^{76}Ge(n,n′γ) 2017Mu03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

2017Mu03: E(n)=1.6-3.7 MeV from Van de Graaff accelerator at the University of Kentucky Accelerator Laboratory (UKAL). Measured Eγ, Iγ, γ(θ) for E(n)=3.0-3.5 MeV, excitation functions, σ(E), level lifetimes by DSAM. Neutrons impinged upon a sample of 19.56 g of GeO_2, enriched to 84% in ^{76}Ge. The main contaminant in the sample was ^{74}Ge, contributing about 14%. Deduced levels, J^π, multipolarities and mixing ratios, B(E2), B(M1), 2^+ mixed-symmetry state. Comparison with large-scale shell-model calculations using NuShellX computer code.

1977SiZT (and 1976SiZZ) E=2.0-4.1 MeV. Measured Eγ, Iγ.

1987Do14 (also 1984KoZN): E=reactor fast neutrons. Measured Eγ, Iγ, γ(θ). Population of following levels compared with calculated (Hauser-Feshbach) values: 563, 1108, 1410, 1539, 1911, 2022, 2204, 2504, 2590, 2656, 2692, 2732, 2748, 2769, 2841, 2898, 2920, 2962, 3141, 3323. Experimental to theoretical ratios vary from 0.4 to 1.5.

2015Cr06: E(n) up to 4.9 MeV from van de Graaff accelerator at the University of Kentucky Accelerator Laboratory (UKAL). Measured Eγ, Iγ, γ(θ). Deduced level lifetimes from DSAM, and σ for γ rays. Detailed analysis of γ spectrum in the region of 2039 keV, which is relevant to search for $0\nu\beta\beta$ decay of ^{76}Ge and associated background γ-ray peaks from reactions taking place in the detector material. 2015CrZZ report is from the same group. See also 2016To01 for discussion of 2040.7-keV γ ray, relevant to the measurements of ^{76}Ge $0\nu\beta\beta$ decay by GERDA Collaboration.

Measured σ (2015Cr06) in the region of 2039 keV peak in γ spectrum: 7.1 mb *7* at E(n)=4.3 MeV, 5.8 mb *6* at E(n)=4.5 MeV, 5.5 mb *6* at E(n)=4.7 MeV, and 4.8 mb *7* at E(n)=4.9 MeV. The γ rays contributing in this region are: 2037.5 keV *5* γ-ray from 3147-keV level, to a lesser extent, the 2037.5 keV *5* γ-ray from 3577-keV level, and 2040.70-keV γ-ray from 3951.89 level.

Others:

2013Ro31: E=white neutron spectrum; measured σ, and upper limit on the cross section of 2040.7γ from a 3952 level. This γ ray is of interest in double beta decay experiments. Cross sections were measured for 431, 546, 563, 847 and 1348 γ rays populating 563, 1108, 1410, 1539 and 1911 levels.

1990DoZU (also 1984KoZN): E=reactor fast neutrons. Measured $T_{1/2}$ by DSA.

1982Sh26: E=14.2 MeV, measured σ.

1970Ch15: E=0.5-2.55 MeV, measured γ(θ) and excitation functions for three γ rays.

1969Li12: E=0.3-1.5 MeV. Measured σ(θ), Eγ, Iγ.

1961Ni03: measured Eγ, Iγ.

^{76}Ge Levels

Following levels, reported in literature, have not been confirmed in the present work: 2019.9,(4^+); 2204.9,$(1,2^+)$; 2284.2,$(3)^-$; 2456.0; 2478.2,$(1,2^+)$; 2554.0; 2591.1,$(1^+,2^+)$; 2624.0; 2654.5; 2768.8,2^+; 2921.0,3^-; 2962.3,(5^-); and 2988.2. The γ rays reported from these levels were not been seen by 2017Mu03, and in one case a γ ray was assigned to another level, based on their measurements at neutron energy thresholds.

E(level)[†]	J^π[#]	$T_{1/2}$[b]	Comments
0.0	0^+		
562.921 *23*	2^+		
1108.403 *27*	2^+		
1409.96 *4*	4^+		
1539.364 *33*	3^+	35 ps *7*	J^π: 1984KoZN suggest 2^+.
1911.13 *7*	0^+	1.25 ps *+62−35*	
2021.67 *4*	4^+	1.5 ps *+10−4*	
2203.84 *5*	$(1,2^+)$	0.010[d] ps *4*	
2453.72 *6*	6^+	0.26 ps *+29−10*	
2478.2 *5*	$(1,2^+)$		
2487.02 *9*	5^+	1.04 ps *+55−28*	
2504.09 *4*	2^+	0.7 ps *5*	$T_{1/2}$: weighted average of 0.24 ps *+55−10* (1984KoZN) and 1.18 ps *+49−28* (2017Mu03).
2589.6[&]	$(1^+,2^+)$		

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

^{76}Ge Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[b]	Comments
2656[@]	$(0^+,1^+)$		
2669.11 *5*	4^+	1.9 ps *+14−6*	
2692.327 *34*	3^-	0.162 ps *14*	$T_{1/2}$: weighted average of 0.28 ps *+15−8* (1984KoZN) and 0.160 ps *14* (2017Mu03). B(E3)=0.021 *7* (2002Ki06 evaluation, from β_3 in (p,p′)).
2697.19[‡] *4*	0^+	0.70 ps *+36−18*	
2733.22 *5*	4^+	0.33[d] ps *8*	$T_{1/2}$: weighted average of 0.17 ps *+18−8* (1977SiZT) and 0.37 ps *+7−6* (2017Mu03).
2747.75 *4*	2^+	0.182 ps *21*	$T_{1/2}$: from 2017Mu03. Other: 0.33 ps *+33−12* (1984KoZN).
2766.68 *5*	2^+	14.6 fs *21*	Based on large B(M1) value of 0.24 for 2203.7γ and low B(E2)(W.u.) of 0.33 for the 2766.7γ, and shell-model calculations, this level is identified by 2017Mu03 as a mixed-symmetry state.
2841.63 *10*	2^+	0.0277 ps *28*	$T_{1/2}$: weighted average of 0.028 ps *8* (1984KoZN) and 0.0277 ps *28* (2017Mu03).
2856.76[‡] *10*	4^+	97 fs *8*	
2897.55 *9*	0^+	0.310 ps *+56−44*	
2919.68 *11*	1^+	0.154 ps *14*	$T_{1/2}$: weighted average of 0.21 ps *+10−6* (1984KoZN) and 0.152 ps *14* (2017Mu03).
2957.90 *15*	5^-		
2986.05[‡] *7*	$(2,3)^+$	99.8 fs *62*	
2993.89 *4*	4^+	0.50 ps *+13−8*	
3004.73[‡] *8*	0^+	0.214 ps *+38−28*	
3007.15 *5*	1^+	19 fs *7*	$T_{1/2}$: unweighted average of 26 fs *+6−5* (2015Cr06) and 11.8 fs *14* (2017Mu03).
3021.13[‡] *7*	$(2,3)^+$	0.340 ps *+47−36*	
3041.38[‡] *8*	$(1,2,3)^+$	0.0638 ps *42*	$T_{1/2}$: from 2017Mu03. Other: 0.23 ps *+35−10* (1990DoZU).
3052.53 *10*	$(3)^+$	0.035 ps *5*	$T_{1/2}$: weighted average of 0.030 ps *+14−10* (1990DoZU) and 0.0360 ps *49* (2017Mu03).
3062.11[‡] *9*	$(4,5)^+$	0.122 ps *22*	
3066.84[‡] *10*	$(2,3,4)^+$	0.90 ps *+56−28*	
3070.39[‡] *11*	4^+	0.76 ps *+49−21*	
3092.08[‡] *10*	$(3,5)^+$	0.268 ps *+42−32*	
3129.86[‡] *8*	2^+	0.245 ps *+26−24*	
3141.30 *5*	1^+	48.5 fs *28*	$T_{1/2}$: others: 60 fs *+70−40* (1990DoZU); 119 fs *+13−12* (2015Cr06) is discrepant.
3147.53 *10*	$(2,3)^+$	118 fs *13*	$T_{1/2}$: weighted average of 164 fs *+36−27* (2015Cr06) and 115 fs *+9−8* (2017Mu03).
3162.63[‡] *6*	$(4)^+$	14.6 fs *21*	
3181.95 *6*	$(2,3)^+$	0.59 ps *+42−18*	
3182.04[a] *6*	(2^+)	0.25[d] ps *+35−11*	
3191.04[‡] *4*	2^+	0.128 ps *14*	
3200.00[‡] *13*	$(3)^+$	0.7 ps *+16−3*	
3236.02 *9*	$(5)^+$	30.5 fs *+35−28*	
3243.80[‡] *7*	1^+	40.9 fs *+35−28*	
3322.9[&] *5*	(2^+)	0.16[c] ps *+14−6*	
3420.4 *5*	1^+		Jπ: from Adopted Levels.
3484.0 *7*	3^-		Jπ: from Adopted Levels.
3576.96 *26*		30 fs *+6−5*	Level from 2015Cr06. $T_{1/2}$: from DSAM (2015Cr06).
3952.2 *6*	1^-	28 fs *5*	Level from 2015Cr06. $T_{1/2}$: from DSAM (2015Cr06).

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

^{76}Ge Levels (continued)

† From a least-squares fit to Eγ data.
‡ New level assigned by 2017Mu03.
# Proposed in 2017Mu03, based on previous assignments, and others from γ(θ) and excitation function measurements in the present work, unless otherwise noted.
@ Level from 1987Do14 (or 1990DoZU) only.
& Level from 1984KoZN only.
a Level from 1990DoZU only.
b From DSAM (2017Mu03), unless otherwise stated.
c From DSA (1984KoZN).
d From DSA (1990DoZU).

γ(^{76}Ge)

The B(E2)(W.u.) and B(M1) values are as given in 2017Mu03. When two sets of B(E2)(W.u.) and B(M1) values are listed, these correspond to two alternative δ(E2/M1) values, and listed in that order. The B(M1) values are in μ_N^2 units. Evaluators′ note: several values and their uncertainties cannot be reproduced, exactly, as listed in Table I of 2017Mu03. For example, for 1639.3γ from 2747 level, evaluators obtains B(M1)=0.034 *4* instead of 0.03 *3* in authors′ Table I. The 1639.3γ is almost a pure M1 transition, thus B(M1) cannot overlap zero value as implied by authors′ value.

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.‡	δ#	Comments
562.921	2+	562.93 *3*	100	0.0	0+	(E2)		B(E2)(W.u.)=29 *1* A_2=+0.16 *1* (1970Ch15) Eγ: other: 562.9 *5* (1977SiZT). Mult.: Q from γ(θ) in 1970Ch15.
1108.403	2+	545.51 *5*	59.5 *18*	562.921	2+	M1+E2	+2.5 *2*	A_2=+0.20 *3* (1970Ch15); A_2=+0.26 *5*; A_4=−0.08 *7* (1987Do14) B(E2)(W.u.)=39 *+5−4*; B(M1)↓=0.003 *+2−3* Eγ: other: 545.8 *5* (1977SiZT). Mult.,δ: δ(Q/D)=+3.5 *15* from γ(θ) in 1970Ch15.
		1108.38 *7*	40.5 *18*	0.0	0+	E2		A_2=+0.48 *2* (1970Ch15); A_2=+0.26 *7*; A_4=−0.09 *9* (1987Do14) B(E2)(W.u.)=0.90 *3* Eγ: other: 1108.6 *5* (1977SiZT). Mult.: Q from γ(θ) in 1987Do14.
1409.96	4+	847.06 *5*	100	562.921	2+	E2		A_2=+0.36 *6*; A_4=−0.11 *7* (1987Do14) B(E2)(W.u.)=38 *9* Eγ: other: 847.2 *5* (1977SiZT). δ(O/Q)=0.0 *1* from γ(θ) (1987Do14).
1539.364	3+	430.95 *5*	41.9 *30*	1108.403	2+	M1+E2		Eγ: other: 430.8 *5* (1977SiZT). δ(E2/M1)=+0.84 *4* or +1.87 *+17−11* (2017Mu03).
		976.44 *6*	58.1 *23*	562.921	2+	M1+E2	+2.72 *20*	A_2=+0.54 *4*; A_4=+0.09 *6* (1987Do14) Eγ: other: 976.2 *5* (1977SiZT). δ(E2/M1)=+2.0 *+5−3* or +0.75 *+15−10* (1987Do14).
1911.13	0+	1348.20 *6*	100	562.921	2+	E2		B(E2)(W.u.)=5 *2* Eγ: other: 1348.5 *5* (1977SiZT).
2021.67	4+	482.33 *5*	7.8 *8*	1539.364	3+	M1+E2		B(E2)(W.u.)=12 *+6−5*; B(M1)↓=0.02 *1* B(E2)(W.u.)=56 *+57−32*; B(M1)↓=0.002 *1* δ(E2/M1)=+0.48 *+9−7* or +2.9 *1* (2017Mu03).
		611.72 *4*	37.1 *16*	1409.96	4+	M1+E2		B(E2)(W.u.)=7 *+4−3*; B(M1)↓=0.04 *2* B(E2)(W.u.)=23 *13*; B(M1)↓=0.03 *+3−2*

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

γ(^{76}Ge) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
								δ(E2/M1)=+0.29 *+42−9* or +0.59 *+14−41* (2017Mu03).
2021.67	4+	913.24 *7*	55.1 *22*	1108.403	2+	E2		B(E2)(W.u.)=18 *8* E_γ: other: 913.2 *5* (1977SiZT).
2203.84	(1,2+)	1097.4[&] *5*		1108.403	2+			
		2203.79[c]		0.0	0+			E_γ: other: 2206.0 *5* (1977SiZT,1976SiZZ).
2453.72	6+	1043.75 *5*	100	1409.96	4+	E2		B(E2)(W.u.)=91 *+55−48*
2478.2	(1,2+)	1915[a] *1*		562.921	2+			
		2478.2[@] *5*		0.0	0+			
2487.02	5+	465.31 *10*	9.8 *9*	2021.67	4+	M1+E2		B(E2)(W.u.)=37 *+42−16*; B(M1)↓=0.03 *+1−2* B(E2)(W.u.)=85 *+104−67*; B(M1)↓=0.01 *+2−1* δ(E2/M1)=+0.65 *+93−18* or +1.4 *10* (2017Mu03).
		947.77 *17*	90.2 *30*	1539.364	3+	E2		B(E2)(W.u.)=33 *+12−11*
2504.09	2+	964.68 *5*	9.3 *8*	1539.364	3+	M1+E2		B(E2)(W.u.)=3 *+2−1*; B(M1)↓=0.0004 *3* B(E2)(W.u.)=0.7 *+3−2*; B(M1)↓=0.003 *1* δ(E2/M1)=+2.8 *+11−8* or +0.57 *+18−12* (2017Mu03).
		1094.22 *12*	11.8 *8*	1409.96	4+	E2		B(E2)(W.u.)=2 *1*
		1395.66 *5*	58.3 *30*	1108.403	2+	M1+E2		B(E2)(W.u.)=2 *1*; B(M1)↓=0.002 *1* B(E2)(W.u.)=0.02 *1*; B(M1)↓=0.007 *2* E_γ: weighted average of 1395.1 *5* (1977SiZT) and 1395.66 *4* (2017Mu03). δ(E2/M1)=+1.9 *2* or +0.08 *4* (2017Mu03).
		2504.08 *6*	20.6 *10*	0.0	0+	E2		B(E2)(W.u.)=0.05 *2* E_γ: weighted average of 2503.6 *5* (1977SiZT) and 2504.09 *6* (2017Mu03). E_γ: 2504.1 (1984KoZN).
2669.11	4+	647.44 *4*	14.2 *7*	2021.67	4+	M1+E2		B(E2)(W.u.)=0.001 *1*; B(M1)↓=0.009 *4* B(E2)(W.u.)=10 *+7−5*; B(M1)↓=0.004 *+2−3* δ(E2/M1)=−0.01 *10* or +1.1 *2* (2017Mu03).
		1129.80 *10*	53.8 *30*	1539.364	3+	M1(+E2)	+0.01 *2*	B(E2)(W.u.)=0.001 *1*; B(M1)↓=0.007 *3*
		1259.12 *5*	32.1 *12*	1409.96	4+	M1+E2		B(E2)(W.u.)=0.00001 *1*; B(M1)↓=0.003 *1* B(E2)(W.u.)=0.78 *40*; B(M1)↓=0.0020 *2* E_γ: other: 1259.1 *4* (1977SiZT). δ(E2/M1)=−0.002 *63* or +1.09 *2* (2017Mu03).
2692.327	3−	1282.35 *5*	10.7 *7*	1409.96	4+	E1		B(E1)(W.u.)=0.00012 *1*
		1583.93 *3*	5.4 *6*	1108.403	2+	E1		B(E1)(W.u.)=0.00003 *1*
		2129.34 *6*	83.9 *33*	562.921	2+	E1		B(E1)(W.u.)=0.00020 *2* E_γ: other: 2129.5 *5* (1977SiZT). E_γ: 2129.6 (1984KoZN).
2697.19	0+	1588.76 *4*	21.1 *10*	1108.403	2+	E2		B(E2)(W.u.)=0.9 *3*
		2134.25 *5*	78.9 *31*	562.921	2+	E2		B(E2)(W.u.)=0.8 *3*
2733.22	4+	1193.92 *12*	26.9 *11*	1539.364	3+	M1+E2		B(E2)(W.u.)=8 *+4−3*; B(M1)↓=0.001 *4* B(E2)(W.u.)=1.0 *2*; B(M1)↓=0.015 *3* δ(E2/M1)=+4.3 *9* or +0.36 *+6−5* (2017Mu03).
		1624.78 *5*	74.1 *30*	1108.403	2+	E2		B(E2)(W.u.)=5 *1*
2747.75	2+	1208.35 *8*	25.2 *13*	1539.364	3+	M1+E2	+0.09 *5*	B(E2)(W.u.)=0.14 *1*; B(M1)↓=0.030 *3* E_γ: other: 1208.4 *5* (1977SiZT).

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

γ(^{76}Ge) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
2747.75	2^+	1639.31 *5*	69.4 *28*	1108.403	2^+	M1(+E2)	−0.002 *29*	B(E2)(W.u.)=0.00004 *1*; B(M1)↓=0.03 *3* E_γ: weighted average of 1639.8 *5* (1977SiZT) and 1639.30 *5* (2017Mu03). Other: 1639.4 (1984KoZN).
		2184.83 *6*	5.4 *6*	562.921	2^+	M1+E2		B(E2)(W.u.)=0.16 *+18−7*; B(M1)↓=0.0001 *1* B(E2)(W.u.)=0.0009 *1*; B(M1)↓=0.001 *1* δ(E2/M1)=+2.9 *+23−11* or −0.07 *+15−6* (2017Mu03).
2766.68	2^+	2203.71 *6*	97.4 *40*	562.921	2^+	M1+E2	−0.09 *2*	B(E2)(W.u.)=0.28 *3*; B(M1)↓=0.24 *3* δ(E2/M1)=+3.1 *3* is also possible from γ(θ) data, but the corresponding B(E2)(W.u.)=35 *+9−7* is unrealistic. B(M1)=0.02 *1* for δ=+3.1 *3*.
		2766.65 *8*	2.6 *8*	0.0	0^+	E2		B(E2)(W.u.)=0.33 *6*
2841.63	2^+	1733.06 *14*	70.2 *30*	1108.403	2^+	M1(+E2)	+0.01 *+3−2*	B(E2)(W.u.)=0.00007 *1*; B(M1)↓=0.19 *2* E_γ: other: 1732.9 *5* (1977SiZT), 1732.9 (1984KoZN). δ(E2/M1)=+2.3 *3* is also possible from γ(θ) data, but the corresponding B(E2)(W.u.)=40 *+10−9* is unrealistic (2017Mu03) B(M1)=0.03 *1* for δ=+2.3 *3*.
		2278.82 *14*	29.8 *15*	562.921	2^+	M1+E2		B(E2)(W.u.)=0.038 *4*; B(M1)↓=0.036 *4* B(E2)(W.u.)=5 *1*; B(M1)↓=0.004 *1* E_γ: weighted average of 2278.5 *5* (1977SiZT) and 2278.84 *14* (2017Mu03). Other: 2278.2 (1984KoZN). δ(E2/M1)=+3.0 *+9−5* or −0.08 *6* (2017Mu03).
2856.76	4^+	1446.79 *9*	100	1409.96	4^+	M1(+E2)	−0.08 *8*	B(E2)(W.u.)=0.32 *3*; B(M1)↓=0.13 *1*
2897.55	0^+	1789.23 *13*	27.6 *14*	1108.403	2^+	E2		B(E2)(W.u.)=1.4 *3*
		2334.51 *11*	72.4 *30*	562.921	2^+	E2		B(E2)(W.u.)=1.0 *2* E_γ: other: 2334.7 *5* (1977SiZT).
2919.68	1^+	1811.47 *17*	12.5 *7*	1108.403	2^+	M1+E2	−0.8 *+63−6*	B(E2)(W.u.)=0.4 *+20−2*; B(M1)↓=0.003 *+2−13*
		2356.57 *23*	19.1 *10*	562.921	2^+	M1+E2	+1.3 *+50−9*	B(E2)(W.u.)=0.3 *+12−2*; B(M1)↓=0.0013 *+9−41*
		2919.48 *17*	68.4 *33*	0.0	0^+	M1		A_2=−0.17 *3*; A_4=−0.08 *5* (2017Mu03) B(M1)↓=0.007 *1* E_γ: weighted average of 2919.0 *5* (1977SiZT) and 2919.53 *17* (2017Mu03). Other: 2919.6 (1984KoZN).
2957.90	5^-	265.3 *5*	3.5 *6*	2692.327	3^-	E2		
		1547.95 *15*	96.5 *38*	1409.96	4^+	E1		
2986.05	$(2,3)^+$	1576.02 *8*	18.8 *11*	1409.96	4^+			
		1877.76 *12*	81.2 *31*	1108.403	2^+			
2993.89	4^+	972.30 *6*	42.7 *17*	2021.67	4^+	M1+E2	−0.61 *+7−5*	B(E2)(W.u.)=0.10 *2*; B(M1)↓=0.035 *9*
		1454.37 *9*	7.8 *8*	1539.364	3^+	M1+E2		B(E2)(W.u.)=0.7 *+17−7*; B(M1)↓=0.0001 *1* B(E2)(W.u.)=0.004 *2*; B(M1)↓=0.002 *1* δ(E2/M1)=−5.2 *+75−36* or −0.08 *+13−59*.
		2430.91 *5*	49.5 *24*	562.921	2^+	E2		B(E2)(W.u.)=0.34 *8*

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

γ(^{76}Ge) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
3004.73	0^+	2441.77 *7*	100	562.921	2^+	E2		B(E2)(W.u.)=1.58 *24*
3007.15	1^+	1898.73 *6*	63.4 *25*	1108.403	2^+	M1(+E2)	−0.8 *+18−7*	B(E2)(W.u.)=23 *+35−12*; B(M1)↓=0.20 *+13−20* E_γ: other: 1900.2 *5* (1977SiZT,1976SiZZ).
		3007.07 *8*	36.6 *18*	0.0	0^+	M1		B(M1)↓=0.04 *1* E_γ: others: 3007.0 *3* (2015Cr06), 3008.6 *5* (1977SiZT,1976SiZZ).
3021.13	$(2,3)^+$	1481.73 *9*	36.8 *18*	1539.364	3^+			
		1611.36 *16*	15.9 *9*	1409.96	4^+			
		1912.59 *13*	47.4 *19*	1108.403	2^+			
3041.38	$(1,2,3)^+$	1130.24[c]		1911.13	0^+			E_γ: 1129.3 *5* (1977SiZT,1976SiZZ).
		2478.8 *11*	100	562.921	2^+			E_γ: unweighted average of 2477.7 *5* (1977SiZT) and 2479.80 *12* (2017Mu03).
3052.53	$(3)^+$	1513.15 *9*	100	1539.364	3^+	M1+E2		B(E2)(W.u.)=0.28 *1*; B(M1)↓=0.31 *1* B(E2)(W.u.)=76 *+15−13*; B(M1)↓=0.09 *2* E_γ: other: 1513.5 *5* (1977SiZT,1976SiZZ). δ(E2/M1)=−0.05 *+6−5* or +1.64 *2* (2017Mu03).
3062.11	$(4,5)^+$	1652.13 *8*	100	1409.96	4^+			
3066.84	$(2,3,4)^+$	1527.46 *9*	100	1539.364	3^+			
3070.39	4^+	1660.41 *10*	100	1409.96	4^+	M1+E2		B(E2)(W.u.)=0.05 *2*; B(M1)↓=0.0110 *+5−45* B(E2)(W.u.)=2.1 *+50−12*; B(M1)↓=0.004 *+1−2* δ(E2/M1)=−0.13 *8* or +1.5 *3* (2017Mu03).
3092.08	$(3,5)^+$	1682.10 *9*	100	1409.96	4^+			
3129.86	2^+	2022.4 *9*	84.9 *35*	1108.403	2^+	M1+E2		B(E2)(W.u.)=0.27 *4*; B(M1)↓=0.015 *2* B(E2)(W.u.)=3 *+5−1*; B(M1)↓=0.0002 *1* E_γ: unweighted average of 2023.3 *5* (1977SiZT) and 2021.48 *10* (2017Mu03). δ(E2/M1)=−0.31 *+5−6* or +10 *+11−3* (2017Mu03).
		3129.78 *8*	15.1 *9*	0.0	0^+	E2		B(E2)(W.u.)=0.06 *2*
3141.30	1^+	1230.2[b] *5*		1911.13	0^+			
		2578.42 *8*	38.9 *11*	562.921	2^+	M1+E2		B(E2)(W.u.)=0.7 *+67−3*; B(M1)↓=0.01 *+13−1* B(E2)(W.u.)=1.6 *+86−21*; B(M1)↓=0.002 *+10−2* E_γ: weighted average of 2578.7 *3* (1977SiZT) and 2578.40 *8* (2017Mu03). E_γ: this γ is not resolved from a 2580.07-keV γ ray from a 3175.5, 3^- level in ^{74}Ge (2017Mu03). δ(E2/M1)=+0.7 *+150−10* or +3 *+13−3* (2017Mu03).
		3141.17 *7*	61.1 *11*	0.0	0^+	M1		B(M1)↓=0.016 *1*
3147.53	$(2,3)^+$	1608.29 *13*	63.3 *13*	1539.364	3^+			

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

γ(^{76}Ge) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[#]	Comments
3147.53	$(2,3)^+$	2038.2 *7*	8.4 *10*	1108.403	2^+			E_γ: unweighted average of 2037.5 *3* (2015Cr06) and 2038.89 *15* (2017Mu03).
		2584.41 *15*	28.3 *12*	562.921	2^+			E_γ: weighted average of 2584.7 *2* (2015Cr06) and 2584.34 *10* (2017Mu03).
3162.63	$(4)^+$	1752.65 *5*	100	1409.96	4^+	M1+E2		B(E2)(W.u.)=1.0 *1*; B(M1)↓=0.50 *5* B(E2)(W.u.)=80 *+25−20*; B(M1)↓=0.18 *+6−5* δ(E2/M1)=−0.09 *9* or +1.4 *3* (2017Mu03).
3181.95	$(2,3)^+$	489.73 *9*	25.1 *19*	2692.327	3^-			
		2618.93 *6*	74.9 *37*	562.921	2^+			
3182.04	(2^+)	2073.61[c]		1108.403	2^+			
3191.04	2^+	2082.51 *9*	23.1 *17*	1108.403	2^+	M1+E2		B(E2)(W.u.)=1.2 *+67−14*; B(M1)↓=0.0006 *+8−27* B(E2)(W.u.)=0.6 *+88−2*; B(M1)↓=0.005 *+2−59* δ(E2/M1)=−3 *+13−3* or −1 *+20−1* (2017Mu03).
		2628.08 *12*	67.6 *27*	562.921	2^+	M1+E2		B(E2)(W.u.)=0.14 *3*; B(M1)↓=0.010 *2* B(E2)(W.u.)=0.75 *+22−44*; B(M1)↓=0.005 *+3−1* δ(E2/M1)=+0.36 *+21−10* or +1.03 *+25−81* (2017Mu03).
		3190.99 *4*	9.3 *9*	0.0	0^+	E2		B(E2)(W.u.)=0.06 *+3−2*
3200.00	$(3)^+$	2091.67 *14*	44.9 *23*	1108.403	2^+	M1+E2		B(E2)(W.u.)=0.001 *1*; B(M1)↓=0.003 *2* B(E2)(W.u.)=0.5 *+25−4*; B(M1)↓=0.00005 *9* δ(E2/M1)=+0.05 *+9−1* or −7 *+14−3* (2017Mu03).
		2636.64 *27*	55.1 *22*	562.921	2^+	M1+E2		B(E2)(W.u.)=0.18 *+81−16*; B(M1)↓=0.00002 *4* B(E2)(W.u.)=0.001 *1*; B(M1)↓=0.002 *+14−12* δ(E2/M1)=−8 *+13−3* or +0.08 *8* (+ sign assumed by evaluators).
3236.02	$(5)^+$	1214.23 *11*	45.9 *22*	2021.67	4^+	M1+E2	+2.2 *+31−18*	B(E2)(W.u.)=40 *+270−130*; B(M1)↓=0.05 *+7−5*
		1826.18 *12*	54.1 *22*	1409.96	4^+	M1+E2		B(E2)(W.u.)=5 *1*; B(M1)↓=0.09 *2* B(E2)(W.u.)=21 *+15−10*; B(M1)↓=0.02 *+3−1* δ(E2/M1)=+0.48 *+13−20* or +1.9 *+10−17* (2017Mu03).
3243.80	1^+	2680.90 *10*	85.6 *41*	562.921	2^+	M1+E2		B(E2)(W.u.)=4 *+92−3*; B(M1)↓=0.003 *+2−500* B(E2)(W.u.)=0.006 *1*; B(M1)↓=0.04 *1* δ(E2/M1)=−4 *+60−2* or +0.04 *2* (2017Mu03).
		3243.66 *9*	14.4 *10*	0.0	0^+	M1		B(M1)↓=0.004 *1*
3322.9	(2^+)	1912.9[b] *5*		1409.96	4^+			
3420.4	1^+	3420.3[a] *5*	100	0.0	0^+			
3484.0	3^-	2074[a] *1*		1409.96	4^+			
		2921[a] *1*		562.921	2^+			
3576.96		2037.5[d]		1539.364	3^+			E_γ: from 2015Cr06.

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^{76}Ge(n,n′γ) 2017Mu03 (continued)

γ(^{76}Ge) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Comments
3576.96		3014.0 *3*		562.921	2^+	E_γ: from 2015Cr06.
3952.2	1^-	2844		1108.403	2^+	
		3389	38.5 *49*	562.921	2^+	Iγ(3389)/Iγ(3952)=63 *8*/100 (2015Cr06). I_γ: unweighted average of 62 *12* at E(n)=4.3 MeV, 47 *8* at E(n)=4.5 MeV, 80 *14* at E(n)=4.7 MeV, and 65 *18* at E(n)=4.9 MeV (2015Cr06).
		3952	61	0.0	0^+	

† From 2017Mu03, unless otherwise noted.
‡ M1+E2 assignments are as implied by ΔJ^π, mixing ratios and lifetime measurements. The assignments of pure E2, M1 and E1 are from Table I in 2017Mu03.
# From γ(θ) data in 2017Mu03, based on comparison with theoretical values and χ^2 analysis. When only one value is given, it is preferred based on lower χ^2.
@ Unresolved doublet.
& Contributed by ^{74}Ge also.
a From 1977SiZT.
b From 1984KoZN, uncertainty assigned by the evaluators.
c From 1990DoZU. Uncertainty=0.5 keV assigned by evaluators for the least-squares fit.
d Placement of transition in the level scheme is uncertain.

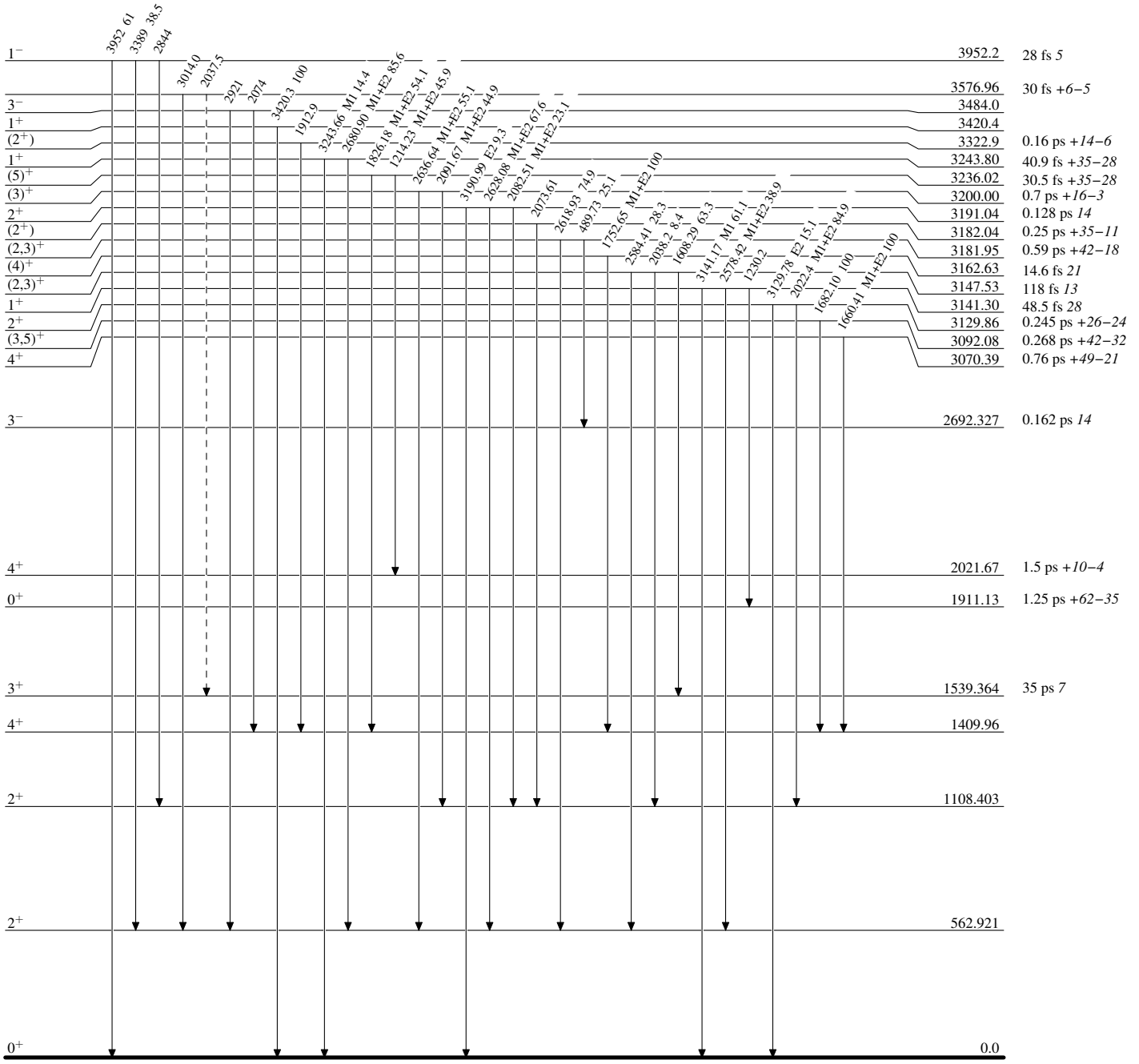
^{76}Ge(n,n′γ) **2017Mu03**

Legend

Level Scheme

Intensities: % photon branching from each level

- - - - - - ► γ Decay (Uncertain)

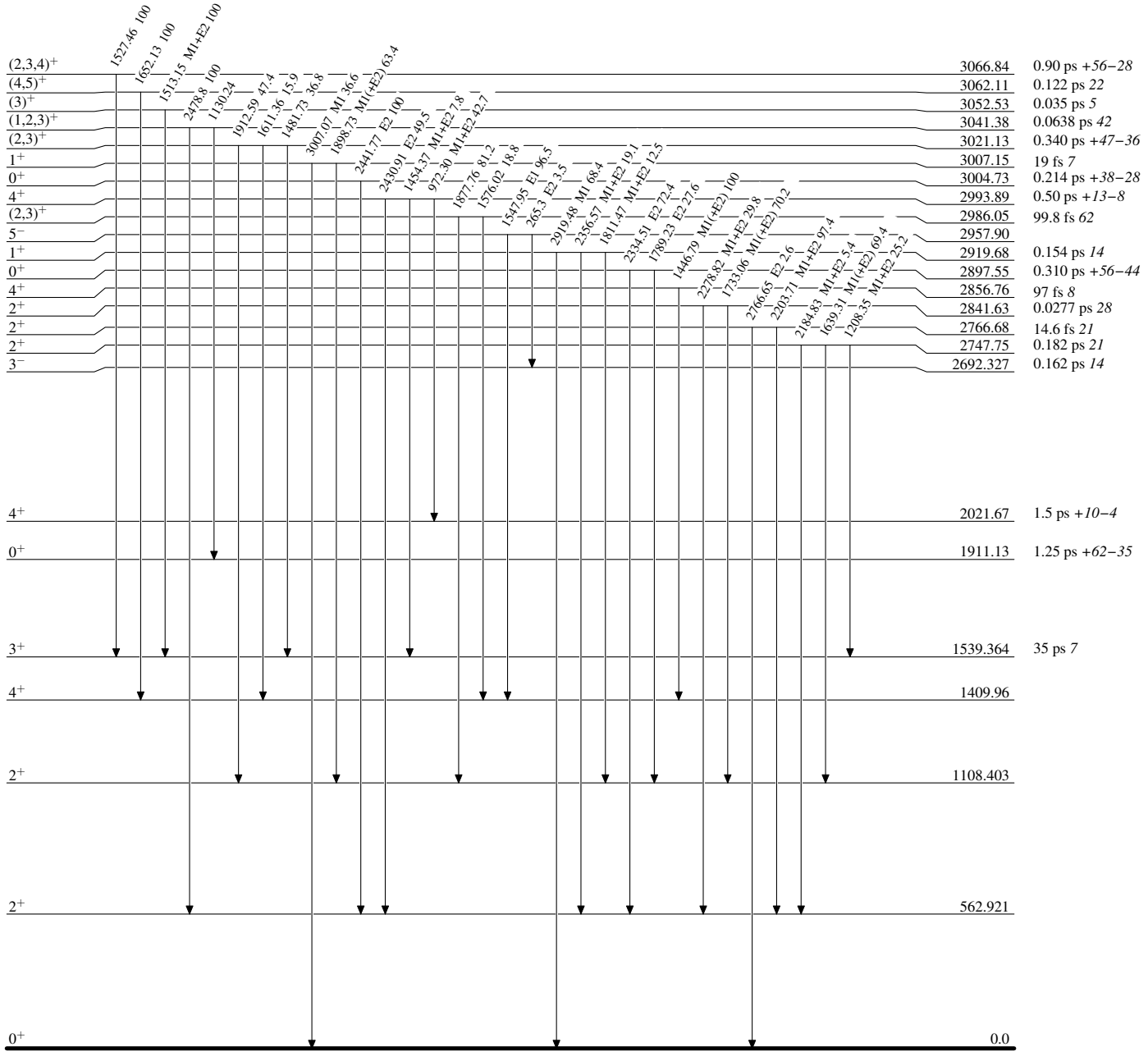


$^{76}_{32}Ge_{44}$

^{76}Ge(n,n′γ) 2017Mu03

Level Scheme (continued)

Intensities: % photon branching from each level

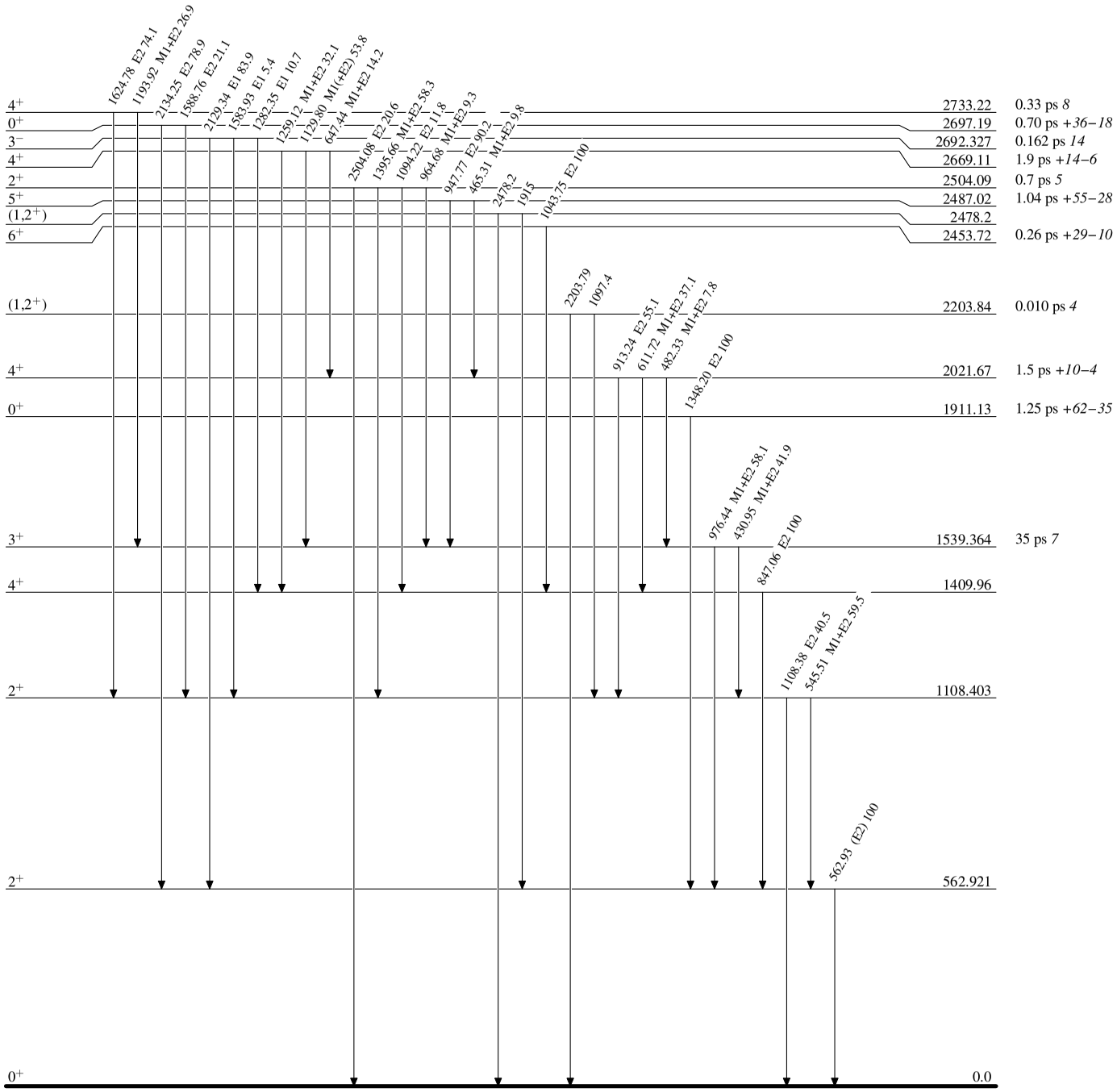


$^{76}_{32}Ge_{44}$

^{76}Ge(n,n′γ) 2017Mu03

Level Scheme (continued)

Intensities: % photon branching from each level



$^{76}_{32}Ge_{44}$