additional information 1. $T_{1/2}$: weighted average of 29.1 ps 14 (1974Va13), 28.9 ps 12 (1976Ke02), and 31.4 ps 4 (1991Ja11), all by RDM.
3943.4 10	9/2 ⁺		
4347.8 3	9/2 ⁻		
5407.3 [@] 3	11/2 ⁻		
5926.9 5	11/2 ⁻		
6087.2 4	13/2 ⁻		
6380.8 8			
7873.4 ^{&} 4	13/2 ⁺		

Continued on next page (footnotes at end of table)

$^{24}\text{Mg}(^{16}\text{O},\alpha p\gamma)$ **2007De14,1976Va24** (continued) ^{35}Cl Levels (continued)

E(level) ^{†‡}	J ^π #	T _{1/2}	Comments
8319.7 [@] 5	15/2 ⁻		
8487.4 5	15/2 ⁻		
8788.9 ^{&} 6	15/2 ⁺		
8844.6 ^{&} 5	17/2 ⁺	6.1 ps 11	T _{1/2} : from RDM in 1991Ja11.
10181.1 [@] 5	19/2 ⁻		
10222.5 11	17/2 ⁻		
10859.1 ^{&} 8	19/2 ⁺		
11459.0 ^{&} 7	21/2 ⁺		
12572.2 [@] 6	23/2 ⁻		

[†] Additional information 2.

[‡] From a least-squares fit to γ -ray energies.

As proposed in 2007De14 based on measured $\gamma\gamma(\theta)$ (ADO) and band assignments, unless otherwise noted. When considered in Adopted Levels, firm assignments here will be placed in parentheses if there are no strong supporting arguments.

@ Band(A): Band based on 3163, 7/2⁻ level. Configuration=f_{7/2}.

& Band(B): Band based on 7873, 13/2⁺ level.

 $\gamma(^{35}\text{Cl})$

R_{ADO} values under comments are from $\gamma\gamma(\theta)$ (ADO) in 2007De14. Expected values are ≈ 1.3 for $\Delta J=2$, quadrupole (and $\Delta J=0$, dipole in few cases) and ≈ 0.8 for $\Delta J=1$, dipole transitions (2007De14).

E _{γ} [†]	I _{γ} [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [‡]	δ [#]	Comments
161 [@] 1		3162.9	7/2 ⁻	3001.9	5/2 ⁺			
296 [@] 1		6380.8		6087.2	13/2 ⁻			
517.3 5	11.1 13	3162.9	7/2 ⁻	2645.9	7/2 ⁺			E _{γ} : weighted average of 517.4 5 (2007De14) and 517 1 (1976Va24).
680.5 5	33.0 7	6087.2	13/2 ⁻	5407.3	11/2 ⁻	D		R _{ADO} =0.84 2.
882.7 5	4.0 1	2645.9	7/2 ⁺	1763.3	5/2 ⁺	D		E _{γ} : weighted average of 882.9 5 (2007De14) and 882 1 (1976Va24).
								R _{ADO} =0.75 3.
915.4 4	7.2 5	8788.9	15/2 ⁺	7873.4	13/2 ⁺	D		R _{ADO} =0.69 3.
971 [@] 1		6380.8		5407.3	11/2 ⁻			
971.4 5	75.3 19	8844.6	17/2 ⁺	7873.4	13/2 ⁺	Q		R _{ADO} =1.38 3.
1059.5 2	17.1 4	5407.3	11/2 ⁻	4347.8	9/2 ⁻	M1+E2	+0.12 3	E _{γ} : weighted average of 1059.6 5 (2007De14) and 1059.5 2 (1976Va24).
								I _{γ} : other: 7.7 3 (1976Va24, E=38 MeV).
								R _{ADO} =1.05 4.
								A ₂ =-0.08 6, A ₄ =+0.049 46, POL=-0.11 12 (1976Va24).
1113.3 5	4.1 3	12572.2	23/2 ⁻	11459.0	21/2 ⁺	D		R _{ADO} =0.86 9.
1184.9 3	44.4 16	4347.8	9/2 ⁻	3162.9	7/2 ⁻	M1+E2	-0.65 30	E _{γ} : weighted average of 1184.9 5 (2007De14) and 1184.9 3 (1976Va24).
								I _{γ} : other: 22.2 3 (1976Va24, E=38 MeV).
								R _{ADO} =0.54 2, giving $\Delta J=1$.
								A ₂ =-0.663 25, A ₄ =+0.004 25, POL=+0.07 7 (1976Va24).
1336.3 5	23.5 8	10181.1	19/2 ⁻	8844.6	17/2 ⁺	D		R _{ADO} =0.75 2.

Continued on next page (footnotes at end of table)

$^{24}\text{Mg}(^{16}\text{O},\alpha p\gamma)$ **2007De14,1976Va24 (continued)** $\gamma(^{35}\text{Cl})$ (continued)

E_γ^\dagger	I_γ^\dagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	$\delta^\#$	Comments
1377.8 10	5.4 4	10222.5	17/2 ⁻	8844.6	17/2 ⁺			R _{ADO} =1.32 12 also consistent with $\Delta J=0$.
1399.9 7	0.5 2	3162.9	7/2 ⁻	1763.3	5/2 ⁺			
1578.9 5	31.8 13	5926.9	11/2 ⁻	4347.8	9/2 ⁻	D		E_γ : other: 1579 1 (1976Va24). R _{ADO} =0.48 1.
1693.5 5	19.8 21	10181.1	19/2 ⁻	8487.4	15/2 ⁻	Q		R _{ADO} =1.44 7.
1701.7 5	23.1 6	4347.8	9/2 ⁻	2645.9	7/2 ⁺	E1+M2	+0.5 4	E_γ : weighted average of 1701.6 5 (2007De14) and 1702 1 (1976Va24). R _{ADO} =0.76 6, giving $\Delta J=1$.
1739.6 5	2.6 3	6087.2	13/2 ⁻	4347.8	9/2 ⁻	Q		E_γ : weighted average of 1739.5 5 (2007De14) and 1740 1 (1976Va24). R _{ADO} =1.38 10.
1763.3 2	21.2 7	1763.3	5/2 ⁺	0	3/2 ⁺	D+Q	-2.6 4	E_γ : weighted average of 1763.1 5 (2007De14) and 1763.3 2 (1976Va24). I_γ : other: 18.5 3 (1976Va24, E=38 MeV). A ₂ =-0.368 18, A ₄ =+0.13 2, POL=+0.06 20 (1976Va24). R _{ADO} =0.77 3, giving $\Delta J=1$.
1786.2 5	4.5 2	7873.4	13/2 ⁺	6087.2	13/2 ⁻			R _{ADO} =1.37 7, consistent with $\Delta J=0$ from level scheme.
1861.3 5	19.6 13	10181.1	19/2 ⁻	8319.7	15/2 ⁻	Q		R _{ADO} =1.39 7.
1946.2 5	22.4 12	7873.4	13/2 ⁺	5926.9	11/2 ⁻	D		R _{ADO} =0.80 4.
2014.7 9	23.1 12	10859.1	19/2 ⁺	8844.6	17/2 ⁺	D		R _{ADO} =0.50 3.
2069.8 10	7.5 5	10859.1	19/2 ⁺	8788.9	15/2 ⁺	Q		R _{ADO} =1.57 11.
2180 [@] 1		3943.4	9/2 ⁺	1763.3	5/2 ⁺			
2232.7 6	10.3 5	8319.7	15/2 ⁻	6087.2	13/2 ⁻			
2244.3 2	89 2	5407.3	11/2 ⁻	3162.9	7/2 ⁻	E2(+M3)	0.000 1	E_γ : weighted average of 2243.9 5 (2007De14) and 2244.3 2 (1976Va24). I_γ : other: 30.3 20 (1976Va24, E=38 MeV). R _{ADO} =1.26 3, giving $\Delta J=2$. A ₂ =+0.303 20, A ₄ =-0.119 22, POL=+0.26 28 (1976Va24).
2390.8 5	16.8 7	12572.2	23/2 ⁻	10181.1	19/2 ⁻	Q		R _{ADO} =1.34 12.
2399.8 8	14.8 5	8487.4	15/2 ⁻	6087.2	13/2 ⁻			
2466.2 5	46.2 9	7873.4	13/2 ⁺	5407.3	11/2 ⁻	D		E_γ : other: 2466 1 (1976Va24, unplaced). R _{ADO} =0.77 2.
2614.5 5	19.0 8	11459.0	21/2 ⁺	8844.6	17/2 ⁺	Q		R _{ADO} =1.33 4.
2645.8 5	36.1 8	2645.9	7/2 ⁺	0	3/2 ⁺	Q		E_γ : weighted average of 2645.7 5 (2007De14) and 2646 1 (1976Va24). R _{ADO} =1.35 4.
2911.9 8	18.0 8	8319.7	15/2 ⁻	5407.3	11/2 ⁻	Q		R _{ADO} =1.35 5.
3080.0 7	4.7 3	8487.4	15/2 ⁻	5407.3	11/2 ⁻	Q		R _{ADO} =1.20 12.
3162.6 3	100 2	3162.9	7/2 ⁻	0	3/2 ⁺	M2+E3	+0.18 7	E_γ : weighted average of 3163.1 5 (2007De14) and 3162.4 3 (1976Va24). I_γ : other: 100.0 15 (1976Va24, E=38 MeV). R _{ADO} =1.30 2, giving $\Delta J=2$. A ₂ =+0.416 6, A ₄ =-0.001 6, POL=-0.57 12 (1976Va24).
4347.8 8	5.5 5	4347.8	9/2 ⁻	0	3/2 ⁺			

[†] From 2007De14. Note that a few I_γ values in 2007De14 have very small uncertainties (<1%) which is unrealistic for an in-beam measurement with Ge detectors. It is very likely the reported uncertainties are statistical only and the evaluators have added in quadrature a typical 2% systematic uncertainty from efficiency calibration.

Continued on next page (footnotes at end of table)

${}^{24}\text{Mg}({}^{16}\text{O},\alpha p\gamma)$ [2007De14,1976Va24](#) (continued)

$\gamma({}^{35}\text{Cl})$ (continued)

‡ D with $\Delta J=1$ or Q with $\Delta J=2$ are deduced by the evaluators based on measured $\gamma\gamma(\theta)$ (ADO) in [2007De14](#) and others are from $\gamma(\theta)$ and $\gamma(\text{lin pol})$ in [1976Va24](#). Assignments are not explicitly listed in [2007De14](#).

From $\gamma(\theta)$ in [1976Va24](#).

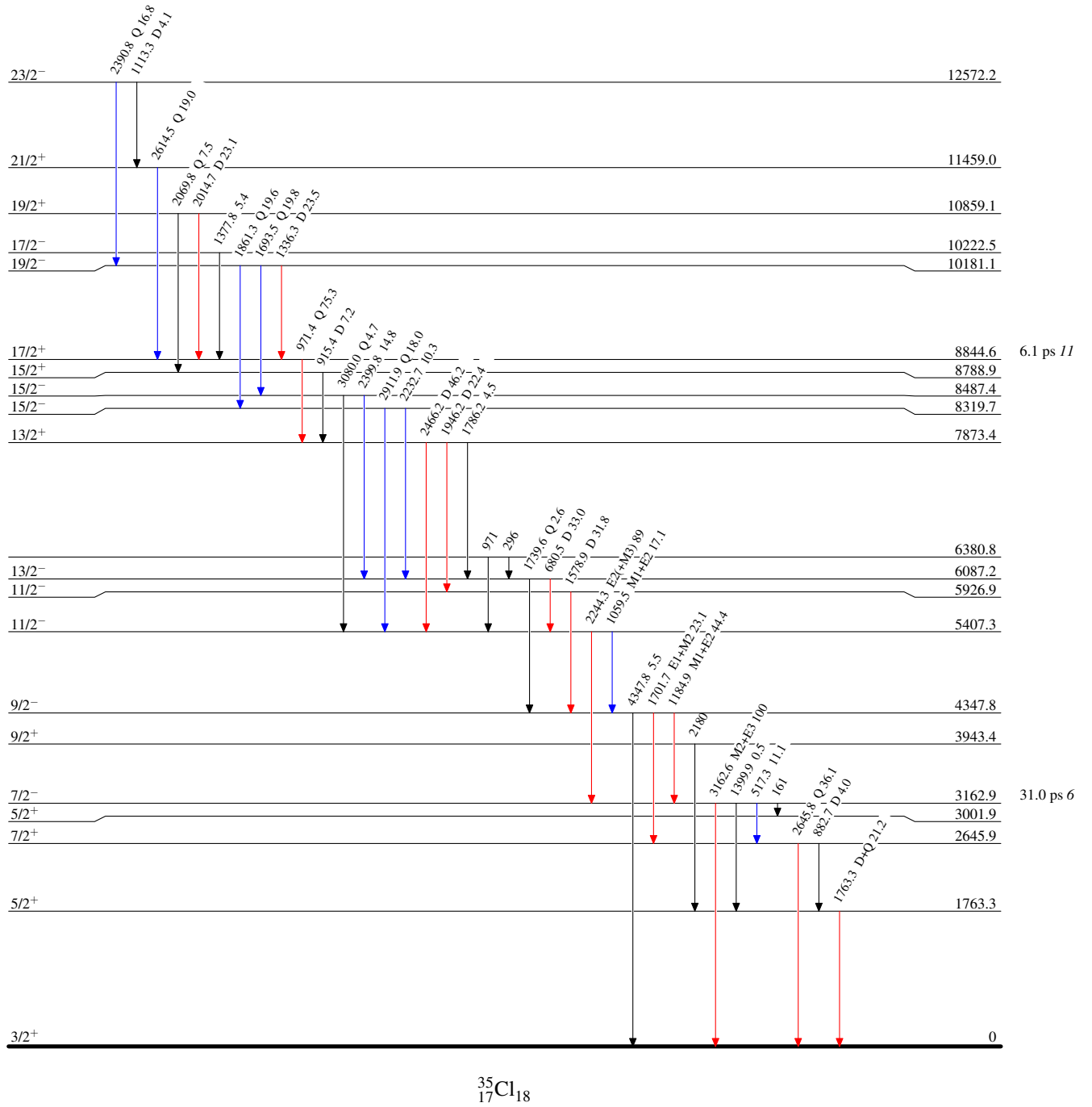
@ From [1976Va24](#) only.

$^{24}\text{Mg}(^{16}\text{O},\alpha\gamma)$ 2007De14,1976Va24

Level Scheme
Intensities: Relative I_γ

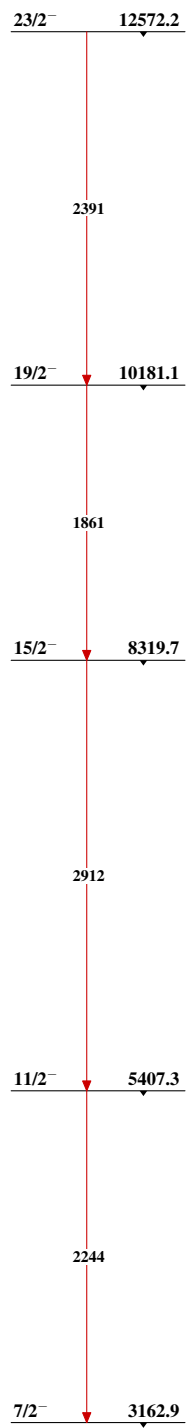
Legend

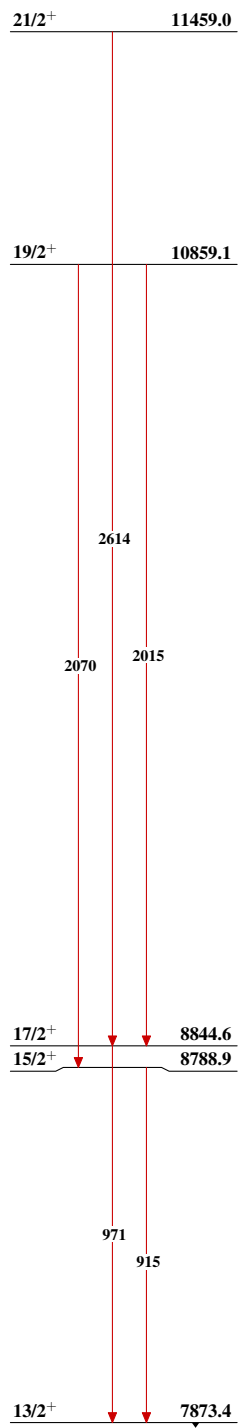
- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$



$^{24}\text{Mg}(^{16}\text{O},\alpha p\gamma)$ 2007De14,1976Va24

Band(A): Band based on
3163, 7/2⁻ level

 $^{35}_{17}\text{Cl}_{18}$

$^{24}\text{Mg}(^{16}\text{O},\alpha p\gamma)$ 2007De14,1976Va24 (continued)Band(B): Band based on 7873, 13/2⁺
level $^{35}_{17}\text{Cl}_{18}$