

<sup>69</sup>Ga( $\gamma,\gamma'$ ) 1973Ar04,1973Mo05

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 115, 1 (2014)	31-Jul-2013

Target  $J^\pi=3/2^-$ .

1973Ar04: resonant scattering of bremsstrahlung radiation; measured  $E_\gamma$ ,  $I_\gamma$ ,  $\Gamma$ 's.

1973Mo05: photoexcitation of 6874 and 7306 resonances using capture  $\gamma$  rays from Cu and V; measured  $E_\gamma$ ,  $I_\gamma$ ,  $\gamma(\theta)$ ,  $\gamma$ -linear polarization.

1968La05: resonance fluorescence scattering with gaseous sources of <sup>69</sup>Ge; measured  $\sigma(\theta)$ ,  $T_{1/2}$ .

Others: 1968Al13, 1968La05, 1970WiZY.

All spin assignments of 1973Mo05 are by assuming that the transitions from the 6874 and 7306 levels are pure dipole.

<sup>69</sup>Ga Levels

E(level) <sup>†</sup>	$J^\pi$ <sup>‡</sup>	$T_{1/2}$ <sup>#</sup>	$gW\Gamma_0^2/\Gamma$ <sup>@</sup>	Comments
0	3/2 <sup>-</sup>			
320 2	1/2 <sup>-</sup>			$J^\pi$ : 1/2 or 3/2 from dipole transitions from J=1/2 level.
573.9 9	5/2 <sup>-</sup>	12.8 ps +17-13	0.053 6	$J^\pi$ : 5/2 from $\gamma(\theta)$ of 6732 $\gamma$ (1973Mo05). $T_{1/2}$ : 3.5 ps 21 (1968La05).
872.0 9	3/2 <sup>-</sup>	0.28 ps 5	1.43 15	$J^\pi$ : 3/2 from dipole transitions from $J^\pi=1/2$ and 3/2 resonances; confirmed by $\gamma(\theta)$ of corresponding $\gamma$ 's (1973Mo05). $\pi$ : L(p,t)=0. $T_{1/2}$ : 0.22 ps 4 (1968La05).
1029	1/2 <sup>-</sup>	>0.53 ps	<0.06	
1106 1	5/2 <sup>-</sup>	0.240 ps +19-16	2.7 2	$T_{1/2}$ : 0.11 ps 2 (1968La05).
1337 1	7/2 <sup>-</sup>	1.18 ps 6	0.70 4	
1488.2 9	7/2 <sup>-</sup>	1.9 ps +10-5	0.12 4	$J^\pi$ : 3/2 or 7/2 from $\gamma(\theta)$ (1973Mo05).
1526 1	3/2 <sup>-</sup>	>0.91 ps	<0.06	
1723 2	5/2 <sup>-</sup>	0.40 ps +18-10	0.32 10	
1892.1 16	3/2 <sup>-</sup>	20 fs 3	10.3 6	$J^\pi$ : 3/2 from dipole transitions from J=1/2 and 3/2 levels; confirmed by $\gamma(\theta)$ of 5415 $\gamma$ (1973Mo05).
1923 3	7/2 <sup>-</sup>	>34 fs	<0.4	$T_{1/2}/(2J+1)>2.5$ fs from the data of 1973Ar04.
1978? 4	(1/2) <sup>-</sup>			E(level): From 1973Mo05. $J^\pi$ : 1/2 or 3/2 from dipole transitions from J=1/2 level (1973Mo05).
2024 2	5/2 <sup>-</sup>	0.173 ps +13-11	2.9 2	
2045 2	5/2 <sup>-</sup>	40 fs 7	2.1 2	
2197 4				
2352 4	5/2			
2426 4				
2457.3 20	7/2 <sup>(-)</sup>			
2484.3 20	5/2 <sup>(+)</sup>			
2565? 4				$J^\pi$ : 5/2 from $\gamma(\theta)$ of 4822 $\gamma$ (1973Mo05). $J^\pi$ : 1/2 or 3/2 from dipole transitions from J=1/2 level (1973Mo05).
2660.2 20	3/2 <sup>-</sup>			$J^\pi$ : 3/2 from dipole transitions from J=1/2 and 3/2 levels; confirmed by $\gamma(\theta)$ of 4646 $\gamma$ (1973Mo05).
2765 4				
2797 4	(7/2) <sup>-</sup>			
2846 4	+			
2860 5				
2964 4	-			
2978.3 22	-			
3051 4	3/2 <sup>-</sup> , 7/2 <sup>-</sup>			$J^\pi$ : 3/2 or 7/2 from $\gamma(\theta)$ of 4255 $\gamma$ (1973Mo05).

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$^{69}\text{Ga}(\gamma, \gamma')$  **1973Ar04, 1973Mo05** (continued)

$^{69}\text{Ga}$  Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> <sup>‡</sup>	T <sub>1/2</sub> <sup>#</sup>	Comments
3076 5	5/2 <sup>+</sup>		J <sup>π</sup> : 5/2 from $\gamma(\theta)$ of 4230 $\gamma$ (1973Mo05).
3204 5	(3/2 <sup>-</sup> )		
3225 6			
3282 6	3/2 <sup>-</sup>		
3318 6	7/2		J <sup>π</sup> : 7/2 from $\gamma(\theta)$ of 3988 $\gamma$ (1973Mo05).
6874.2 18	1/2		J <sup>π</sup> : 1/2 from isotropic $\gamma(\theta)$ of 6874 $\gamma$ (1973Mo05). E(level): $\Gamma(0) > 0.01$ eV and $< 0.05$ eV and $\Gamma(0)/\Gamma < 0.2$ (1973Mo05).
7306.5 10	5/2 <sup>+</sup>	<4.3 fs	J <sup>π</sup> : J from $\gamma(\theta)$ of 7306 $\gamma$ ; $\pi$ from linear polarization measurement. $\gamma(\theta)$ gives J=5/2 and multi=D (1973Mo05). T <sub>1/2</sub> : if J=5/2 and $\Gamma_g = 0.105$ eV 20 (1973Mo05).

<sup>†</sup> From least squares fit to E $\gamma$  data.

<sup>‡</sup> From Adopted Levels. Supporting arguments from this reaction are indicated.

<sup>#</sup> Calculated by the evaluator from the width data, adopted J<sup>π</sup>, and branching data.

<sup>@</sup> From 1973Ar04 where  $g = (2J+1)/(2J_0+1)$  and W is the angular distribution factor taken as 1.0 at 125°. The units are MeV.

$\gamma(^{69}\text{Ga})$

E $\gamma$ <sup>†</sup>	Branching <sup>‡</sup>	E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>	Mult. <sup>@</sup>	$\delta$	I $\gamma$ <sup>#</sup>	Comments
574 1		573.9	5/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
872 1		872.0	3/2 <sup>-</sup>	0	3/2 <sup>-</sup>	(M1+E2)	<0.55		$\delta$ : from $\gamma(\theta)$ (1968La05). E $\gamma$ : from 1973Mo05.
915 2		1488.2	7/2 <sup>-</sup>	573.9	5/2 <sup>-</sup>				
1029 &		1029	1/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
1106 1		1106	5/2 <sup>-</sup>	0	3/2 <sup>-</sup>	M1+E2	<0.55		Mult.: from adopted gammas. $\delta$ : $> -0.45$ and $< -0.10$ for J <sup>π</sup> (1106) = -3/2, phase convention not defined (1968La05).
1337 1		1337	7/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
1488 1		1488.2	7/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
1526 &		1526	3/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
<sup>x</sup> 1630 3									E $\gamma$ : Observed by 1973Mo05.
1723 2		1723	5/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
1892 2		1892.1	3/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
1924 &		1923	7/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
2024 2		2024	5/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
2045 2		2045	5/2 <sup>-</sup>	0	3/2 <sup>-</sup>				
2340 4		2660.2	3/2 <sup>-</sup>	320	1/2 <sup>-</sup>				
2484 4		2484.3	5/2 <sup>(+)</sup>	0	3/2 <sup>-</sup>				
3988 6	7.9 12	7306.5	5/2 <sup>+</sup>	3318	7/2				
4024 6	1.9 3	7306.5	5/2 <sup>+</sup>	3282	3/2 <sup>-</sup>				
4081 6	4.2 6	7306.5	5/2 <sup>+</sup>	3225					
4102 4	4.2 6	7306.5	5/2 <sup>+</sup>	3204	(3/2 <sup>-</sup> )				
4214 4		6874.2	1/2	2660.2	3/2 <sup>-</sup>			7.3 15	
4230 4	6.5 10	7306.5	5/2 <sup>+</sup>	3076	5/2 <sup>+</sup>				
4255 3	6.9 10	7306.5	5/2 <sup>+</sup>	3051	3/2 <sup>-</sup> , 7/2 <sup>-</sup>				
4309 <sup>a</sup> 4		6874.2	1/2	2565?				4.9 10	
4328 2	2.3 3	7306.5	5/2 <sup>+</sup>	2978.3	-				
4342 3	0.77 12	7306.5	5/2 <sup>+</sup>	2964	-				
<sup>x</sup> 4417 4									E $\gamma$ : Placement by authors (1973Mo05) from 6874 levels is inconsistent with spin change of 1/2 to 7/2.

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$^{69}\text{Ga}(\gamma, \gamma')$  **1973Ar04, 1973Mo05 (continued)** $\gamma(^{69}\text{Ga})$  (continued)

$E_\gamma$ †	Branching ‡	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. @	$I_\gamma$ #	Comments
4446 4	1.5 2	7306.5	5/2 <sup>+</sup>	2860				
4460 3	0.77 12	7306.5	5/2 <sup>+</sup>	2846	+			
4509 3	3.8 6	7306.5	5/2 <sup>+</sup>	2797	(7/2) <sup>-</sup>			
4541 3	1.15 17	7306.5	5/2 <sup>+</sup>	2765				
4646 2	8.1 12	7306.5	5/2 <sup>+</sup>	2660.2	3/2 <sup>-</sup>			
4822 2	3.8 6	7306.5	5/2 <sup>+</sup>	2484.3	5/2 <sup>(+)</sup>			
4849 2	3.7 6	7306.5	5/2 <sup>+</sup>	2457.3	7/2 <sup>(-)</sup>			
4880 3	1.9 3	7306.5	5/2 <sup>+</sup>	2426				
4896 <sup>a</sup> 4		6874.2	1/2	1978?	(1/2) <sup>-</sup>		12 2	
4954 3	2.5 4	7306.5	5/2 <sup>+</sup>	2352	5/2			
4980 4		6874.2	1/2	1892.1	3/2 <sup>-</sup>		4.9 10	
5109 3	0.96 14	7306.5	5/2 <sup>+</sup>	2197				
5349 4		6874.2	1/2	1526	3/2 <sup>-</sup>		9.8 20	
5383 3	0.19 3	7306.5	5/2 <sup>+</sup>	1923	7/2 <sup>-</sup>			
5415 3	1.5 2	7306.5	5/2 <sup>+</sup>	1892.1	3/2 <sup>-</sup>			
5818 2	11.5 17	7306.5	5/2 <sup>+</sup>	1488.2	7/2 <sup>-</sup>			
6002 4		6874.2	1/2	872.0	3/2 <sup>-</sup>		39 8	
6434 2	5.8 9	7306.5	5/2 <sup>+</sup>	872.0	3/2 <sup>-</sup>			
6554 4		6874.2	1/2	320	1/2 <sup>-</sup>		100 20	
6732 2	6.9 10	7306.5	5/2 <sup>+</sup>	573.9	5/2 <sup>-</sup>			
6874 4		6874.2	1/2	0	3/2 <sup>-</sup>		49 10	
7306 2	100 15	7306.5	5/2 <sup>+</sup>	0	3/2 <sup>-</sup>	E1		Mult.: dipole radiation assumed, E1 from $\gamma$ -linear polarization, 1973Mo05.

† From 1973Ar04 for  $E_\gamma < 2100$  and from 1973Mo05 for  $E_\gamma > 2300$ , except as noted.

‡ Relative branching ratio are given for  $\gamma$ 's ( $\geq 3000$ ) for transitions from 7306 level (1973Mo05).

# Relative intensities are given for  $\gamma$ 's for transitions from 6874 level (1973Mo05).

@ From  $\gamma(\theta)$  (1968La05); parity from  $J^\pi$  of initial and final levels.

& Transition not seen by 1973Ar04. Authors give upper limit on level width.  $E_\gamma$  is a rounded-off value from adopted gammas.

<sup>a</sup> Placement of transition in the level scheme is uncertain.

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

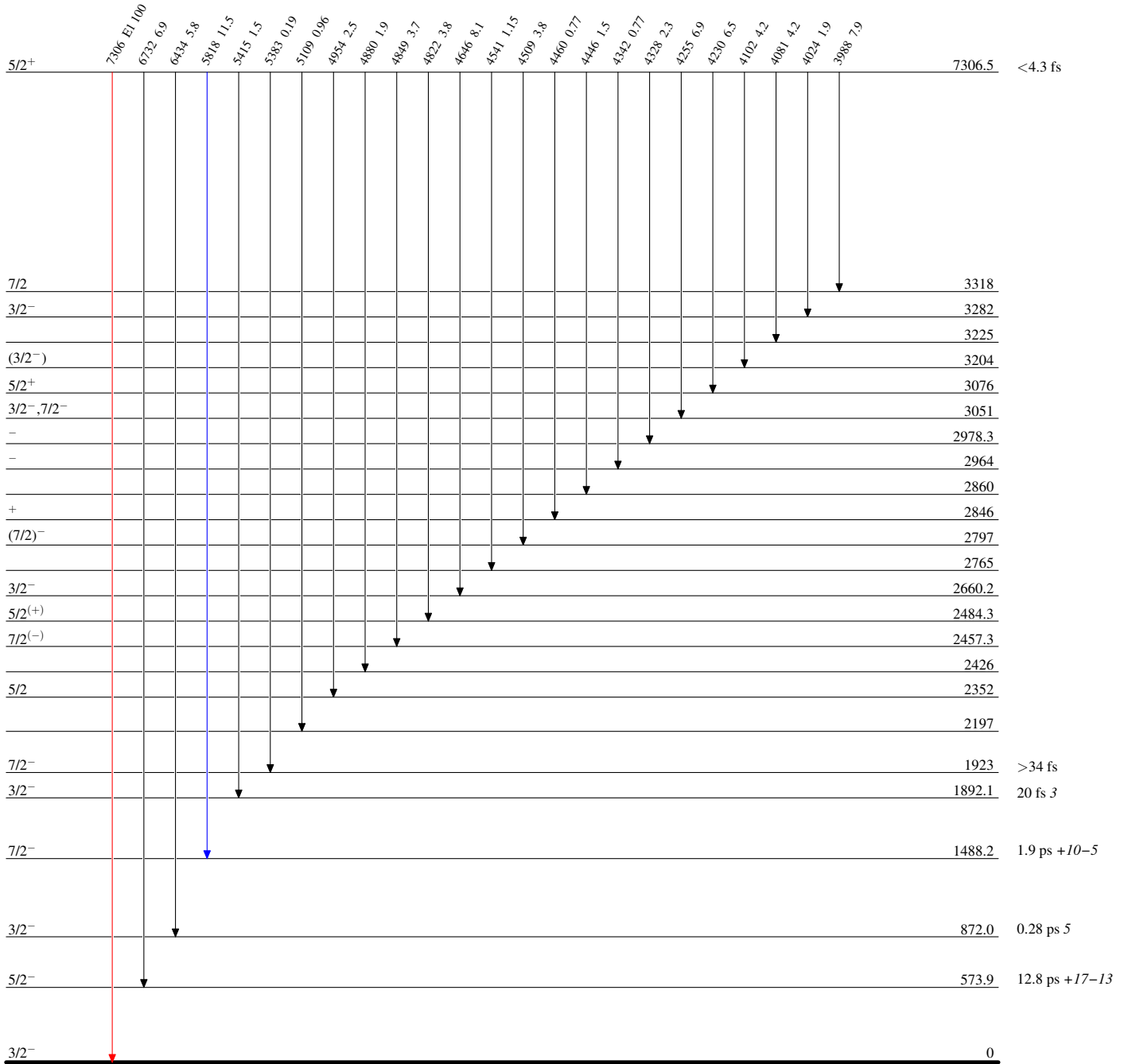
$^{69}\text{Ga}(\gamma, \gamma)$  1973Ar04,1973Mo05

Level Scheme

Intensities: Type not specified

Legend

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



$^{69}_{31}\text{Ga}_{38}$

$^{69}\text{Ga}(\gamma,\gamma')$  1973Ar04,1973Mo05

Legend

## Level Scheme (continued)

Intensities: Type not specified

-----►  $\gamma$  Decay (Uncertain)