

⁷⁶Ge(¹³C, ¹²Cγ) 2009Ka22,2009KaZZ

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	30-Sep-2020

2009KaZZ provides more details of data than given in 2009Ka22.

E=29 MeV. Measured E_γ, I_γ, γγ, γ(θ), (⁷⁷Ge fragment)γ coin using Gammasphere array and Fragment Mass Analyzer at ANL facility.

Other: 1991ZoZX: E=40 MeV. Measured γ, γγ, nγ coin.

No evidence was found by 2009Ka22 for the existence of previously reported 581 and 778 levels. The 421γ and 619γ previously placed from 581 and 778 levels, respectively are now placed as g.s. transitions. The 197γ, previously placed from a 778 level, is now placed from 619 level to feed the 421 level.

⁷⁷Ge Levels

E(level) [†]	J ^π	E(level) [†]	J ^π	E(level) [†]	J ^π
0.0	7/2 ⁺	760.58 ^{& 6}	7/2 ⁺ [‡]	1275.40 ^{#@ 13}	
159.73 ^{& 8}	1/2 ⁻	809.09 ^{#@ 17}		1286.54 ^{#@ 13}	
224.95 ^{& 7}	9/2 ⁺	884.31 ^{& 10}	5/2 ⁺	1344.74 ^{#@ 21}	
421.35 ^{& 6}	(5/2) ⁺ [‡]	910.60 ^{# 10}	(5/2,7/2) ⁺ [‡]	1358.89 ^{@ 16}	
492.04 ^{& 7}	5/2 ⁽⁻⁾ [‡]	1021.63 ^{@ 10}	(3/2) ⁻ [‡]	1385.32 ^{& 6}	5/2 ⁺
504.84 ^{& 6}	5/2 ⁺	1052.83 ^{@ 16}	(1/2,3/2) ⁻	1408.45 ^{#@ 21}	
618.86 ^{& 6}	3/2 ⁺ [‡]	1110.67 ^{@ 17}		1836.12 ^{@ 21}	(1/2 ⁺)
629.72 ^{& 9}	3/2 ⁻	1247.05 ^{@ 10}	1/2 ⁺		

[†] From least-squares fit to E_γ data.

[‡] Assignment by 2009Ka22 based on their γ(θ) data and/or decay modes. In some cases previous information from known L-transfers is also used.

New level proposed by 2009Ka22.

@ Level listed in 2009KaZZ.

& Excited state reported also in 1991ZoZX.

γ(⁷⁷Ge)

E _γ	I _γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	δ [@]	Comments
83.5 1	37 2	504.84	5/2 ⁺	421.35	(5/2) ⁺			A ₂ =-0.03 10; A ₄ =+0.19 12 E _γ : 84.4 (1991ZoZX).
114.0 2	0.14 ^{‡ 3}	618.86	3/2 ⁺	504.84	5/2 ⁺			
126.8 2	0.36 ^{‡ 5}	618.86	3/2 ⁺	492.04	5/2 ⁽⁻⁾			
159.6		159.73	1/2 ⁻	0.0	7/2 ⁺	(E3)		E _γ : from 1991ZoZX. Mult.: from the Adopted Gammas.
197.5 1	6.3 ^{‡ 7}	618.86	3/2 ⁺	421.35	(5/2) ⁺			
224.9 1	100	224.95	9/2 ⁺	0.0	7/2 ⁺	D+Q		A ₂ =-0.39 6; A ₄ =+0.12 7 E _γ : 224.9 (1991ZoZX).
255.7 1	14 1	760.58	7/2 ⁺	504.84	5/2 ⁺	D(+Q)	≈0.0	A ₂ =-0.3 2; A ₄ =+0.2 3 E _γ : 255.7 (1991ZoZX).
279.9 2	4.3 ^{‡ 9}	504.84	5/2 ⁺	224.95	9/2 ⁺			A ₂ =-1.2 6; A ₄ =+1.2 6 (2009KaZZ) E _γ : 279.8 (1991ZoZX). Evaluators' note: according to e-mail reply of June 29, 2009 from the first author, the angular distribution result for the 279.9γ should be disregarded since

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$^{76}\text{Ge}(^{13}\text{C}, ^{12}\text{C}\gamma)$ **2009Ka22,2009KaZZ (continued)** $\gamma(^{77}\text{Ge})$ (continued)

E_γ	I_γ^\dagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	δ^\oplus	Comments
291.8 2	3.0 [‡] 4	910.60	(5/2,7/2) ⁺	618.86	3/2 ⁺			half the data points were missing and the intensity of the transition is weak. Coefficients are listed in 2009KaZZ for the sake of completeness.
301.6 [#] 2	0.05 [#] 2	1110.67		809.09				
332.4 2	1.3 [‡] 9	492.04	5/2 ⁽⁻⁾	159.73	1/2 ⁻			
363.7 [#] 2	0.07 [#] 3	1385.32	5/2 ⁺	1021.63	(3/2) ⁻			
364.6 [#] 2	0.54 [#] 11	1275.40		910.60	(5/2,7/2) ⁺			
391.9 [#] 2	2.8 [#] 8	1021.63	(3/2) ⁻	629.72	3/2 ⁻			
402.8 [#] 2	2.3 [#] 7	1021.63	(3/2) ⁻	618.86	3/2 ⁺			
418.5 1	8.4 [‡] 8	910.60	(5/2,7/2) ⁺	492.04	5/2 ⁽⁻⁾			
421.4 1	124 3	421.35	(5/2) ⁺	0.0	7/2 ⁺	(D+Q)	-0.10	$A_2=-0.01$ 6; $A_4=-0.03$ 7 E_γ : 421.3 (1991ZoZX).
423.0 [#] 2	2.6 [#] 10	1052.83	(1/2,3/2) ⁻	629.72	3/2 ⁻			
450.8 [#] 2	3.39 [#] 5	1836.12	(1/2 ⁺)	1385.32	5/2 ⁺			
459.2 1	32 2	618.86	3/2 ⁺	159.73	1/2 ⁻	D		$A_2=-0.08$ 11; $A_4=-0.10$ 14 E_γ : 459.2 (1991ZoZX).
470.0 1	61 2	629.72	3/2 ⁻	159.73	1/2 ⁻	D		$A_2=-0.10$ 8; $A_4=+0.01$ 10 E_γ : 470.0 (1991ZoZX).
492.0 1	23 1	492.04	5/2 ⁽⁻⁾	0.0	7/2 ⁺	D		$A_2=-0.42$ 15; $A_4=-0.16$ 19 E_γ : 491.9 (1991ZoZX).
504.8 1	96 3	504.84	5/2 ⁺	0.0	7/2 ⁺	D		$A_2=-0.20$ 6; $A_4=-0.01$ 8 E_γ : 504.8 (1991ZoZX).
535.6 1	24 1	760.58	7/2 ⁺	224.95	9/2 ⁺	D+Q	+0.2	$A_2=-0.53$ 13; $A_4=+0.17$ 16 E_γ : 535.6 (1991ZoZX).
560.9 [#] 2	2.85 [#] 4	1052.83	(1/2,3/2) ⁻	492.04	5/2 ⁽⁻⁾			
618.9 1	8 [‡] 2	618.86	3/2 ⁺	0.0	7/2 ⁺			
624.7 1	39 2	1385.32	5/2 ⁺	760.58	7/2 ⁺	D+Q		$A_2=-0.69$ 17; $A_4=+0.2$ 2 E_γ : 624.7 (1991ZoZX).
656.6 [#] 2	1.0 [#] 7	1275.40		618.86	3/2 ⁺			
657.1 [#] 2	1.6 [#] 7	1286.54		629.72	3/2 ⁻			
667.6 [#] 2	0.9 [#] 5	1286.54		618.86	3/2 ⁺			
685.6 2	3.8 [‡] 5	910.60	(5/2,7/2) ⁺	224.95	9/2 ⁺			
729.1 [#] 2	0.59 [#] 12	1358.89		629.72	3/2 ⁻			
740.1 [#] 2	1.53 [#] 3	1358.89		618.86	3/2 ⁺			
755.6 1	30 2	1385.32	5/2 ⁺	629.72	3/2 ⁻	D		$A_2=-1.1$ 1; $A_4=-0.14$ 15 E_γ : 755.4 (1991ZoZX).
760.6 1	8.1 10	760.58	7/2 ⁺	0.0	7/2 ⁺	(D+Q)	-0.55	$A_2=0.0$ 3; $A_4=-0.2$ 3 E_γ : 760.5 (1991ZoZX).
766.5 1	17 1	1385.32	5/2 ⁺	618.86	3/2 ⁺			$A_2=+0.3$ 2; $A_4=-0.5$ 3 Evaluator's note: sign and magnitude of A_4 are in disagreement with theoretical value for 5/2 to 3/2, D+Q transition, but the magnitude agrees within 2σ . E_γ : 766.2 (1991ZoZX).
783.5 [#] 2	2.0 [#] 10	1275.40		492.04	5/2 ⁽⁻⁾			
794.3 [#] 2	1.16 [#] 21	1286.54		492.04	5/2 ⁽⁻⁾			
809.1 [#] 2	2.6 [#] 9	809.09		0.0	7/2 ⁺			
825.8 [#] 1	27.5 [#] 18	1247.05	1/2 ⁺	421.35	(5/2) ⁺			$A_2=-0.17$ 14; $A_4=-0.40$ 18

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$^{76}\text{Ge}(^{13}\text{C}, ^{12}\text{C}\gamma)$ [2009Ka22,2009KaZZ](#) (continued) $\gamma(^{77}\text{Ge})$ (continued)

E_γ	I_γ^\dagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
							Evaluators' note: magnitude of A_4 is in disagreement with expected isotropic pattern for 1/2 initial level spin. However, the initial and final spins for this transition are known from other sources.
839.9 [#] 2	2.1 [#] 4	1344.74		504.84	5/2 ⁺		
861.9 [#] 1	19.1 [#] 10	1021.63	(3/2) ⁻	159.73	1/2 ⁻	D+Q	$A_2=-0.51$ 16; $A_4=-0.54$ 22 Evaluators' note: sign and magnitude of A_4 are in disagreement with theoretical value for 3/2 to 1/2, D+Q transition. However, the initial and final spins for this transition are known from other sources.
880.5 1	36 2	1385.32	5/2 ⁺	504.84	5/2 ⁺		$A_2=+0.5$ 2; $A_4=-0.2$ 2
884.3 1	33 2	884.31	5/2 ⁺	0.0	7/2 ⁺	D+Q	E_γ : 880.5 (1991ZoZX). $A_2=-0.07$ 19; $A_4=+0.5$ 3 E_γ : 884.3 (1991ZoZX).
885.7 [#] 2	0.58 [#] 11	1110.67		224.95	9/2 ⁺		
893.3 1	5.2 [‡] 6	1385.32	5/2 ⁺	492.04	5/2 ⁽⁻⁾		
916.4 [#] 2	0.7 [#] 5	1408.45		492.04	5/2 ⁽⁻⁾		
963.9 1	11 [‡] 1	1385.32	5/2 ⁺	421.35	(5/2) ⁺		$A_2=+0.1$ 6; $A_4=+0.7$ 11 (2009KaZZ) E_γ : 963.8 (1991ZoZX).
1087.2 [#] 1	67 [#] 3	1247.05	1/2 ⁺	159.73	1/2 ⁻		$A_2=+0.03$ 10; $A_4=+0.14$ 13
1385.0 ^{&}		1385.32	5/2 ⁺	0.0	7/2 ⁺		E_γ : not seen by 2009Ka22 , γ from 1991ZoZX treated as uncertain by the evaluator.

[†] The uncertainties listed here are statistical only, systematic uncertainty is estimated by [2009Ka22](#) as 5%.

[‡] γ too weak to analyze angular distribution.

[#] γ listed in [2009KaZZ](#).

@ Listed in caption of figure 2 in [2009Ka22](#).

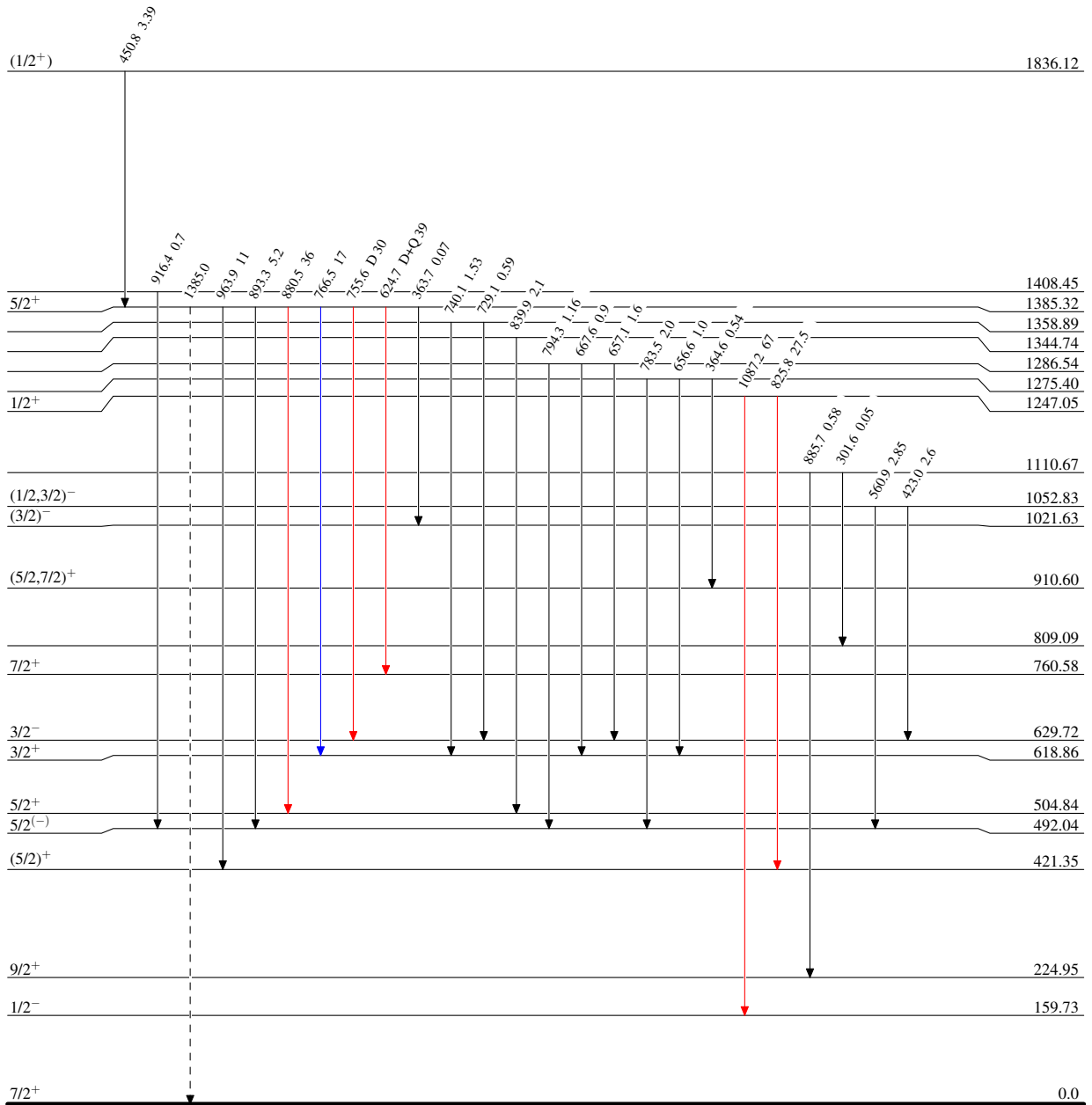
& Placement of transition in the level scheme is uncertain.

$^{76}\text{Ge} (^{13}\text{C}, ^{12}\text{C}\gamma)$ 2009Ka22,2009KaZZ

Legend

Level Scheme
Intensities: Relative I_γ

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



$^{77}\text{Ge}_{45}$

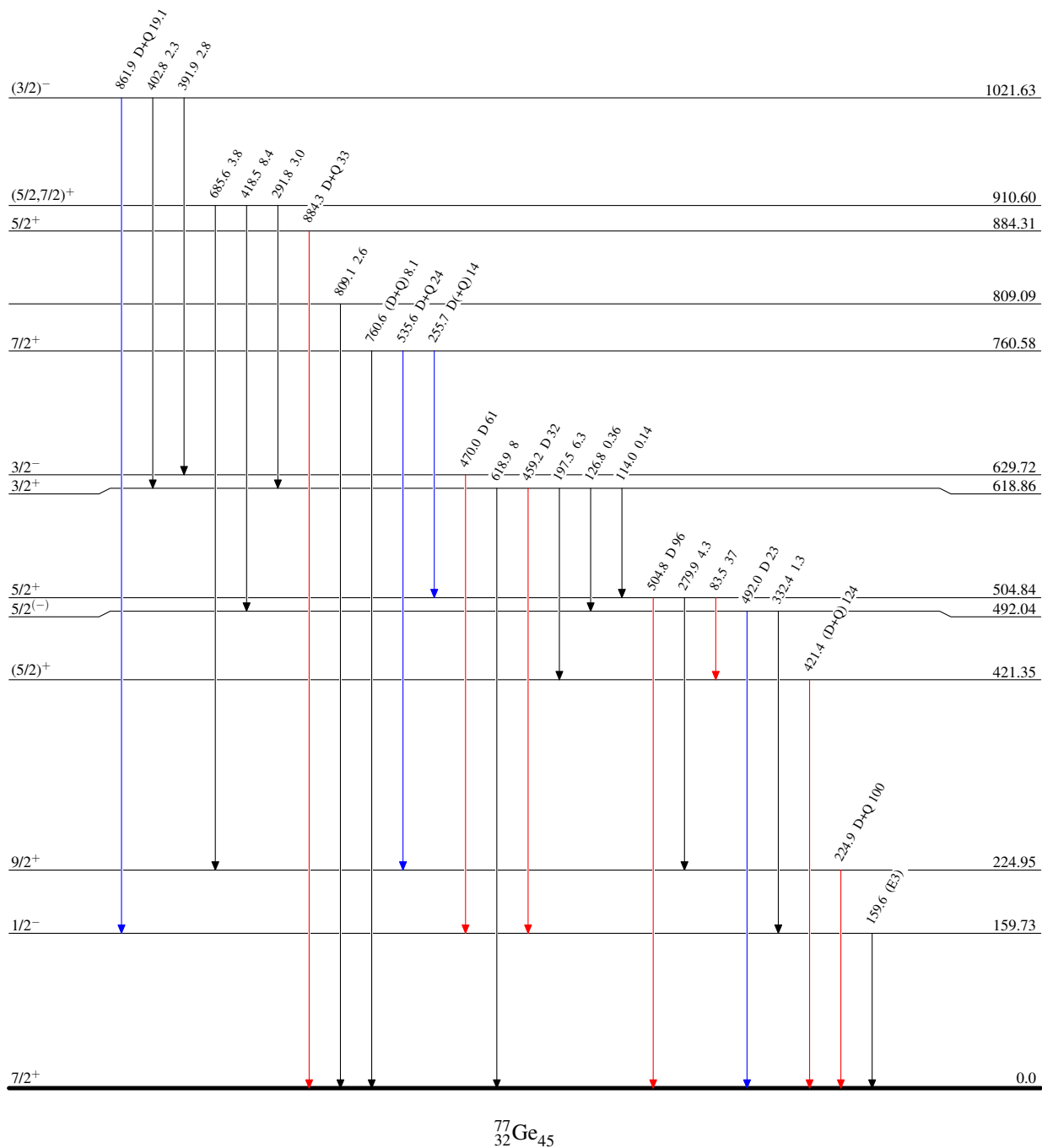
$^{76}\text{Ge} (^{13}\text{C}, ^{12}\text{C}\gamma)$ 2009Ka22,2009KaZZ

Level Scheme (continued)

Intensities: Relative I_γ

Legend

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

 $^{77}\text{Ge}_{45}$