$^{24}Mg(^{14}N,\alpha p\gamma)$ 2017Ay04

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 199,1 (2025)	30-Sep-2024

2017Ay04: E=40 MeV ^{14}N beam was produced from the LNL-Legnaro XTU-tandem accelerator. Target was 1 mg/cm^2 99.7% enriched ^{24}Mg evaporated on an 8 mg/cm^2 gold layer. γ rays were detected with the 4π GASP array composed of 40 Compton-suppressed HPGe detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$(ADO), Doppler-shift attenuation. Deduced levels, J, π, γ-ray multipolarities, mixing ratios, transition strengths. Comparison with large-scale shell-model calculations using the ANTOINE code with the USD, PSDPF, and *sdfp* effective interactions.

^{33}S Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0	3/2$^+$		
841.0 *2*	1/2$^+$		
1967.3 *2*	5/2$^+$		
2934.8 *3*	7/2$^-$		
2969.4 *5*	7/2$^+$		
4048.8 *5*	9/2$^+$		
4095.0 *5*	7/2$^+$		
4730.3 *5*	9/2$^-$	90 fs *28*	T$_{1/2}$: from mean lifetime τ=0.13 ps *4*.
4866.9 *5*	11/2$^-$	280 fs *70*	T$_{1/2}$: from mean lifetime τ=0.40 ps *10*.
5478.6 *5*	9/2$^-$	≤28 fs	T$_{1/2}$: from mean lifetime τ≤0.04 ps.
5722.0 *8*	9/2$^+$		
6525.4 *11*	11/2$^-$	125 fs *35*	T$_{1/2}$: from mean lifetime τ=0.18 ps *5*.
7000.2 *5*	11/2$^+$	222 fs *42*	T$_{1/2}$: from mean lifetime τ=0.32 ps *6*.
7181.3 *8*	13/2$^-$	62 fs *21*	T$_{1/2}$: from mean lifetime τ=0.09 ps *3*.
7575.7 *8*	13/2$^-$	≤28 fs	T$_{1/2}$: from mean lifetime τ≤0.04 ps.
7819.2 *10*	15/2$^-$	55 fs *21*	T$_{1/2}$: from mean lifetime τ=0.08 ps *3*.
8639.8 *8*	15/2$^+$	284 fs *28*	T$_{1/2}$: from mean lifetime τ=0.41 ps *4*.
9814.4 *15*	17/2$^+$	118 fs *28*	T$_{1/2}$: from mean lifetime τ=0.17 ps *4*.
11700.8 *20*	19/2$^+$	35 fs *14*	T$_{1/2}$: from mean lifetime τ=0.05 ps *2*.

[†] From a least-squares fit to γ-ray energies.
[‡] As given in 2017Ay04 based on known assignments of low-lying levels and their measured $\gamma\gamma(\theta)$(ADO) data.
[#] From DSAM in 2017Ay04.

$\gamma(^{33}S)$

R(ADO)=(Iγ(34°)+Iγ(146°))/2Iγ(90°). Expected value is ≈1.35 for stretched quadrupole (ΔJ=2) and for ΔJ=0 dipole transitions, and ≈0.75 for stretched ΔJ=1 dipole transitions (2017Ay04).
B(M1) values are in μ_N^2 units, B(E1) in e^{2}b, B(E2) in e^{2}b^2 units.

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡]	Comments
394.4 *5*	0.5 *1*	7575.7	13/2$^-$	7181.3	13/2$^-$	D	ADO=1.34 *10*. %Iγ branching=5.4 *14*. B(M1)≥1.156 (2017Ay04).
611.7 *4*	0.3 *1*	5478.6	9/2$^-$	4866.9	11/2$^-$	D	R(ADO)=0.81 *10*. %Iγ branching=3.9 *4*. B(M1)≥0.224 (2017Ay04).
637.9 *10*	0.4 *1*	7819.2	15/2$^-$	7181.3	13/2$^-$	D	ADO=0.82 *10*. %Iγ branching=2 *1*. B(M1)=0.055 *34* (2017Ay04).
748.3 *5*	0.6 *2*	5478.6	9/2$^-$	4730.3	9/2$^-$	D	R(ADO)=1.35 *12*.

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^{24}Mg(^{14}N,αpγ) 2017Ay04 (continued)

γ(^{33}S) (continued)

E_γ†	I_γ†	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	δ‡	Comments
								%Iγ branching=6.7 *4*. B(M1)≥0.210 (2017Ay04).
841.0 *2*	2.7 *1*	841.0	1/2$^+$	0.0	3/2$^+$			%Iγ branching=100.
967.5 *3*	43.4 *15*	2934.8	7/2$^-$	1967.3	5/2$^+$	D		R(ADO)=0.74 *2*. %Iγ branching=57 *3*.
1002.3 *8*	1.9 *2*	2969.4	7/2$^+$	1967.3	5/2$^+$	D		R(ADO)=0.74 *5*. %Iγ branching=6.4 *4*.
1050.3 *9*	0.6 *2*	7575.7	13/2$^-$	6525.4	11/2$^-$	D		ADO=0.69 *10*. %Iγ branching=6.1 *6*. B(M1)≥0.074 (2017Ay04).
1064.1 *11*	8.5 *18*	8639.8	15/2$^+$	7575.7	13/2$^-$	D		ADO=0.73 *5*. %Iγ branching=73 *14*.
1079.2 *7*	3.3 *8*	4048.8	9/2$^+$	2969.4	7/2$^+$	D+Q		R(ADO)=0.48 *8*. %Iγ branching=19 *1*.
1113.8 *14*	0.6 *2*	4048.8	9/2$^+$	2934.8	7/2$^-$	D		R(ADO)=0.75 *4*.
1126.2 *2*	1.2 *2*	1967.3	5/2$^+$	841.0	1/2$^+$	Q		R(ADO)=1.35 *4*. %Iγ branching=1.2 *2*.
1174.5 *17*	10.5 *29*	9814.4	17/2$^+$	8639.8	15/2$^+$	D		ADO=0.77 *4*. %Iγ branching=74 *30*. B(M1)=0.152 *72* (2017Ay04).
1278.2 *9*	0.9 *3*	7000.2	11/2$^+$	5722.0	9/2$^+$	M1+E2	−0.5 *2*	%Iγ branching=4 *1*. R(ADO)=0.47 *10*. B(M1)=0.003 *1*, B(E2)=0.0006 *4* (2017Ay04).
1383.3 *7*	1.5 *4*	5478.6	9/2$^-$	4095.0	7/2$^+$	D		R(ADO)=0.73 *6*. %Iγ branching=17 *5*. B(E1)≥93×10^{-7} (2017Ay04).
1458.5 *10*	0.6 *2*	8639.8	15/2$^+$	7181.3	13/2$^-$			
1521.5 *6*	5.3 *9*	7000.2	11/2$^+$	5478.6	9/2$^-$	D		R(ADO)=0.75 *6*.
1639.6 *9*	23.9 *37*	8639.8	15/2$^+$	7000.2	11/2$^+$	E2		ADO=1.37 *7*. B(E2)=0.0122 *26* (2017Ay04).
1673.1 *13*	0.09 *3*	5722.0	9/2$^+$	4048.8	9/2$^+$			
1760.8 *9*	15.1 *20*	4730.3	9/2$^-$	2969.4	7/2$^+$	D		R(ADO)=0.79 *4*. %Iγ branching=84 *14*. B(E1)=75×10^{-7} *28* (2017Ay04).
1795.0 *20*	2.0 *7*	6525.4	11/2$^-$	4730.3	9/2$^-$	M1+E2	−0.5 *2*	R(ADO)=0.44 *10*. %Iγ branching=100. B(M1)=0.044 *14*, B(E2)=0.0049 *32* (2017Ay04).
1795.4 *13*	2.9 *4*	4730.3	9/2$^-$	2934.8	7/2$^-$	(M1+E2)		R(ADO)=1.45 *7*. %Iγ branching=16 *3*. B(M1)=0.006 *3*, B(E2)=0.0027 *12* (2017Ay04) for δ(E2/M1)=1.0 *3* taken from 2011Ch49 evaluation. For B(M1) and B(E2), 2017Ay04 used.
1931.9 *6*	48.2 *28*	4866.9	11/2$^-$	2934.8	7/2$^-$	E2		R(ADO)=1.20 *9*. %Iγ branching=100. B(E2)=0.0076 *19* (2017Ay04).
1967.2 *3*	100.0 *57*	1967.3	5/2$^+$	0.0	3/2$^+$	D+Q		R(ADO)=0.46 *5*. %Iγ branching=99 *6*.
1995.1 *19*	3.7 *14*	9814.4	17/2$^+$	7819.2	15/2$^-$	D		ADO=0.75 *11*.
2081.5 *6*	13.5 *14*	4048.8	9/2$^+$	1967.3	5/2$^+$	Q		R(ADO)=1.27 *6*. %Iγ branching=78 *4*.
2097.0 *15*	1.7 *5*	7575.7	13/2$^-$	5478.6	9/2$^-$	E2		ADO=1.27 *7*. %Iγ branching=18 *6*. B(E2)≥0.0083 (2017Ay04).

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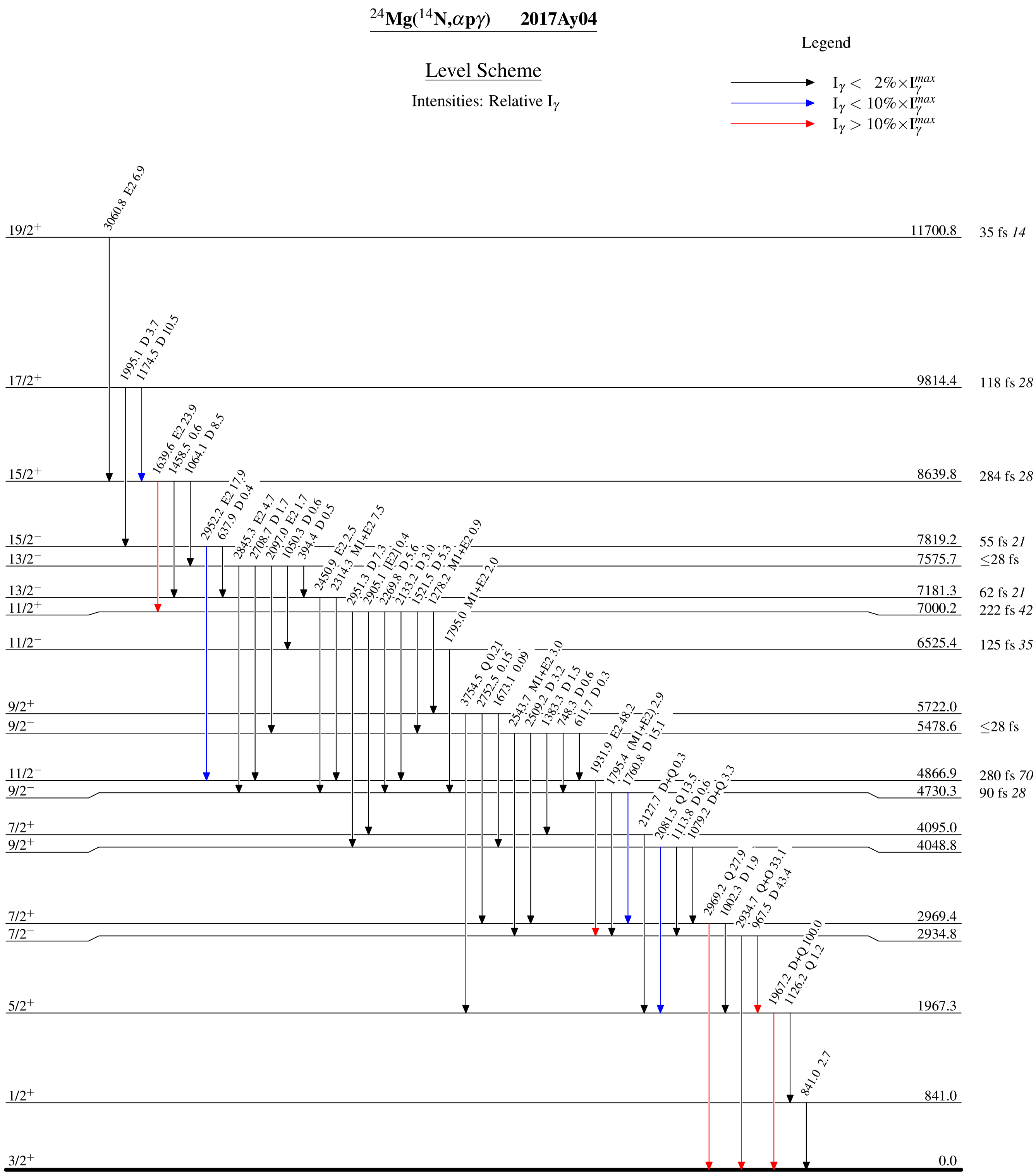
^{24}Mg(^{14}N,αpγ) 2017Ay04 (continued)

γ(^{33}S) (continued)

E_γ †	I_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡	δ ‡	Comments
2127.7 *14*	0.3 *1*	4095.0	7/2$^+$	1967.3	5/2$^+$	D+Q		R(ADO)=0.95 *11*. %Iγ branching=100.
2133.2 *6*	3.0 *6*	7000.2	11/2$^+$	4866.9	11/2$^-$	D		R(ADO)=1.31 *9*.
2269.8 *5*	5.6 *9*	7000.2	11/2$^+$	4730.3	9/2$^-$	D		R(ADO)=0.75 *5*.
2314.3 *20*	7.5 *9*	7181.3	13/2$^-$	4866.9	11/2$^-$	M1+E2	+0.4 *1*	R(ADO)=1.31 *8*. %Iγ branching=75 *12*. B(M1)=0.033 *13*, B(E2)=0.0014 *9* (2017Ay04).
2450.9 *25*	2.5 *4*	7181.3	13/2$^-$	4730.3	9/2$^-$	E2		R(ADO)=1.34 *13*. %Iγ branching=25 *5*. B(E2)=0.0026 *10* (2017Ay04).
2509.2 *7*	3.2 *7*	5478.6	9/2$^-$	2969.4	7/2$^+$	D		R(ADO)=0.79 *9*. %Iγ branching=37 *9*. B(E1)$\geq 34\times10^{-7}$ (2017Ay04).
2543.7 *6*	3.0 *7*	5478.6	9/2$^-$	2934.8	7/2$^-$	M1+E2	+0.7 *3*	R(ADO)=1.37 *8*. %Iγ branching=35 *2*. B(M1)$\geq$0.019, B(E2)$\geq$0.0021 (2017Ay04).
2708.7 *15*	1.7 *5*	7575.7	13/2$^-$	4866.9	11/2$^-$	D		ADO=0.71 *8*. %Iγ branching=18 *6*. B(M1)$\geq$0.012 (2017Ay04).
2752.5 *14*	0.15 *5*	5722.0	9/2$^+$	2969.4	7/2$^+$			
2845.3 *17*	4.7 *12*	7575.7	13/2$^-$	4730.3	9/2$^-$	E2		R(ADO)=1.37 *5*. %Iγ branching=51 *15*. B(E2)$\geq$0.0051 (2017Ay04).
2905.1 *3*	0.4 *1*	7000.2	11/2$^+$	4095.0	7/2$^+$	[E2]		%Iγ branching=1.8 *5*. B(E2)=0.000022 *7* (2017Ay04).
2934.7 *4*	33.1 *13*	2934.8	7/2$^-$	0.0	3/2$^+$	Q+O		R(ADO)=1.17 *4*. %Iγ branching=43 *3*.
2951.3 *8*	7.3 *12*	7000.2	11/2$^+$	4048.8	9/2$^+$	D		R(ADO)=0.84 *3*. %Iγ branching=32 *6*. B(M1)=0.002 *1* (2017Ay04).
2952.2 *12*	17.9 *32*	7819.2	15/2$^-$	4866.9	11/2$^-$	E2		ADO=1.38 *10*. %Iγ branching=98 *24*. B(E2)=0.0045 *20* (2017Ay04).
2969.2 *14*	27.9 *23*	2969.4	7/2$^+$	0.0	3/2$^+$	Q		R(ADO)=1.29 *5*. %Iγ branching=94 *8*.
3060.8 *18*	6.9 *28*	11700.8	19/2$^+$	8639.8	15/2$^+$	E2		ADO=1.33 *11*. %Iγ branching=100. B(E2)=0.0060 *24* (2017Ay04).
3754.5 *25*	0.21 *8*	5722.0	9/2$^+$	1967.3	5/2$^+$	Q		R(ADO)=1.36 *11*.

† From 2017Ay04. Values of relative intensities quoted here are the original values in 2017Ay04 divided by a factor of 10. %Iγ branching ratios deduced by 2017Ay04 from those relative intensities are given under comments.

‡ From 2017Ay04 based on measured $\gamma\gamma(\theta)$(ADO), with magnetic or electric nature of transition deduced based on RUL and measured level $T_{1/2}$, where available. The evaluators have replaced M1 or E1 by mult=D, and E2 by mult=Q where there is no measured level $T_{1/2}$ in 2017Ay04 for supporting magnetic or electric nature assigned by 2017Ay04.



24Mg(14N,αpγ) 2017Ay04
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγ^max
Iγ < 10%×Iγ^max
Iγ > 10%×Iγ^max
19/2+ 11700.8 35 fs 14
3060.8 E2 6.9
17/2+ 9814.4 118 fs 28
1995.1 D 3.7
1174.5 D 10.5
15/2+ 8639.8 284 fs 28
1639.6 E2 23.9
1458.5 0.6
1064.1 D 8.5
15/2− 7819.2 55 fs 21
2952.2 E2 17.9
637.9 D 0.4
13/2− 7575.7 ≤28 fs
2845.3 E2 4.7
2708.7 D 1.7
2097.0 E2 1.7
1050.3 D 0.6
394.4 D 0.5
13/2− 7181.3 62 fs 21
2450.9 E2 2.5
2314.3 M1+E2 7.5
11/2+ 7000.2 222 fs 42
2951.3 D 7.3
2905.1 [E2] 0.4
2269.8 D 5.6
2133.2 D 3.0
1521.5 D 5.3
1278.2 M1+E2 0.9
11/2− 6525.4 125 fs 35
1795.0 M1+E2 2.0
9/2+ 5722.0
3754.5 Q 0.21
2752.5 0.15
1673.1 0.09
9/2− 5478.6 ≤28 fs
2543.7 M1+E2 3.0
2509.2 D 3.2
1383.3 D 1.5
748.3 D 0.6
611.7 D 0.3
11/2− 4866.9 280 fs 70
1931.9 E2 48.2
9/2− 4730.3 90 fs 28
1795.4 (M1+E2) 2.9
1760.8 D 15.1
7/2+ 4095.0
2127.7 D+Q 0.3
9/2+ 4048.8
2081.5 Q 13.5
1113.8 D 0.6
1079.2 D+Q 3.3
7/2+ 2969.4
2969.2 Q 27.9
1002.3 D 1.9
7/2− 2934.8
2934.7 Q+O 33.1
967.5 D 43.4
5/2+ 1967.3
1967.2 D+Q 100.0
1126.2 Q 1.2
1/2+ 841.0
841.0 2.7
3/2+ 0.0

$^{33}_{16}S_{17}$