^{24}Mg(^{16}O,3pγ) 2009Io01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	John Cameron, Jun Chen and Balraj Singh, Ninel Nica	NDS 113, 365 (2012)	15-Jan-2012

2009Io01: E=70 MeV ^{16}O beam produced from the XTU Tandem Accelerator at Legnaro National Laboratory. Target of ^{24}Mg foils. Detectors: the GASP array consisting of 40 Compton-suppressed HPGe detectors and an 80-element bismuth germanate ball. Measured Eγ, Iγ, $\gamma(\theta)$, $\gamma\gamma$-coin. Deduced levels, J, π, $T_{1/2}$ using Doppler Shift Attenuation Method (DSAM).

^{37}Cl Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	E(level)[†]	J^π[‡]	$T_{1/2}$[#]	E(level)[†]	J^π[‡]
0.0[&]	$3/2^+$		6799.36[&] *11*	$13/2^+$	0.41 ps *7*	9795.1[&] *5*	$19/2^+$
3085.87[&] *18*	$5/2^+$		7020.29[&] *11*	$15/2^+$		10104.5 *4*	$17/2^+$
3103.21[a] *8*	$7/2^-$		7269.0[@] *4*	$13/2^+$		10307.8 *11*	$19/2^-$
4009.98[a] *8*	$9/2^-$		7452.74[a] *10*	$15/2^-$	0.13 ps *4*	10571.1[@] *5*	$19/2^+$
4272.7 *3*	$7/2^-$		7561.28 *19*	$13/2^+$		10962.58[a] *22*	$21/2^-$
4460.32 *21*	$7/2^-$		7857.69[@] *16*	$15/2^+$	0.85 ps *15*	11398.7[a] *4*	$23/2^-$
4545.85[a] *9*	$11/2^-$		8070.8 *3*	$15/2^-$		11432.4[&] *5*	$21/2^+$
4903.65[&] *19*	$7/2^+$		8529.91 *14*	$15/2^+$		11973.9[@] *14*	$(21/2^+)$
4920.52[a] *15*	$9/2^-$		8670.5 *11*	$15/2^-$		12476.0 *7*	$23/2^-$
5270.73[a] *9*	$13/2^-$		8701.99[&] *21*	$17/2^+$		13840.8[a] *8*	$25/2^-$
5546.95[a] *10*	$11/2^-$	0.14 ps *5*	8715.2 *15*	$15/2^-$		13842.9[&] *9*	$(25/2^+)$
5594.85[&] *12*	$9/2^+$		8811.98[@] *19*	$17/2^+$	0.38 ps *11*	15448[a] *3*	$(27/2^-)$
5705.09 *10*	$11/2^-$	0.16 ps *5*	8910.86[a] *14*	$19/2^-$	0.68 ps *8*	17008.7[&] *13*	$(29/2^+)$
6046.01[&] *10*	$11/2^+$		9169.2 *7*	$17/2^+$			
6196.13 *24*	$11/2^-$		9428.48[a] *22*	$17/2^-$			

† From least-squares fit to Eγ's. Normalized χ^2 is 1.7, somewhat higher than critical χ^2=1.5. It seems that uncertainties of some of the high-energy γ rays are underestimated in 2009Io01. Two γ rays (671.6 and 2181.6) are poorly fitted, deviating by more than 3 standard deviations.

‡ From R(ADO).

From 2009Io01 using DSAM.

@ Band(A): Sequence of levels based on $13/2^+$.

& Band(B): Sequence of levels based on g.s.

a Band(C): Sequence of levels based on $7/2^-$.

γ(^{37}Cl)

R(ADO)=[$I_\gamma(34°)+I_\gamma(146°)$]/2$I_\gamma(90°)$. Expected ratios are: ≈0.8 for ΔJ=1, dipole; ≈1.35 for ΔJ=2, quadrupole and ≈1.4 for ΔJ=0, D+Q transitions (<0.8 for negative δ and >0.8 for positive δ).

E_γ[†]	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	Comments
157.6 *3*	0.2 *1*	5705.09	$11/2^-$	5546.95	$11/2^-$		
220.9 *1*	1.2 *1*	7020.29	$15/2^+$	6799.36	$13/2^+$		
281.6 *3*	0.6 *1*	8811.98	$17/2^+$	8529.91	$15/2^+$		
296.1 *2*	0.2 *1*	7857.69	$15/2^+$	7561.28	$13/2^+$		
434.4 *1*	0.6 *2*	5705.09	$11/2^-$	5270.73	$13/2^-$		
451.2 *1*	2.7 *2*	6046.01	$11/2^+$	5594.85	$9/2^+$	M1	R(ADO)=0.89 *16*.
467.3 *9*	0.2 *1*	9169.2	$17/2^+$	8701.99	$17/2^+$		
517.8 *3*	0.5 *2*	9428.48	$17/2^-$	8910.86	$19/2^-$		

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^{24}Mg(^{16}O,3pγ) 2009Io01 (continued)

γ(^{37}Cl) (continued)

E_γ[†]	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
535.7 *1*	78 *5*	4545.85	11/2⁻	4009.98	9/2⁻	M1		R(ADO)=0.84 *2*.
588.1 *6*	0.4 *2*	7857.69	15/2⁺	7269.0	13/2⁺			
626.4 *2*	0.5 *2*	5546.95	11/2⁻	4920.52	9/2⁻			
653.6 *2*	1.1 *3*	7452.74	15/2⁻	6799.36	13/2⁺	E1		R(ADO)=0.78 *11*.
671.6 *2*	0.6 *3*	8529.91	15/2⁺	7857.69	15/2⁺			E_γ: level-energy difference=672.2.
691.3 *3*	0.8 *2*	5594.85	9/2⁺	4903.65	7/2⁺	M1+E2		R(ADO)=1.8 *4*.
724.6 *1*	37 *3*	5270.73	13/2⁻	4545.85	11/2⁻	M1+E2		R(ADO)=1.01 *8*.
741.5 *3*	0.5 *2*	8811.98	17/2⁺	8070.8	15/2⁻	E1		R(ADO)=0.69 *21*.
753.4 *1*	10.9 *10*	6799.36	13/2⁺	6046.01	11/2⁺	M1		R(ADO)=0.87 *11*.
761.6 *2*	1.3 *3*	7561.28	13/2⁺	6799.36	13/2⁺	M1		R(ADO)=1.45 *20*.
776.1 *9*	0.4 *2*	10571.1	19/2⁺	9795.1	19/2⁺			
784.4 *3*	1.4 *2*	5705.09	11/2⁻	4920.52	9/2⁻	M1		R(ADO)=0.98 *18*.
837.4 *3*	0.6 *2*	7857.69	15/2⁺	7020.29	15/2⁺			
861.4 *4*	0.5 *2*	11432.4	21/2⁺	10571.1	19/2⁺			
906.8 *1*	85 *3*	4009.98	9/2⁻	3103.21	7/2⁻	M1+E2		R(ADO)=1.45 *8*.
911.2 *5*	3.5 *5*	4920.52	9/2⁻	4009.98	9/2⁻			
974.4 *1*	5.0 *9*	7020.29	15/2⁺	6046.01	11/2⁺	E2		R(ADO)=1.7 *4*.
1001.2 *1*	9.6 *10*	5546.95	11/2⁻	4545.85	11/2⁻	M1		R(ADO)=1.51 *17*.
1058.1 *2*	4.5 *5*	7857.69	15/2⁺	6799.36	13/2⁺	M1		R(ADO)=0.81 *11*.
1093.3 *6*	0.4 *2*	9795.1	19/2⁺	8701.99	17/2⁺			
1125.4 *4*	1.4 *4*	6046.01	11/2⁺	4920.52	9/2⁻	E1		R(ADO)=0.80 *25*.
1142.4 *2*	1.1 *3*	6046.01	11/2⁺	4903.65	7/2⁺	E2		R(ADO)=1.6 *5*.
1159.2 *1*	11.6 *4*	5705.09	11/2⁻	4545.85	11/2⁻	M1		R(ADO)=1.29 *8*.
1169.5 *3*	4.4 *5*	4272.7	7/2⁻	3103.21	7/2⁻	M1+E2		R(ADO)=1.31 *19*.
1204.4 *2*	2.2 *5*	6799.36	13/2⁺	5594.85	9/2⁺			
1222.7 *4*	2.0 *4*	7269.0	13/2⁺	6046.01	11/2⁺	M1		R(ADO)=0.75 *12*.
1244.6 *6*	0.8 *2*	5705.09	11/2⁻	4460.32	7/2⁻			
1252.4 *3*	4.7 *5*	6799.36	13/2⁺	5546.95	11/2⁻	E1		R(ADO)=0.83 *10*.
1256.4 *3*	1.7 *5*	7452.74	15/2⁻	6196.13	11/2⁻			
1260.6 *1*	2.4 *5*	5270.73	13/2⁻	4009.98	9/2⁻			
1275.4 *3*	4.4 *5*	6196.13	11/2⁻	4920.52	9/2⁻	M1		R(ADO)=0.85 *11*.
1357.1 *3*	1.6 *2*	4460.32	7/2⁻	3103.21	7/2⁻			R(ADO)=1.26 *22*.
1374.4 *2*	1.1 *2*	4460.32	7/2⁻	3085.87	5/2⁺			
1432.4 *5*	1.8 *2*	5705.09	11/2⁻	4272.7	7/2⁻			
1442.6 *1*	3.4 *4*	4545.85	11/2⁻	3103.21	7/2⁻	E2		R(ADO)=1.7 *3*.
1458.1 *1*	42 *3*	8910.86	19/2⁻	7452.74	15/2⁻	E2		R(ADO)=1.47 *11*.
1500.1 *3*	1.5 *4*	6046.01	11/2⁺	4545.85	11/2⁻	E1		R(ADO)=1.6 *4*.
1513.4 *7*	2.4 *3*	12476.0	23/2⁻	10962.58	21/2⁻	M1+E2		R(ADO)=1.1 *3*.
1534.2 *3*	1.6 *6*	10962.58	21/2⁻	9428.48	17/2⁻			
1537.2 *2*	1.6 *5*	5546.95	11/2⁻	4009.98	9/2⁻			
1574.6 *3*	2.1 *4*	10104.5	17/2⁺	8529.91	15/2⁺	M1		R(ADO)=0.85 *21*.
1681.6 *2*	6.2 *4*	8701.99	17/2⁺	7020.29	15/2⁺	M1+E2		R(ADO)=1.37 *19*.
1694.6 *3*	4.5 *3*	5705.09	11/2⁻	4009.98	9/2⁻	M1+E2	+0.17 *7*	R(ADO)=1.14 *18*.
1730.6 *1*	1.6 *4*	8529.91	15/2⁺	6799.36	13/2⁺	M1		R(ADO)=0.82 *22*.
1747.6 *1*	19.6 *21*	7452.74	15/2⁻	5705.09	11/2⁻	E2		R(ADO)=1.65 *20*.
1749.4 *1*	21.0 *21*	7020.29	15/2⁺	5270.73	13/2⁻	E1		R(ADO)=0.80 *13*.
1791.6 *3*	3.9 *10*	8811.98	17/2⁺	7020.29	15/2⁺	M1+E2	−0.25 *10*	R(ADO)=0.51 *14*.
1816.6 *3*	10.1 *12*	4920.52	9/2⁻	3103.21	7/2⁻			
1818.1 *4*	0.3 *1*	4903.65	7/2⁺	3085.87	5/2⁺			
1903.2 *5*	2.4 *6*	8701.99	17/2⁺	6799.36	13/2⁺	E2		R(ADO)=1.5 *4*.
1906.0 *1*	11.4 *11*	7452.74	15/2⁻	5546.95	11/2⁻	E2		R(ADO)=1.51 *17*.
1975.6 *3*	4.1 *8*	9428.48	17/2⁻	7452.74	15/2⁻	M1+E2		R(ADO)=0.59 *12*.
2012.7 *3*	3.3 *3*	8811.98	17/2⁺	6799.36	13/2⁺	E2		R(ADO)=1.37 *22*.
2036.1 *1*	17.2 *12*	6046.01	11/2⁺	4009.98	9/2⁻	E1		R(ADO)=0.82 *9*.
2051.6 *2*	7.1 *7*	10962.58	21/2⁻	8910.86	19/2⁻	M1+E2		R(ADO)=0.32 *5*.
2148.7 *12*	1.5 *3*	9169.2	17/2⁺	7020.29	15/2⁺	M1		R(ADO)=0.77 *25*.

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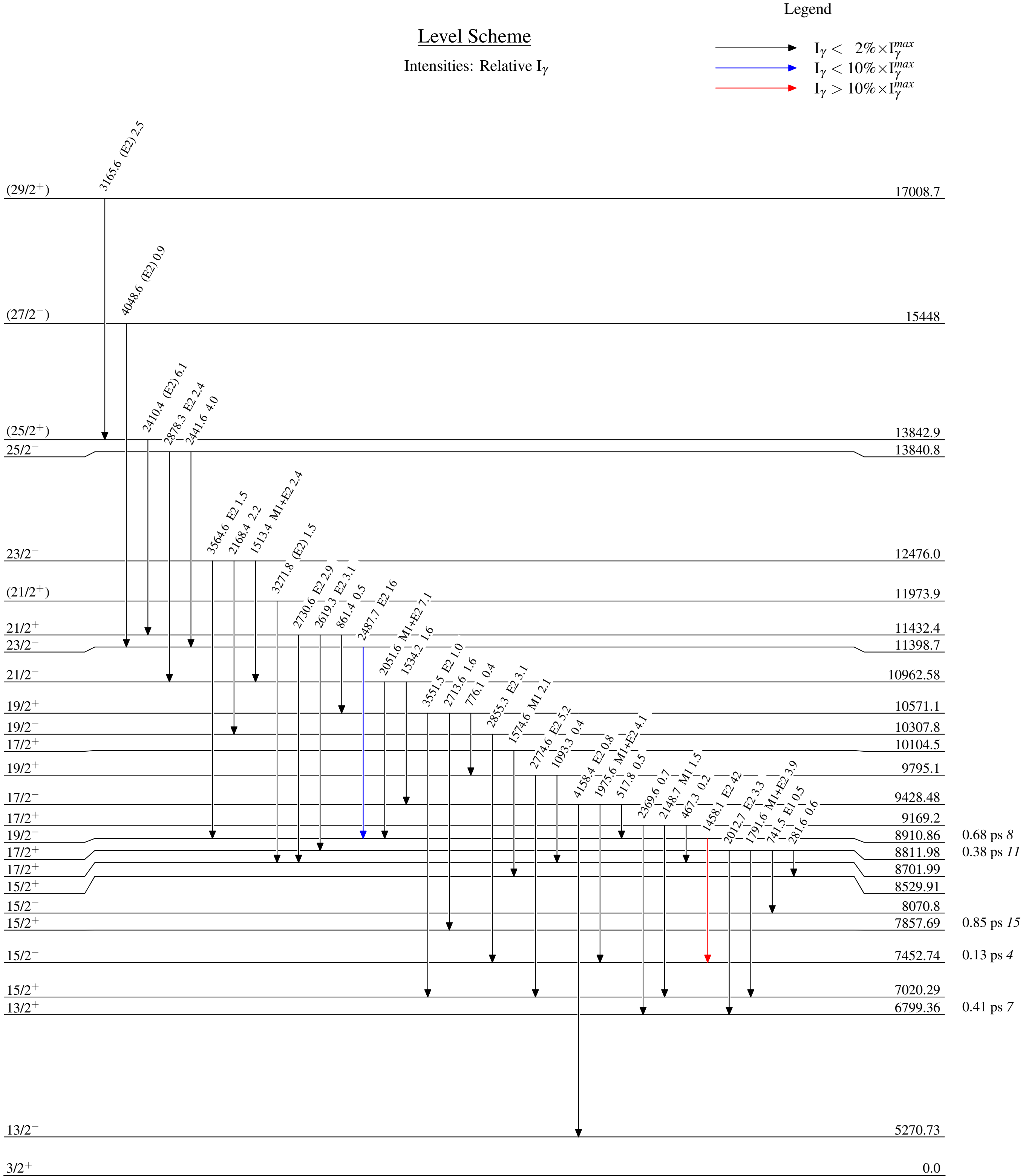
^{24}Mg(^{16}O,3pγ) 2009Io01 (continued)

γ(^{37}Cl) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
2168.4 *14*	2.2 *11*	12476.0	23/2⁻	10307.8	19/2⁻			
2181.6 *1*	8.3 *8*	7452.74	15/2⁻	5270.73	13/2⁻	M1+E2	−0.20 *7*	E_γ: level-energy difference=2181.9. R(ADO)=0.52 *6*.
2253.4 *2*	3.3 *5*	6799.36	13/2⁺	4545.85	11/2⁻	E1		R(ADO)=0.77 *13*.
2369.6 *15*	0.7 *2*	9169.2	17/2⁺	6799.36	13/2⁺			
2410.4 *7*	6.1 *7*	13842.9	(25/2⁺)	11432.4	21/2⁺	(E2)		R(ADO)=1.61 *21*.
2441.6 *14*	4.0 *9*	13840.8	25/2⁻	11398.7	23/2⁻			
2443.8 *2*	6.0 *11*	5546.95	11/2⁻	3103.21	7/2⁻			
2487.7 *3*	16 *3*	11398.7	23/2⁻	8910.86	19/2⁻	E2		R(ADO)=1.6 *3*.
2491.6 *2*	2.2 *2*	5594.85	9/2⁺	3103.21	7/2⁻			
2508.9 *2*	3.6 *3*	5594.85	9/2⁺	3085.87	5/2⁺			
2601.9 *1*	3.5 *4*	5705.09	11/2⁻	3103.21	7/2⁻			
2619.3 *9*	3.1 *5*	11432.4	21/2⁺	8811.98	17/2⁺	E2		R(ADO)=1.28 *19*.
2713.6 *9*	1.6 *7*	10571.1	19/2⁺	7857.69	15/2⁺			
2730.6 *7*	2.9 *8*	11432.4	21/2⁺	8701.99	17/2⁺	E2		R(ADO)=1.4 *3*.
2774.6 *6*	5.2 *5*	9795.1	19/2⁺	7020.29	15/2⁺	E2		R(ADO)=1.35 *20*.
2800.4 *4*	4.4 *5*	8070.8	15/2⁻	5270.73	13/2⁻	M1+E2		R(ADO)=1.23 *13*.
2855.3 *14*	3.1 *8*	10307.8	19/2⁻	7452.74	15/2⁻	E2		R(ADO)=1.6 *4*.
2878.3 *8*	2.4 *5*	13840.8	25/2⁻	10962.58	21/2⁻	E2		R(ADO)=1.5 *3*.
2906.8 *1*	16.8 *21*	7452.74	15/2⁻	4545.85	11/2⁻	E2		R(ADO)=1.42 *19*.
3086.2 *5*	3.1 *5*	3085.87	5/2⁺	0.0	3/2⁺			
3103.2 *1*	100.0 *19*	3103.21	7/2⁻	0.0	3/2⁺	M2+E3		R(ADO)=1.20 *4*.
3165.6 *9*	2.5 *5*	17008.7	(29/2⁺)	13842.9	(25/2⁺)	(E2)		R(ADO)=1.38 *24*.
3271.8 *13*	1.5 *3*	11973.9	(21/2⁺)	8701.99	17/2⁺	(E2)		R(ADO)=1.22 *24*.
3399.6 *11*	1.7 *3*	8670.5	15/2⁻	5270.73	13/2⁻	M1		R(ADO)=0.83 *16*.
3444.3 *15*	1.6 *3*	8715.2	15/2⁻	5270.73	13/2⁻	M1		R(ADO)=0.75 *16*.
3551.5 *17*	1.0 *3*	10571.1	19/2⁺	7020.29	15/2⁺	E2		R(ADO)=1.3 *4*.
3564.6 *14*	1.5 *5*	12476.0	23/2⁻	8910.86	19/2⁻	E2		R(ADO)=1.5 *6*.
4009.6 *1*	31.6 *16*	4009.98	9/2⁻	0.0	3/2⁺	E3		R(ADO)=1.43 *9*.
4048.6 *25*	0.9 *2*	15448	(27/2⁻)	11398.7	23/2⁻	(E2)		R(ADO)=1.6 *4*.
4158.4 *13*	0.8 *2*	9428.48	17/2⁻	5270.73	13/2⁻	E2		R(ADO)=1.5 *4*.
4903.7 *23*	1.1 *3*	4903.65	7/2⁺	0.0	3/2⁺			

† From 2009Io01.
‡ From 2009Io01 based on R(ADO) values.

^{24}Mg(^{16}O,3pγ) 2009Io01

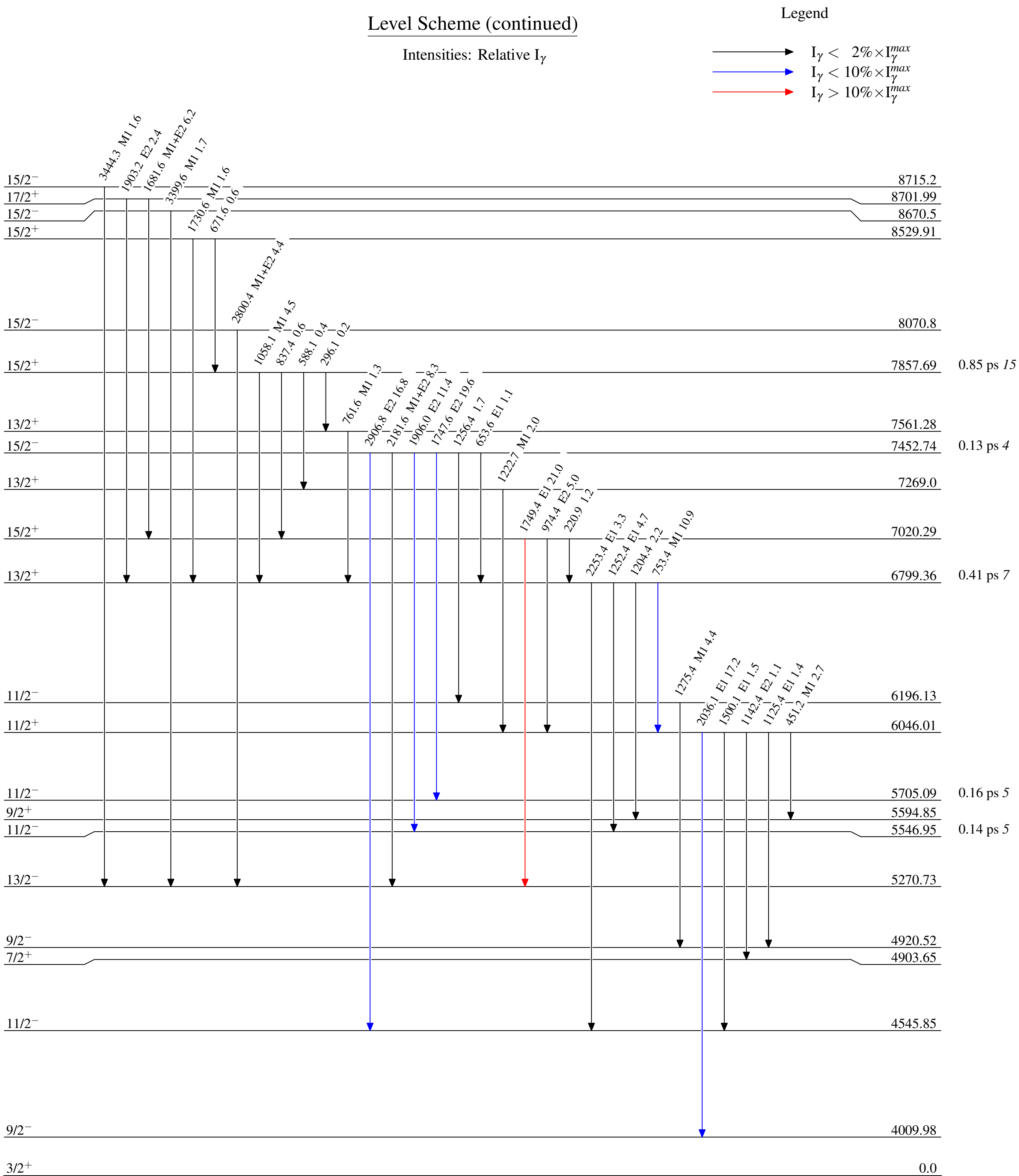


$^{37}_{17}Cl_{20}$

^{24}Mg(^{16}O,3pγ) 2009Io01

Level Scheme (continued)

Intensities: Relative I_γ



$^{37}_{17}Cl_{20}$

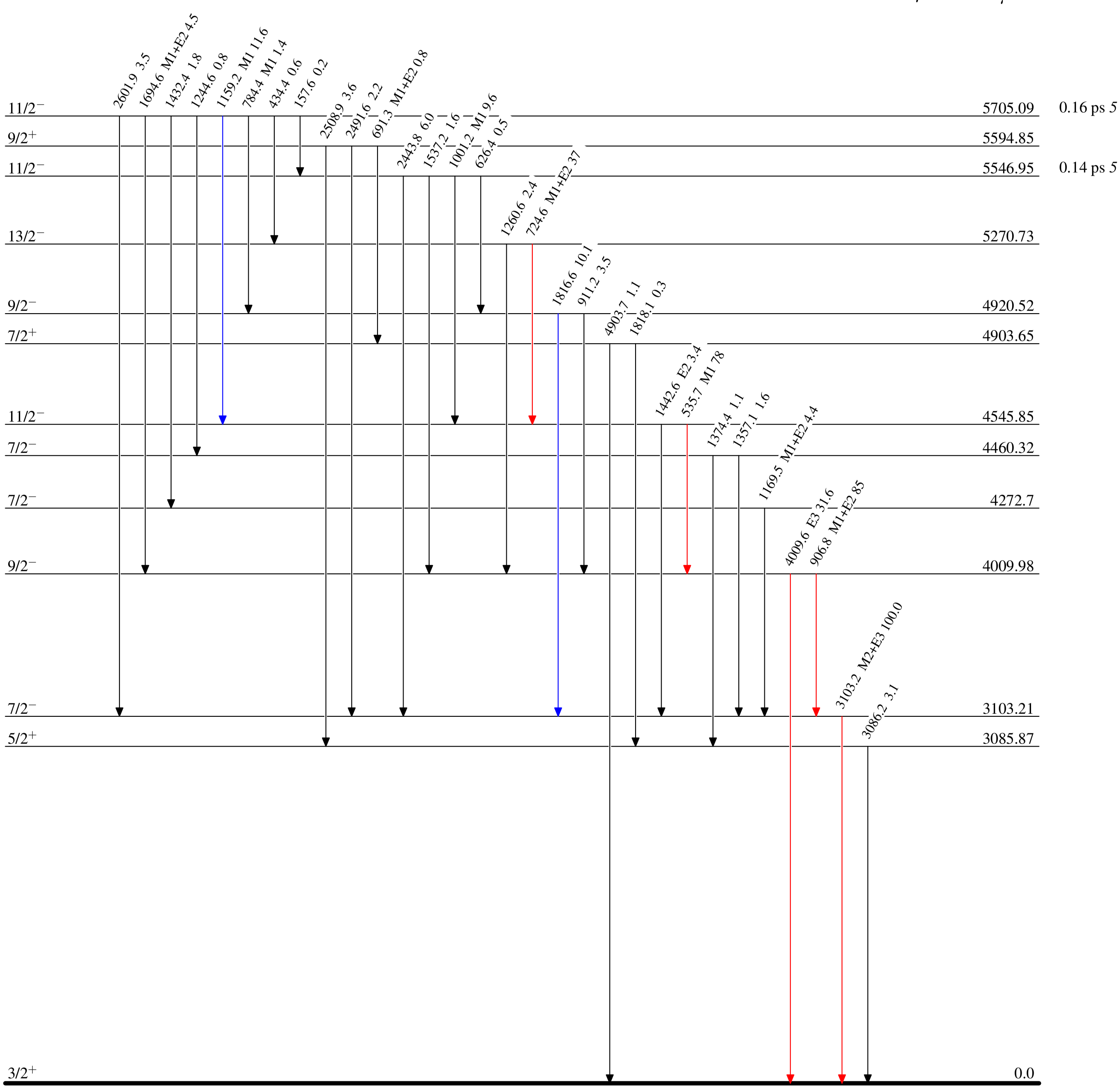
^{24}Mg(^{16}O,3pγ) 2009Io01

Level Scheme (continued)

Intensities: Relative I_γ

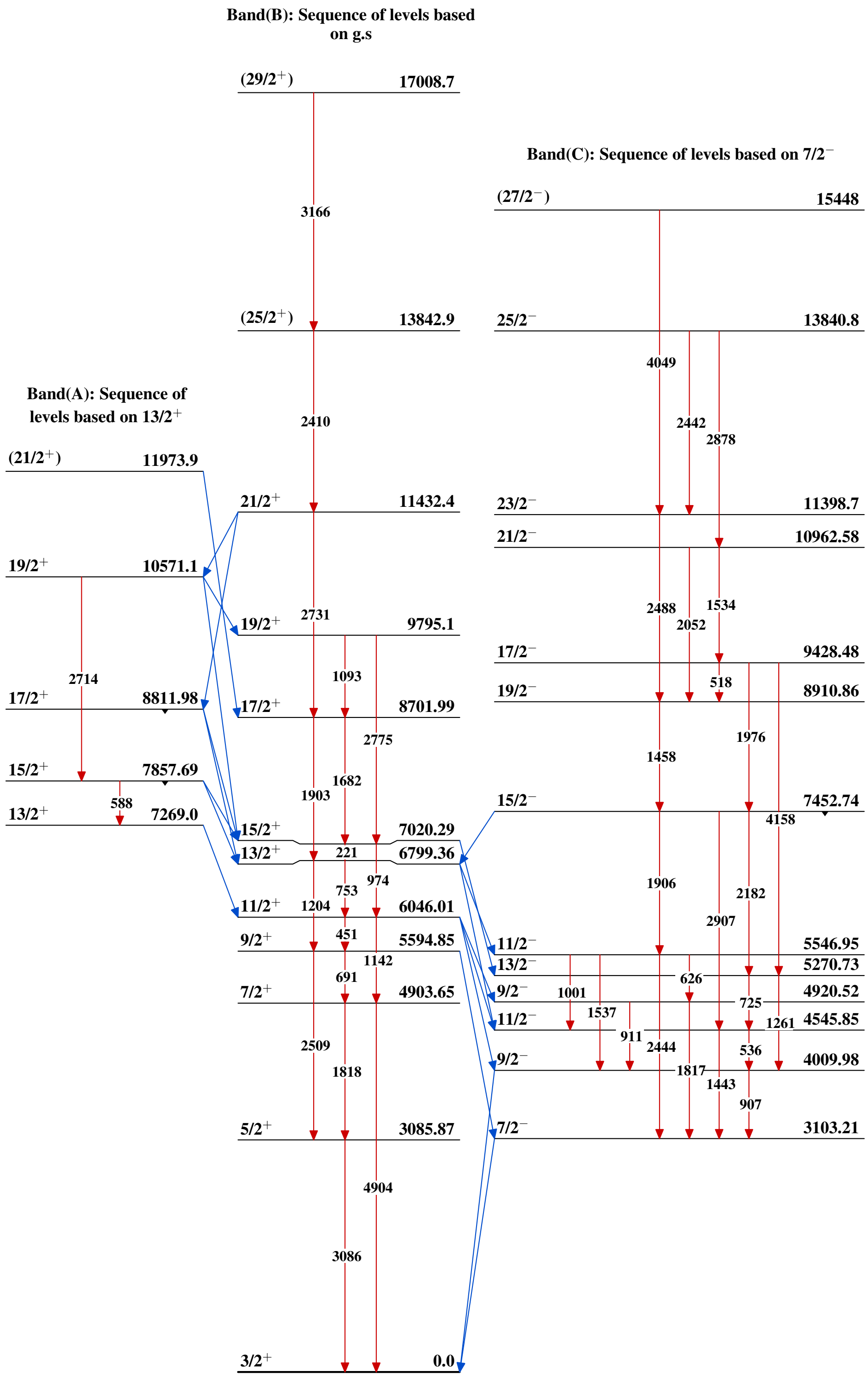
Legend

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



$^{37}_{17}Cl_{20}$

$^{24}Mg(^{16}O,3p\gamma)$ 2009Io01



$^{37}_{17}Cl_{20}$