^{40}Ca(^{24}Mg,3pγ) 1999Vi12,1999Vi07,2004Iz01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Kazimierz Zuber, Balraj Singh	NDS 125, 1 (2015)	25-Jan-2015

2004Iz01: E(^{40}Ca)=96 MeV beam provided by LNL Tandem accelerator, bombarding a ^{24}Mg target. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma$(lin pol) with the EUROBALL Ge-detector array consisting of 26 Clover detectors and 15 Cluster detectors. Evaporated charged particles were detected in the 40-element silicon ΔE-E array ISIS.

1999Vi07, 1999Vi12: E=65 MeV. Measured Eγ, $\gamma\gamma$, Iγ, and $\gamma\gamma(\theta)$(DCO) using the AYEBALL array with TESSA type detectors, eight EUROGAM detectors and one GAMMASPHERE detector.

^{61}Cu Levels

E(level)†	J$^\pi$‡	Comments
0	3/2$^-$	
969.99 *8*	5/2$^-$	
1310.37 *7*	7/2$^-$	
1732.49 *7*	7/2$^-$	
1942.26 *18*	7/2$^-$	J$^\pi$: 7/2$^-$ based on 972 keV M1 γ to 5/2$^-$ (2004Iz01). 1999Vi12 quote J=(7/2$^-$).
2336.23 *12*	9/2$^-$	
2612.17# *12*	9/2$^-$	
2627.14 *11*	11/2$^-$	
2720.13 *11*	9/2$^+$	
3015.8 *4*	11/2$^-$	
3260.54 *10*	11/2$^-$	J$^\pi$: =11/2$^-$, based on 1528.1 keV E2 γ to 7/2$^-$ (2004Iz01). 1999Vi12 quote J=(11/2).
3548.67# *20*	11/2$^{(-)}$	
3779.44 *23*	13/2$^-$	J$^\pi$: =13/2$^-$, based on 1443.2 keV E2 γ to 9/2$^-$ (2004Iz01). 1999Vi12 quote J=(11/2$^-$).
3942.37# *14*	11/2$^+$	
4081.20 *13*	13/2$^+$	
4288.26# *16*	13/2$^-$	
4468.46# *14*	15/2$^-$	
4590.58 *12*	13/2$^+$	
4820.25# *16*	(15/2$^-$)	
4989.70# *24*	(15/2$^+$)	
5119.91 *13*	17/2$^+$	
5137.99# *25*	(15/2$^+$)	
5464.4# *5*		
5702.6# *3*	(15/2$^+$)	
5855.82 *17*	19/2$^+$	J$^\pi$: 19/2$^+$, based on 735.9 keV M1 γ to 17/2$^+$ (2004Iz01). 1999Vi12 quote J=19/2$^-$.
6055.7# *5*	(17/2$^+$)	
6824.82 *17*	21/2$^+$	J$^\pi$: 21/2$^+$, based on 1704.9 keV E2 γ to 17/2$^+$ (2004Iz01). 1999Vi12 quote J=(21/2$^+$).
7388.84 *19*	23/2$^+$	J$^\pi$: 23/2$^+$, based on 1533.0 keV E2 γ to 19/2$^+$ (2004Iz01).
7937.0 *3*	23/2$^-$	J$^\pi$: 23/2$^-$, based on 1112.2 keV E1 γ to 21/2$^+$ (2004Iz01).
9408.5 *5*	27/2$^-$	J$^\pi$: 27/2$^-$, based on 1471.4 keV E2 γ to 23/2$^-$ (2004Iz01).

† From least-squares fit to Eγ data.

‡ Assignments based on DCO(1999Vi12), R(DCO) and linear polarization (2004Iz01).

Not observed by 2004Iz01.

^{40}Ca(^{24}Mg,3pγ) 1999Vi12,1999Vi07,2004Iz01 (continued)

$\gamma(^{61}Cu)$

DCO=[(I(158°) gated at I(79°,101°,134°))/(I(79°,101°,134°) gated at I(158°))]×ε, where I is the number of counts in a peak and ε is an efficiency multiplication factor (1999Vi12 and 1999Vi07).

R_{DCO}=I(γ_1 at 156°; gated with γ_2 at 77°,103°)/I(γ_1 at 77°,103°; gated with γ_2 at 156°), CLOVER detectors at 77° and 103° are equivalent as far as DCO ratios are concerned. Known stretched E2 transitions were used for gating, such the R_{DCO}=1.0 is expected for stretched quadrupole transitions and $R_{DCO}\approx$0.6 for stretched dipoles, ΔJ=0 transitions have values similar to stretched quadrupole transitions (2004Iz01).

POL=[aN(perpendicular)−N(parallel)]/[aN(perpendicular)+N(parallel)], where a(Eγ)=normalization function determined from the ^{152}Eu source calibration. POL takes positive values for pure stretched electrical radiation and negative values for pure stretched magnetic radiation (2004Iz01).

E_γ †	I_γ ‡	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	Comments
209.6 *2*	2.6 *1*	1942.26	7/2$^-$	1732.49	7/2$^-$		DCO=0.78 *10*.
300.2 *3*	1.8 *1*	5119.91	17/2$^+$	4820.25	(15/2$^-$)		DCO=0.62 *13*.
326.4 *4*	2.5 *4*	5464.4		5137.99	(15/2$^+$)		DCO=0.65 *35*.
340.2 *2*	7.5 *5*	1310.37	7/2$^-$	969.99	5/2$^-$	M1+E2	DCO=0.64 *11*. R(DCO)=0.56 *4*, POL=−0.104 *23*.
352.9 *5*	7.2 *5*	6055.7	(17/2$^+$)	5702.6	(15/2$^+$)		DCO=0.49 *11*.
422.0 *1*	13.6 *13*	1732.49	7/2$^-$	1310.37	7/2$^-$		DCO=1.16 *12*. R(DCO)=1.28 *6*, POL=+0.105 *15*. Mult.: ΔJ=0 transition.
529.3 *1*	23.7 *15*	5119.91	17/2$^+$	4590.58	13/2$^+$	E2	DCO=0.94 *10*. R(DCO)=1.04 *5*, POL=+0.101 *11*.
564.6 *2*	1.1 *1*	5702.6	(15/2$^+$)	5137.99	(15/2$^+$)	D	DCO=0.8 *4*. R(DCO)=0.57 *6*. I_γ: from $\gamma\gamma$ coin.
632.7 *9*	6.2 *7*	3260.54	11/2$^-$	2627.14	11/2$^-$		DCO=1.02 *9*.
647.5 *5*	2.1 *3*	4590.58	13/2$^+$	3942.37	11/2$^+$		
648.2 *1*	8.9 *3*	3260.54	11/2$^-$	2612.17	9/2$^-$		
651.6 *3*	1.7 *1*	5119.91	17/2$^+$	4468.46	15/2$^-$		DCO=0.55 *8*.
669.5 *3*	8.6 *13*	2612.17	9/2$^-$	1942.26	7/2$^-$		DCO=0.95 *12*.
735.9 *1*	26.1 *22*	5855.82	19/2$^+$	5119.91	17/2$^+$	M1	DCO=0.56 *3*. R(DCO)=0.65 *8*, POL=−0.137 *17*.
762.5 *1*	8 *5*	1732.49	7/2$^-$	969.99	5/2$^-$		DCO=0.93 *2*.
849.7 *2*	8.5 *9*	5137.99	(15/2$^+$)	4288.26	13/2$^-$		DCO=0.63 *10*.
879.2 *2*	8.9 *15*	2612.17	9/2$^-$	1732.49	7/2$^-$		DCO=0.94 *1*.
908.5 *2*	2.6 *2*	4989.70	(15/2$^+$)	4081.20	13/2$^+$		DCO=0.30 *1*.
936.5 *3*	19.0 *13*	3548.67	11/2$^{(-)}$	2612.17	9/2$^-$		DCO=0.94 *24*.
968		6824.82	21/2$^+$	5855.82	19/2$^+$		E_γ: γ transition from Fig. 3 of 2004Iz01.
969.9 *1*	36.7 *7*	969.99	5/2$^-$	0	3/2$^-$	M1+E2	DCO=0.45 *3*. R(DCO)=0.30 *2*, POL=+0.015 *13*.
972	7.1 *4*	1942.26	7/2$^-$	969.99	5/2$^-$	M1	I_γ: from $\gamma\gamma$ coin, doublet 969.9 keV to g.s. POL=−0.044 *24*.
987.5 *3*	19.8 *7*	2720.13	9/2$^+$	1732.49	7/2$^-$	E1	DCO=0.61 *5*. R(DCO)=0.52 *3*, POL=+0.050 *17*.
1026.3 *5*	4.5 *8*	2336.23	9/2$^-$	1310.37	7/2$^-$	M1+E2	DCO=0.33 *9*. R(DCO)=0.40 *5*, POL=+0.03 *3*.
1038.5 *2*	24.8 *8*	5119.91	17/2$^+$	4081.20	13/2$^+$	E2	DCO=1.02 *4*. R(DCO)=0.95 *4*, POL=+0.063 *16*.
1041.9 *2*	12.0 *13*	4590.58	13/2$^+$	3548.67	11/2$^{(-)}$		DCO=0.67 *1*.
1065.5 *4*	10.8 *6*	4081.20	13/2$^+$	3015.8	11/2$^-$	E1	DCO=0.66 *9*. R(DCO)=0.52 *3*, POL=+0.028 *14*.
1112.2 *3*	11.1 *8*	7937.0	23/2$^-$	6824.82	21/2$^+$	E1	DCO=0.82 *15*. R(DCO)=0.51 *2*, POL=+0.056 *14*.
1222.2 *1*	4.0 *5*	3942.37	11/2$^+$	2720.13	9/2$^+$		DCO=0.46 *11*.

Continued on next page (footnotes at end of table)

^{40}Ca(^{24}Mg,3pγ) 1999Vi12,1999Vi07,2004Iz01 (continued)

$\gamma(^{61}Cu)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
1310.4 *1*	100 *6*	1310.37	7/2$^-$	0	3/2$^-$	E2	DCO=1.10 *4*. R(DCO)=1.04 *4*, POL=+0.104 *9*.
1316.9 *1*	23 *4*	2627.14	11/2$^-$	1310.37	7/2$^-$	E2	DCO=1.03 *10*. R(DCO)=1.04 *4*, POL=+0.082 *16*.
1330.0 *1*	11.6 *19*	4590.58	13/2$^+$	3260.54	11/2$^-$	E1	DCO=0.63 *4*. R(DCO)=0.69 *5*, POL=+0.069 *21*.
1361.0 *1*	35.9 *21*	4081.20	13/2$^+$	2720.13	9/2$^+$	E2	DCO=0.94 *12*. R(DCO)=1.02 *4*, POL=+0.115 *15*.
1366.2 *1*	14.7 *21*	2336.23	9/2$^-$	969.99	5/2$^-$	E2	DCO=1.09 *11*. POL=+0.110 *18*.
1409.7 *1*	20.8 *14*	2720.13	9/2$^+$	1310.37	7/2$^-$	E1	DCO=0.56 *5*. R(DCO)=0.51 *3*, POL=+0.064 *10*.
1443.2 *2*	12 *3*	3779.44	13/2$^-$	2336.23	9/2$^-$	E2	R(DCO)=1.07 *9*, POL=+0.05 *4*.
1471.4 *3*	7.1 *16*	9408.5	27/2$^-$	7937.0	23/2$^-$	E2	DCO=1.12 *8*, POL=+0.113 *17*.
1528.1 *1*	17 *4*	3260.54	11/2$^-$	1732.49	7/2$^-$	E2	DCO=1.1 *3*. R(DCO)=1.02 *9*, POL=+0.11 *5*.
1533.0 *1*	3.2 *2*	7388.84	23/2$^+$	5855.82	19/2$^+$	E2	DCO=0.50 *14*. R(DCO)=1.02 *10*, POL=+0.060 *19*.
1559.4 *2*	6.0 *4*	4820.25	(15/2$^-$)	3260.54	11/2$^-$		DCO=1.50 *12*.
1704.9 *1*	11.1 *10*	6824.82	21/2$^+$	5119.91	17/2$^+$	E2	DCO=1.18 *3*. R(DCO)=0.90 *4*, POL=+0.075 *22*. E_γ: 1704.9+1706 keV a doublet structure.
1706 *1*	23.6 *21*	3015.8	11/2$^-$	1310.37	7/2$^-$	E2	R(DCO)=0.90 *4*, POL=+0.055 *22*. E_γ: 1704.9+1706 keV a doublet structure.
1732.5 *1*	28.0 *16*	1732.49	7/2$^-$	0	3/2$^-$	E2	DCO=0.93 *7*. R(DCO)=1.04 *4*, POL=+0.062 *20*.
1841.3 *1*	12.9 *10*	4468.46	15/2$^-$	2627.14	11/2$^-$		DCO=1.06 *21*.
1870.5 *2*	9.4 *3*	4590.58	13/2$^+$	2720.13	9/2$^+$	E2	DCO=1.04 *4*. R(DCO)=1.12 *6*, POL=+0.11 *3*.
1952.0 *1*	4.8 *2*	4288.26	13/2$^-$	2336.23	9/2$^-$		DCO=1.02 *7*.
1975 *1*	1.8 *4*	6055.7	(17/2$^+$)	4081.20	13/2$^+$		
2193.6 *2*	4.4 *8*	4820.25	(15/2$^-$)	2627.14	11/2$^-$		DCO=0.6 *4*.

[†] From 1999Vi12.
[‡] Intensities listed are singles. 1999Vi12 also quote $\gamma\gamma$ coin intensities.
[#] From DCO (1999Vi12). R(DCO) and linear polarization (2004Iz01) values are given in comments.

^{40}Ca(^{24}Mg,3pγ) 1999Vi12,1999Vi07,2004Iz01

Level Scheme

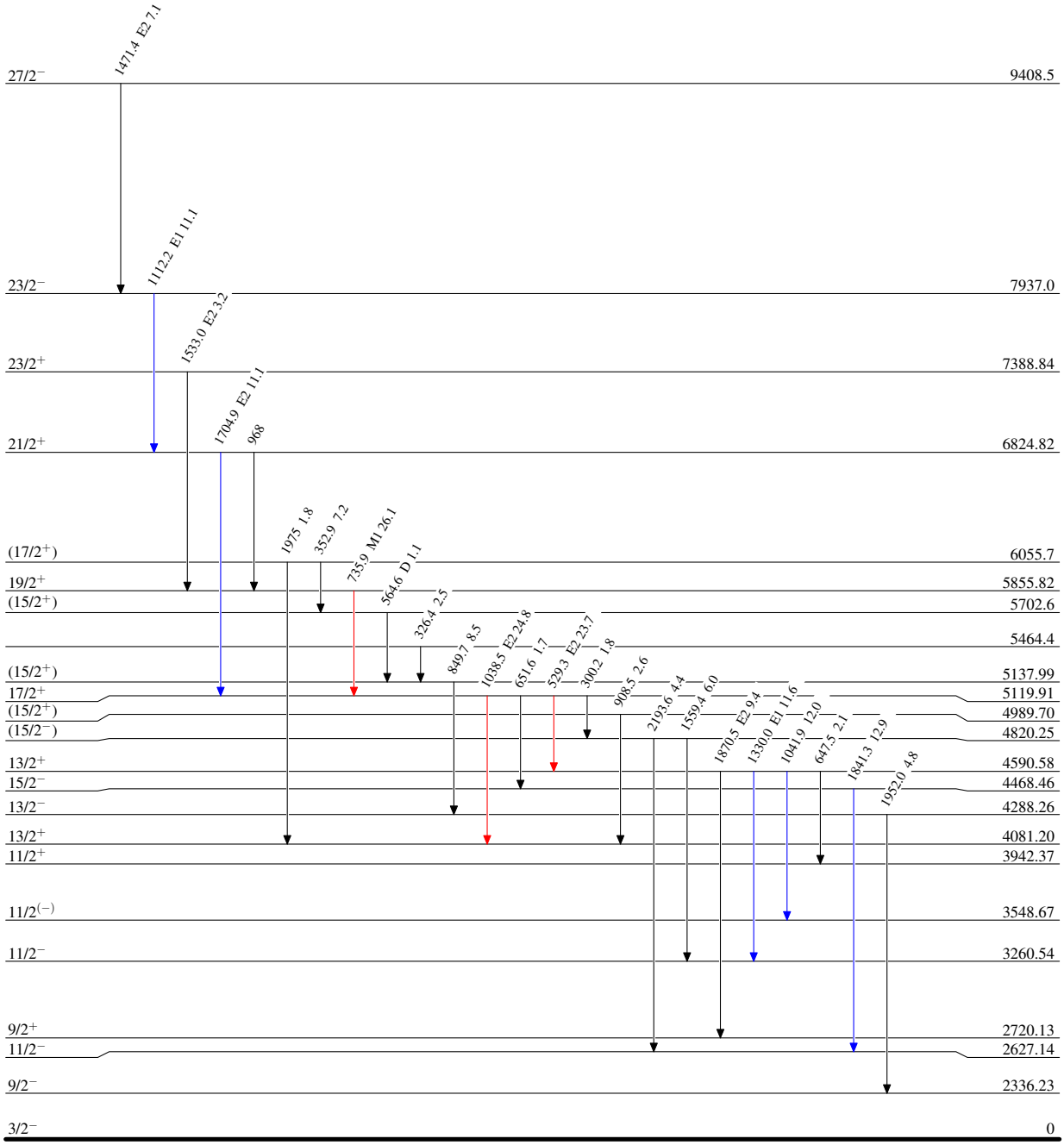
Intensities: Relative I_γ

Legend

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

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

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



$^{61}_{29}Cu_{32}$

^{40}Ca(^{24}Mg,3pγ) 1999Vi12,1999Vi07,2004Iz01

Level Scheme (continued)

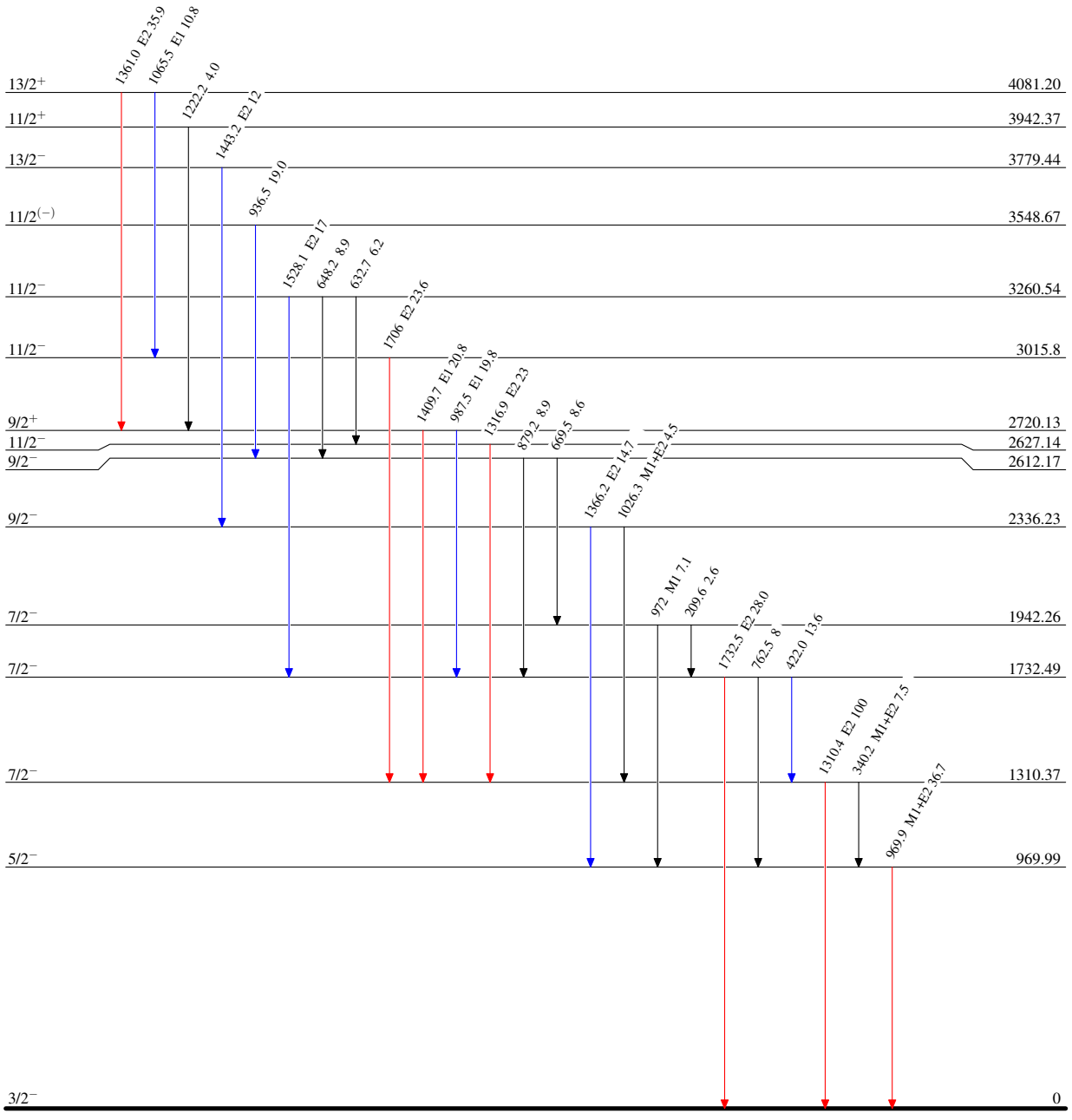
Intensities: Relative I_γ

Legend

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

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

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



$^{61}_{29}Cu_{32}$