

$^{68}\text{Zn}(\text{p},\gamma)$ 1981Pa12,1978Ra06

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

1981Pa12: E=2-4 MeV; measured $E\gamma$, $I\gamma$, $\gamma(\theta)$, $T_{1/2}$ from DSAM.

1978Ra06: E=3.2-3.8 MeV; measured $E\gamma$, $\Gamma(\gamma)$, $\sigma(E)$ and M1 strengths.

1971Ne06: E=2 MeV; measured $E\gamma$, $I\gamma$, $\gamma\gamma$ coincidences.

1973Ne07: E=2 MeV; measured triple $\gamma\gamma(\theta)$, statistical theory analysis.

Other: 1983Ni04.

Data for IAR and associated γ rays are from 1978Ra06.

 ^{69}Ga Levels

E(level) [†]	$J^{\pi\ddagger}$	$T_{1/2}^{\#}$	Comments
0.0	3/2 ⁻		
318.68 5	1/2 ⁻		
574.10 6	5/2 ⁻		J^{π} : 5/2 from triple $\gamma\gamma(\theta)$ (1973Ne07).
872.13 6	3/2 ⁻		
1028.56 14	1/2 ⁻		
1106.84 5	5/2 ⁻		J^{π} : 5/2 from $\gamma(\theta)$.
1336.72 8	7/2 ⁻		J^{π} : 7/2 from $\gamma(\theta)$.
1487.56 7	7/2 ⁻		J^{π} : 7/2 from $\gamma(\theta)$.
1525.64 5	3/2 ⁻	≥ 0.55 ps	J^{π} : 3/2 from $\gamma(\theta)$.
1723.56 8	5/2 ⁻	≥ 0.97 ps	J^{π} : 5/2 from $\gamma(\theta)$.
1764.71 25	9/2 ⁻		
1891.48 6	3/2 ⁻	29 fs 6	J^{π} : 3/2 from $\gamma(\theta)$.
1924.28 7	7/2 ⁻	≥ 0.62 ps	J^{π} : 7/2 from $\gamma(\theta)$.
1973.10 9	(1/2) ⁻	97 fs 28	J^{π} : (1/2) from almost isotropic $\gamma(\theta)$ of 1654 γ and 1973 γ .
1974.13 11	9/2 ⁽⁺⁾		
2007.59 8	3/2 ⁽⁻⁾ , 5/2 ⁽⁻⁾	0.35 ps +21-10	J^{π} : 3/2, 5/2 from $\gamma(\theta)$ of 1135 γ and 2008 γ .
2023.89 9	5/2 ⁻	0.19 ps +8-5	J^{π} : 5/2 from $\gamma(\theta)$ of 2024 γ .
2044.99 8	5/2 ⁻	111 fs 14	J^{π} : 5/2 from $\gamma(\theta)$ of 1173 γ and 2045 γ .
2219.26 20		≥ 0.21 ps	J^{π} : (3/2, 1/2) from $\gamma(\theta)$.
2250.81 11	(1/2, 3/2) ⁻	0.10 ps +5-3	J^{π} : (3/2) from $\gamma(\theta)$.
2319.64 16	(5/2 ⁺ , 7/2 ⁺)	≥ 0.21 ps	J^{π} : (7/2, 5/2) from $\gamma(\theta)$.
2353.21 24	5/2	≥ 0.17 ps	J^{π} : 5/2 from $\gamma(\theta)$.
2458.73 12	7/2 ⁽⁻⁾	0.15 ps +19-6	J^{π} : 7/2 from $\gamma(\theta)$.
2485.70 10	5/2 ⁽⁺⁾	69 fs +56-28	J^{π} : 5/2 from $\gamma(\theta)$.
2529.80 9	(3/2) ⁻	76 fs 21	J^{π} : (3/2) from $\gamma(\theta)$.
2565.0 @			
9813 &			E(p)(lab)=3250, IAS of g.s. of ^{69}Zn .
10247 &a			E(p)(lab)=3690.
10251 &a			E(p)(lab)=3695.
10256 &a			E(p)(lab)=3700.

[†] From least-squares fit to $E\gamma$ data of 1981Pa12, except where noted otherwise.

[‡] From Adopted Levels, supporting arguments from this reaction are indicated. $\gamma(\theta)$ results are from 1981Pa12.

[#] From DSAM (1981Pa12) corrected for side feeding from continuum γ cascades.

@ From 1978Ra06, uncertainty not given.

& From 1978Ra06 data, recalculated by evaluator using E(p)(lab) with c.m. correction. S(p)=6609.9 15 (2012Wa38).

^a Fragments corresponding to the IAS of the 439 level in ^{69}Zn , E(Coulomb)=9683 5 (1978Ra06).

$^{68}\text{Zn}(\text{p},\gamma)$ 1981Pa12,1978Ra06 (continued)

$\gamma(^{69}\text{Ga})$								
E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. @	$\delta^\&$	Comments
234.75 $^\pm$ 6		1106.84	5/2 $^-$	872.13	3/2 $^-$			
318.62 $^\pm$ 8	100	318.68	1/2 $^-$	0.0	3/2 $^-$			I_γ : 300 3 from 1971Ne06.
380.96 10	15.0	1487.56	7/2 $^-$	1106.84	5/2 $^-$	(M1)		δ : -0.03 3.
418.75 8	13.0	1525.64	3/2 $^-$	1106.84	5/2 $^-$	(M1)		δ : +0.05 7.
484.33 $^\pm$ 10		1974.13	9/2 $^{(+)}$	1487.56	7/2 $^-$			I_γ : $\approx$ 6 from 1971Ne06.
553.42 $^\pm$ 11		872.13	3/2 $^-$	318.68	1/2 $^-$			
574.16 $^\pm$ 11	100	574.10	5/2 $^-$	0.0	3/2 $^-$	(M1+E2) b		I_γ : 100 from 1971Ne06.
587.71 6	23.0	1924.28	7/2 $^-$	1336.72	7/2 $^-$	(M1(+E2))		δ : -0.04 4 or +3.1 7 (1973Ne07).
616.70 20	9.0	1723.56	5/2 $^-$	1106.84	5/2 $^-$	(M1)		δ : 0.00 7 value preferred by authors; +1.1 1 also possible.
635.63 $^\pm$ 16		1974.13	9/2 $^{(+)}$	1336.72	7/2 $^-$			δ : +0.05 25.
709.86 $^\pm$ 18		1028.56	1/2 $^-$	318.68	1/2 $^-$			I_γ : 33 4 from 1971Ne06.
762.36 10	6.3	1336.72	7/2 $^-$	574.10	5/2 $^-$	(M1+E2)	-2.2 2	δ : -2.2 2 value preferred by authors; -0.22 4 is also possible.
851.7 4	5.0	1723.56	5/2 $^-$	872.13	3/2 $^-$			
872.14 $^\pm$ 44		872.13	3/2 $^-$	0.0	3/2 $^-$	(M1+E2) b		I_γ : 150 12 from 1971Ne06.
								δ : -0.11 +9-8 or -3.1 +6-12 (1973Ne07).
913.67 7	36.5	1487.56	7/2 $^-$	574.10	5/2 $^-$	(M1+E2)	-2.85 30	
951.43 15	4.0	1525.64	3/2 $^-$	574.10	5/2 $^-$	(M1(+E2))	+0.3 3	
1028.57 $^\pm$ 21		1028.56	1/2 $^-$	0.0	3/2 $^-$			
1052.08 6	38.0	1924.28	7/2 $^-$	872.13	3/2 $^-$	(E2)		
1106.87 9		1106.84	5/2 $^-$	0.0	3/2 $^-$	(M1+E2)	+0.32 2	I_γ : 66 9 from 1971Ne06.
1135.49 10	18.5	2007.59	3/2 $^{(-)}$, 5/2 $^{(-)}$	872.13	3/2 $^-$	(M1+E2)		δ : -0.38 9 for a 3/2 to 3/2 transition; +0.15 4 for a 5/2 to 3/2 transition.
1149.51 13	28.0	1723.56	5/2 $^-$	574.10	5/2 $^-$	(M1+E2)	-0.46 10	
1172.82 20	25.0	2044.99	5/2 $^-$	872.13	3/2 $^-$	(M1+E2)		δ : -0.23 5 or -1.8 2.
1190.60 $^\pm$ 24	100	1764.71	9/2 $^-$	574.10	5/2 $^-$			
1206.98 6	51.0	1525.64	3/2 $^-$	318.68	1/2 $^-$	(M1+E2)	+0.14 2	
1212.79 15	100	2319.64	(5/2 $^+$, 7/2 $^+$)	1106.84	5/2 $^-$	(E1+M2)		δ : -0.23 8 for a 7/2 to 5/2 transition; -1.2 2 for a 5/2 to 5/2 transition.
1246.6 4	21.0	2353.21	5/2	1106.84	5/2 $^-$	D(+Q)	+0.17 30	
1336.51 $^\pm$ 40	93.7	1336.72	7/2 $^-$	0.0	3/2 $^-$			
1349.95 10	27.0	1924.28	7/2 $^-$	574.10	5/2 $^-$	(M1+E2)		δ : -2.6 4 value preferred by authors; -0.15 5 also possible.
1404.91 13	16.0	1723.56	5/2 $^-$	318.68	1/2 $^-$	(E2)		δ : -0.05 7.
1449.76 18	10.0	2023.89	5/2 $^-$	574.10	5/2 $^-$			
1471.01 10	34.0	2044.99	5/2 $^-$	574.10	5/2 $^-$	(M1+E2)		δ : +0.17 14 or -1.15 25.
1481.4 5	27.0	2353.21	5/2	872.13	3/2 $^-$	D(+Q)	-0.19 20	
1487.94 $^\pm$ 52	48.5	1487.56	7/2 $^-$	0.0	3/2 $^-$			
1525.64 8	32.0	1525.64	3/2 $^-$	0.0	3/2 $^-$	(M1+E2)	-0.38 7	
1572.70 10	35.0	1891.48	3/2 $^-$	318.68	1/2 $^-$	(M1(+E2))	-0.09 9	
1654.21 15	33.0	1973.10	(1/2) $^-$	318.68	1/2 $^-$			
1657.63 20	24.0	2529.80	(3/2) $^-$	872.13	3/2 $^-$	(M1(+E2))	-0.05 25	
1723.43 13	42.0	1723.56	5/2 $^-$	0.0	3/2 $^-$	(M1+E2)	-0.75 15	
1778.5 5	21.0	2353.21	5/2	574.10	5/2 $^-$			
1884.60 10	100	2458.73	7/2 $^{(-)}$	574.10	5/2 $^-$	(M1+E2)	-0.17 3	
1891.50 7	65.0	1891.48	3/2 $^-$	0.0	3/2 $^-$	(M1+E2)	-0.15 6	
1900.59 20	71.0	2219.26		318.68	1/2 $^-$			
1924.2 5	9.0	1924.28	7/2 $^-$	0.0	3/2 $^-$			
1932.10 15	33.0	2250.81	(1/2, 3/2) $^-$	318.68	1/2 $^-$	(M1+E2)		δ : +0.03 12 for a 3/2 to 1/2 transition.

Continued on next page (footnotes at end of table)

$^{68}\text{Zn}(\text{p},\gamma)$ **1981Pa12,1978Ra06 (continued)** $\gamma(^{69}\text{Ga})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. @	$\delta^\&$	Comments
1973.15 10	67.0	1973.10	$(1/2)^-$	0.0	$3/2^-$			
2007.52 10	81.5	2007.59	$3/2^{(-)}, 5/2^{(-)}$	0.0	$3/2^-$	(M1+E2)		δ : -1.3 +4-6 for a $3/2$ to $3/2$ transition; +0.01 2 for a $5/2$ to $3/2$ transition.
2023.86 10	90.0	2023.89	$5/2^-$	0.0	$3/2^-$	(M1+E2)	+0.16 3	
2044.83 10	41.0	2044.99	$5/2^-$	0.0	$3/2^-$	(M1+E2)	+0.26 12	
2218.9 6	29.0	2219.26		0.0	$3/2^-$			
2250.77 15	67.0	2250.81	$(1/2, 3/2)^-$	0.0	$3/2^-$	(M1+E2)		δ : -0.23 8 for a $3/2$ to $3/2$ transition.
2353.0 5	31.0	2353.21	$5/2$	0.0	$3/2^-$	D(+Q)	-0.04 30	
2485.65 10	100	2485.70	$5/2^{(+)}$	0.0	$3/2^-$	(E1(+M2))	-0.04 6	
2529.76 10	76.0	2529.80	$(3/2)^-$	0.0	$3/2^-$	(M1(+E2))	-0.03 10	
7683 [#]	22	10247		2565.0		D ^a		$\Gamma(\gamma)=0.004$ eV 1.
7687 [#]	14	10251		2565.0		D ^a		$\Gamma(\gamma)=0.0030$ eV 7.
7692 [#]	27	10256		2565.0		D ^a		$\Gamma(\gamma)=0.007$ eV 1.
8275 [#]	65	10247		1974.13	$9/2^{(+)}$	D ^a		$\Gamma(\gamma)=0.012$ eV 3.
8279 [#]	67	10251		1974.13	$9/2^{(+)}$	D ^a		$\Gamma(\gamma)=0.015$ eV 4.
8284 [#]	57	10256		1974.13	$9/2^{(+)}$	D ^a		$\Gamma(\gamma)=0.015$ eV 4.
8287 [#]	28	9813		1525.64	$3/2^-$	D ^a		$\Gamma(\gamma)=0.52$ eV 14.
8759 [#]	13	10247		1487.56	$7/2^-$	D ^a		$\Gamma(\gamma)=0.0024$ eV 6.
8763 [#]	18	10251		1487.56	$7/2^-$	D ^a		$\Gamma(\gamma)=0.004$ eV 1.
8768 [#]	15	10256		1487.56	$7/2^-$	D ^a		$\Gamma(\gamma)=0.004$ eV 1.
8941 [#]	22	9813		872.13	$3/2^-$	D ^a		$\Gamma(\gamma)=0.48$ eV 11.
9494 [#]		9813		318.68	$1/2^-$	D ^a		E_γ : Transition not seen. $\Gamma(\gamma)<0.1$ eV.
9813 [#]	50	9813		0.0	$3/2^-$	D ^a		$\Gamma(\gamma)=0.88$ eV 20.

[†] Percentage branching from each level with no uncertainties from 1981Pa12, unless indicated otherwise.

[‡] Gammas were not listed in Table VII of 1981Pa12 but are given in Fig.6 (1981Pa12) without uncertainties. The uncertainties for these gammas were estimated by the evaluator from data in Table VII in 1981Pa12.

[#] Deduced from the level scheme of 1978Ra06.

@ From $\gamma(\theta)$ by 1981Pa12, unless indicated otherwise; parity from J^π of initial and final levels.

& From $\gamma(\theta)$ by 1981Pa12, unless indicated otherwise.

^a From $\gamma(\theta)$ in 1978Ra06.

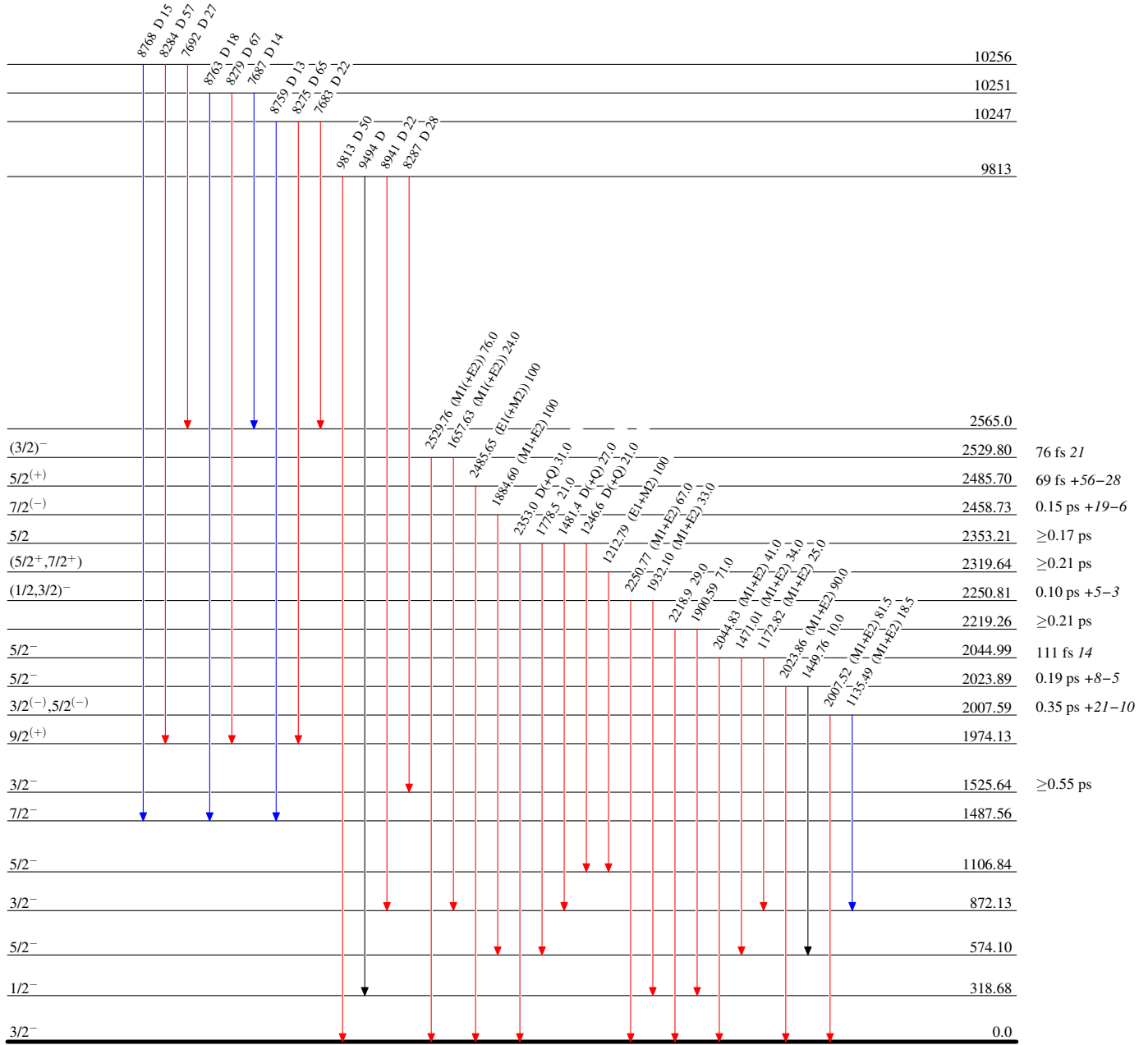
^b From $\gamma(\theta)$ by 1973Ne07.

$^{68}\text{Zn}(\text{p},\gamma)$ 1981Pa12,1978Ra06**Level Scheme**

Intensities: Type not specified

Legend

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

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

