^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Alexandru Negret, Balraj Singh	NDS 114, 841 (2013)	30-Jun-2013

1975Ze02: ^{72}Ge(α,nγ) E=15 MeV, ^{73}Ge(α,2nγ) E=22.5 MeV, measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$.
1976Sa07: ^{72}Ge(α,nγ) E=8.1, 10.0, 13.0 MeV.
Enriched target, measured γ, $\gamma\gamma$, $\gamma(\theta)$, excitation functions.
Level scheme is mainly based on γ, $\gamma\gamma$ data of 1976Sa07 and other reactions.

^{75}Se Levels

E(level)	J$^\pi$[†]	E(level)	J$^\pi$[†]	E(level)	J$^\pi$[†]	E(level)	J$^\pi$[†]
0.0	5/2$^+$	760.94 *22*		1047.17 *20*	5/2$^-$,7/2$^-$	1431.51 *25*	
112.09 *8*	7/2$^+$	777.31 *15*	5/2$^-$	1066.10 *22*	(5/2$^-$)	1454.3 *7*	
132.83 *10*	9/2$^+$	790.2 *3*		1073.69 *23*		1487.42 *25*	11/2$^-$
286.53 *8*	3/2$^-$	813.89 *21*	(11/2$^+$)	1078.58 *17*	9/2$^-$	1629.7 *15*	
292.98 *21*	1/2$^-$	839.4 *4*		1086.89 *18*		1744.1 *11*	
427.8 *1*	5/2$^-$[‡]	859.47 *17*	3/2$^-$	1144.91 *20*	3/2$^+$,5/2$^+$	1803.0 *5*	
586.00 *18*	3/2$^-$	894.8 *4*	1/2$^-$,3/2$^-$	1162.6 *4*	(7/2$^+$,9/2$^+$)	1905.2 *4*	13/2$^-$
611 *1*	1/2$^+$	934.14 *22*	13/2$^+$[#]	1181.84 *21*		1912.3 *21*	(17/2$^+$)
628.19 *14*	5/2$^+$	953.82 *17*		1199.0 *4*		2392.8 *19*	(15/2$^-$)
663.89 *18*	5/2$^-$	962.44 *17*	3/2$^-$	1299.8 *10*		2769 *3*	(19/2$^+$)
747.61 *13*	7/2$^-$	1020.5 *4*	1/2$^-$,3/2$^-$	1374.7 *5*		3022 *3*	(21/2$^+$)

[†] From 1975Ze02 and/or 1976Sa07.
[‡] 141.2 $\gamma(\theta)$ consistent with J=5/2 not J=7/2.
[#] The authors state that J=7/2 or 13/2 from $\gamma(\theta)$ and σ(E) strongly favors the higher J (1976Sa07).

γ(^{75}Se)

E$_\gamma$[†]	I$_\gamma$[‡]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[#]	δ[#]	Comments
6.5[@] *4*		292.98	1/2$^-$	286.53	3/2$^-$			
20.9[@] *4*		132.83	9/2$^+$	112.09	7/2$^+$			Ti(20.9)/Iγ(132.8)=45/55 (1975Ze02), 70/30 (1976Sa07).
112.1 *1*	400 *40*	112.09	7/2$^+$	0.0	5/2$^+$	M1+E2	−0.25 *13*	A$_2$=−0.40 *2* (1976Sa07). A$_2$=−0.23 *12*, A$_4$=−0.07 *14* (1975Ze02). δ: $\gamma(\theta)$ gives −0.25 *13* or −2.1 *4*. Data in (n,γ) and (p,nγ) agree with the first value only.
132.8 *1*	27 *5*	132.83	9/2$^+$	0.0	5/2$^+$			A$_2$=−0.30 *17*, A$_4$=−0.18 *22* (1975Ze02).
141.2 *1*	68 *10*	427.8	5/2$^-$	286.53	3/2$^-$	M1+E2	−0.19 *10*	A$_2$=−0.41 *3*, A$_4$=+0.07 *4* (1976Sa07). A$_2$=−0.31 *5*, A$_4$=−0.05 *7* (1975Ze02). δ: $\gamma(\theta)$ gives −0.19 *10* or −1.6 *2*. Data in (n,γ) and (p,nγ) agree with the first value only.
155[&e]	<0.1	286.53	3/2$^-$	132.83	9/2$^+$	[E3]		E$_\gamma$: observed only in coincidence.
162.2[&c] *3*	2.3 *11*	790.2		628.19	5/2$^+$			
191.3 *3*	1.3 *6*	777.31	5/2$^-$	586.00	3/2$^-$			E$_\gamma$: shown incorrectly from 748 level by 1976Sa07.
211.2 *3*		839.4		628.19	5/2$^+$			
x213.8[&b] *4*	3.5 *12*							
236.2 *3*		663.89	5/2$^-$	427.8	5/2$^-$			
x250.2[&] *5*	0.8 *4*							

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^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07 (continued)

γ(^{75}Se) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
[x]274.4[&] 5	2.9 14							
286.5 1	100 10	286.53	3/2$^-$	0.0	5/2$^+$			A_2=−0.05 2, A_4=+0.03 2 (1976Sa07). Additional information 1.
293.0 2	7 3	586.00	3/2$^-$	292.98	1/2$^-$	M1+E2	+0.12 8	A_2=−0.08 3 (1976Sa07). δ: $\gamma(\theta)$ gives +0.12 8 or −2.5 6. Data in (p,nγ) agree with the first value only.
299.6 3		586.00	3/2$^-$	286.53	3/2$^-$			
315.8 2	4.9 24	427.8	5/2$^-$	112.09	7/2$^+$			
319.8 2	41 8	747.61	7/2$^-$	427.8	5/2$^-$	M1+E2		Additional information 3. A_2=−0.56 4, A_4=+0.05 5 (1975Ze02). δ: −1.5<δ<−0.16.
326.3 3		1073.69		747.61	7/2$^-$			
330.9 2	13 5	1078.58	9/2$^-$	747.61	7/2$^-$			A_2=−0.49 8, A_4=+0.20 9 (1975Ze02). Additional information 7.
341.3[a] 7		628.19	5/2$^+$	286.53	3/2$^-$			Assigned by the evaluators on the basis of ^{74}Se(n,γ) and ^{75}As(p,nγ).
349.5 2	4 2	777.31	5/2$^-$	427.8	5/2$^-$			A_2=+0.21 3 (1976Sa07).
377.4 2	13 5	663.89	5/2$^-$	286.53	3/2$^-$	M1+E2	−0.7 5	A_2=−0.61 5 (1976Sa07). A_2=−0.39 9, A_4=+0.06 10 (1975Ze02).
[x]396.5[a] 8								
404.2 3	1.7 8	1181.84		777.31	5/2$^-$			
408.8 3	6.4 25	1487.42	11/2$^-$	1078.58	9/2$^-$			A_2=−0.86 14, A_4=+0.05 21 (1975Ze02).
418.2[&b] 8	4 2	1905.2	13/2$^-$	1487.42	11/2$^-$			A_2=−0.51 11, A_4=−0.04 22 (1975Ze02).
428.0 2	24 8	427.8	5/2$^-$	0.0	5/2$^+$			Additional information 2. A_2=+0.22 3, A_4=−0.02 4 (1975Ze02).
431.6 2		859.47	3/2$^-$	427.8	5/2$^-$	M1(+E2)	+0.3 3	A_2=−0.20 6 (1976Sa07). δ: $\gamma(\theta)$ gives +0.3 3 or<2.9. Data in (p,nγ) agree with the first value only.
[x]438.5[a] 9								
[x]451.0[&b] 9	2.8 14							
461.2 2	9 5	747.61	7/2$^-$	286.53	3/2$^-$			A_2=+0.39 4, A_4=−0.13 4 (1976Sa07). Additional information 4.
466.5[ac] 9		894.8	1/2$^-$,3/2$^-$	427.8	5/2$^-$			
[x]481.3[&] 10	0.5 3							
484.4 3	4 2	777.31	5/2$^-$	292.98	1/2$^-$			
487.5 3		1073.69		586.00	3/2$^-$			
490.6 2	7 3	777.31	5/2$^-$	286.53	3/2$^-$			
[x]511.8[&] 10	66 10							E_γ: probably annihilation radiation.
516.3 2	11 4	628.19	5/2$^+$	112.09	7/2$^+$			
[x]542.1[&b] 11	2.7 14							
[x]565.7[&] 11	1.6 8							
573.0 2		859.47	3/2$^-$	286.53	3/2$^-$			
[x]588.0[&] 12	2.5 12							
596.1 3		1181.84		586.00	3/2$^-$			
608.4 4		894.8	1/2$^-$,3/2$^-$	286.53	3/2$^-$			
611 1	4 2	611	1/2$^+$	0.0	5/2$^+$			

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^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07 (continued)

γ(^{75}Se) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
619.4 *2*	11 *4*	1047.17	5/2$^-$,7/2$^-$	427.8	5/2$^-$		
628.1[d] *2*	16[d] *6*	628.19	5/2$^+$	0.0	5/2$^+$		
628.1[d] *2*	16[d] *6*	760.94		132.83	9/2$^+$		
635.2 *3*		747.61	7/2$^-$	112.09	7/2$^+$		
650.8 *2*	22 *8*	1078.58	9/2$^-$	427.8	5/2$^-$		A_2=+0.41 *17*, A_4=+0.07 *21* (1975Ze02). Additional information 8.
657.0 *4*		790.2		132.83	9/2$^+$		
676.2 *3*		962.44	3/2$^-$	286.53	3/2$^-$		
678 *1*		790.2		112.09	7/2$^+$		
681 *1*	46 *9*	813.89	(11/2$^+$)	132.83	9/2$^+$		A_2=−0.41 *6*, A_4=−0.06 *9* (1975Ze02). Additional information 5.
683.7 *3*		1431.51		747.61	7/2$^-$		
701.8 *2*	17 *6*	813.89	(11/2$^+$)	112.09	7/2$^+$		A_2=+0.34 *11*, A_4=+0.23 *25* (1975Ze02).
[x]710.3[&] *14*	2.5 *12*						
724.4 *4*	7.6 *25*	1803.0		1078.58	9/2$^-$		
734.0 *2*	4 *2*	1020.5	1/2$^-$,3/2$^-$	286.53	3/2$^-$		A_2=−0.02 *3* (1976Sa07).
739.9 *3*	12 *4*	1487.42	11/2$^-$	747.61	7/2$^-$		A_2=+0.37 *9*, A_4=−0.06 *11* (1975Ze02). Additional information 9.
749.2[&] *15*	3.0 *15*	747.61	7/2$^-$	0.0	5/2$^+$		
754.1 *3*	1.6 *8*	1181.84		427.8	5/2$^-$		
760.5 *4*	1.7 *8*	1047.17	5/2$^-$,7/2$^-$	286.53	3/2$^-$		
767.8 *3*		1431.51		663.89	5/2$^-$		
788.7 *4*		1374.7		586.00	3/2$^-$		
[x]791.3[&] *16*	7 *3*						
801.3 *2*	37 *8*	934.14	13/2$^+$	132.83	9/2$^+$	E2	Mult.: from $\gamma(\theta)$ for J=13/2$^+$ mult=Q, RUL rules out M2. A_2=+0.54 *7*, A_4=−0.41 *7* (1976Sa07). Additional information 6.
810[&]		1744.1		934.14	13/2$^+$		E_γ: not given in the authors' table but shown in the level scheme.
816.1[&] *16*	8 *3*	1629.7		813.89	(11/2$^+$)		A_2=−1.13 *7*, A_4=+0.20 *17* (1975Ze02). Additional information 10.
826.5 *3*	3.0 *15*	1905.2	13/2$^-$	1078.58	9/2$^-$		A_2=+0.81 *17*, A_4=−0.01 *22* (1975Ze02). Additional information 11.
841.3 *3*		953.82		112.09	7/2$^+$		
856.7[a] *17*		2769	(19/2$^+$)	1912.3	(17/2$^+$)		A_2=−0.6 *6*, A_4=+0.3 *7* (1975Ze02).
868.3 *6*		1454.3		586.00	3/2$^-$		
872 *1*		1299.8		427.8	5/2$^-$		
[x]884.0[a] *18*							
[x]893.7[&] *18*	6 *2*						
905.4[&] *18*	2.5 *12*	2392.8	(15/2$^-$)	1487.42	11/2$^-$		A_2=+0.3 *5*, A_4=−0.5 *7* (1975Ze02).
912.5 *4*		1199.0		286.53	3/2$^-$		
[x]914.0[&b] *18*	2.5 *12*						
[x]928.4[&b] *18*	3.0 *15*						
[x]947.4[&] *19*	2.7 *13*						
954.0[d] *2*	19[d] *8*	953.82		0.0	5/2$^+$		
954.0[d] *2*	19[d] *8*	1066.10	(5/2$^-$)	112.09	7/2$^+$		
954.0[d] *2*	19[d] *8*	1086.89		132.83	9/2$^+$		
961.5 *5*		1073.69		112.09	7/2$^+$		
962.3 *2*	2.1 *10*	962.44	3/2$^-$	0.0	5/2$^+$		A_2=−0.14 *2* (1976Sa07).
974.9 *3*		1086.89		112.09	7/2$^+$		

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^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07 (continued)

γ(^{75}Se) (continued)

E_γ †	I_γ ‡	E_i(level)	J_i^π	E_f	J_f^π	Comments
978.2&b 20	16 6	1912.3	(17/2$^+$)	934.14	13/2$^+$	Additional information 12. A_2=+0.30 6, A_4=−0.18 8 (1975Ze02).
x994.1& 20	3.3 15					
x1007.4a 20						
x1026.8a 20						
x1032.1a 20						
1049.9 3	11 4	1162.6	(7/2$^+$,9/2$^+$)	112.09	7/2$^+$	
x1098.7& 22	3.4 17					
1109.6a 22		3022	(21/2$^+$)	1912.3	(17/2$^+$)	A_2=+0.14 18, A_4=+0.01 26 (1975Ze02).
x1139.7& 22	6 2					
1144.9 2		1144.91	3/2$^+$,5/2$^+$	0.0	5/2$^+$	
x1147.8& 23	8 3					
x1156.4& 23	2.1 10					
x1183.0a 24						
x1268& 3	1.1 6					
x1274.0a 25						
x1345& 3	2.7 13					
x1460& 3	1.9 9					
1496& 3	3.1 15	1629.7		132.83	9/2$^+$	

† From 1976Sa07, except as noted.
‡ From ^{73}Ge(α,2nγ) measured at 90° (1975Ze02). Authors state that uncertainties for strong branches are 10%, increasing to 50% for very weak branches. Intensities from (α,nγ) are also available in 1975Ze02.
# D+Q from γ(θ) in 1976Sa07, but M1+E2 known from (n,γ) also E1+M2 ruled out by RUL.
@ From ^{75}As(p,nγ), 1974Ag05.
& From ^{73}Ge(α,2nγ), 1975Ze02.
a From ^{72}Ge(α,nγ), 1975Ze02.
b Unresolved doublet.
c Assigned by the evaluators on the basis of ^{74}Se(n,γ) reaction.
d Multiply placed with undivided intensity.
e Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

^{72}Ge(α,nγ),^{73}Ge(α,2nγ) **1975Ze02,1976Sa07**

Level Scheme

Intensities: Relative I_γ

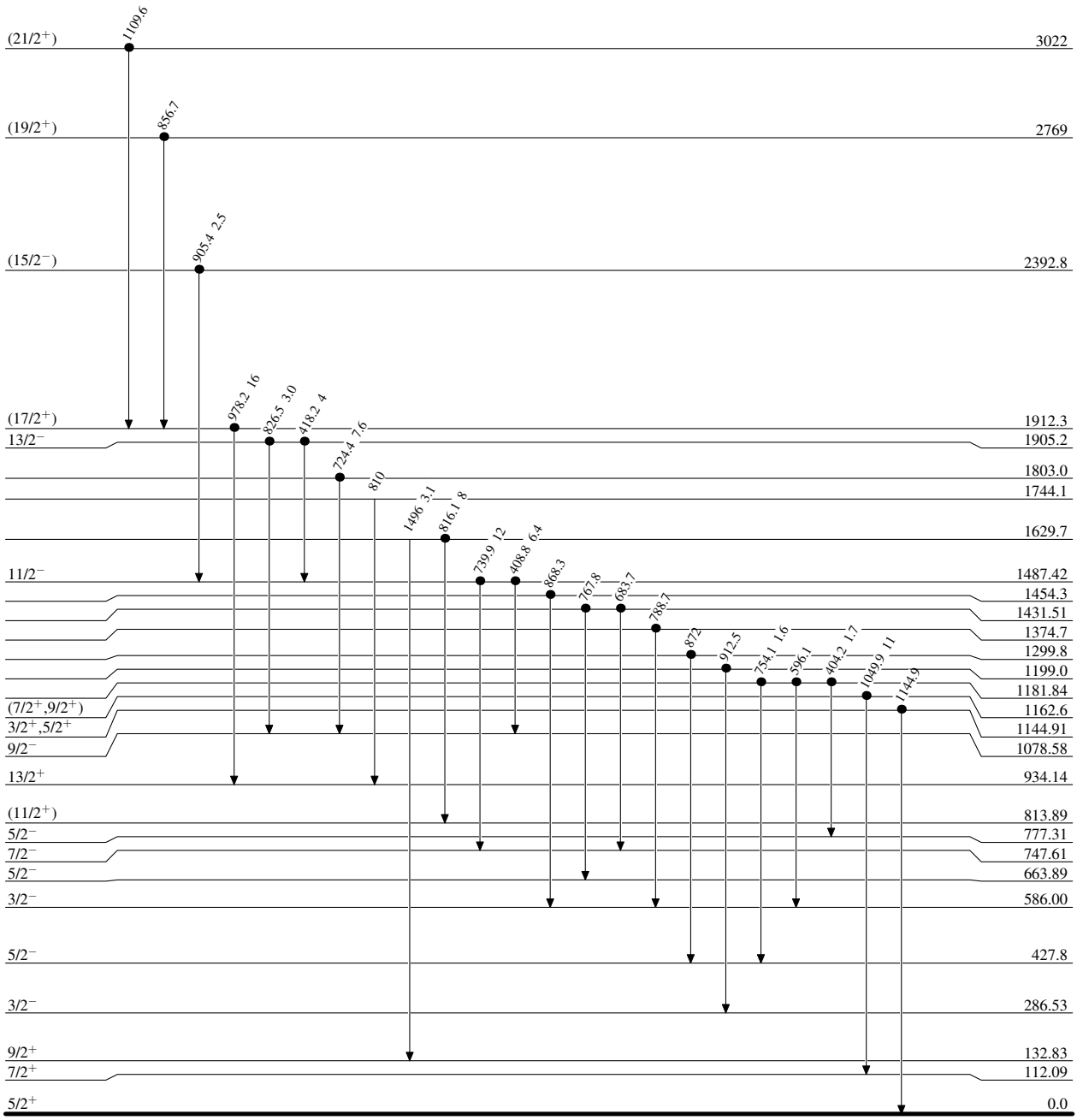
Legend

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

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

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

Coincidence



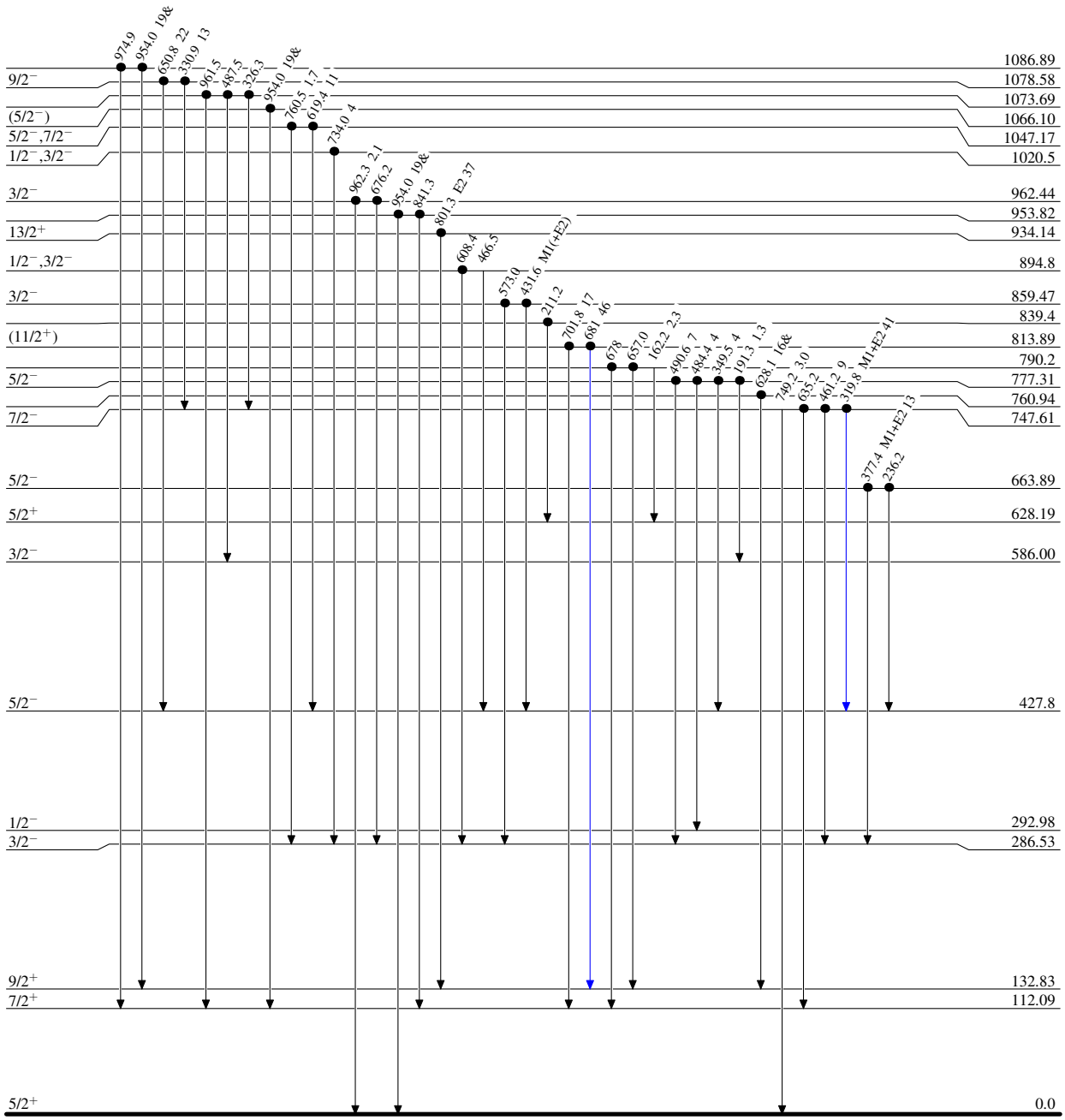
$^{75}_{34}Se_{41}$

^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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



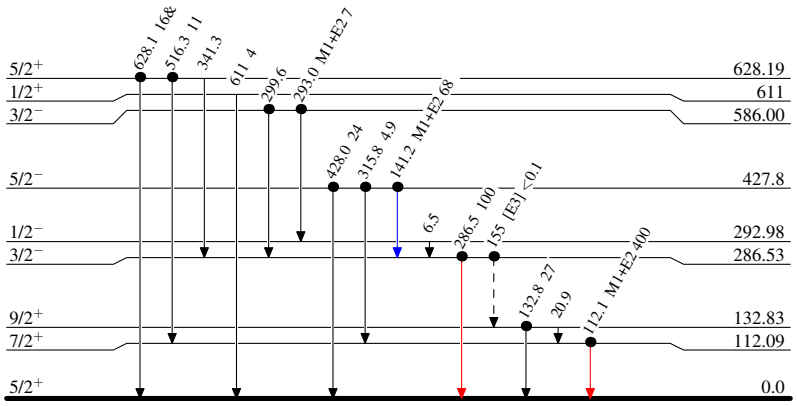
$^{75}_{34}Se_{41}$

^{72}Ge(α,nγ),^{73}Ge(α,2nγ) 1975Ze02,1976Sa07

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence



$^{75}_{34}Se_{41}$