

Target isotope: $^{64}_{30}\text{Zn}$ $I^\pi_{\text{o}} = 0^+$ Abundance: 48.63(60) % $S_{\text{p}} = 3942.35(71)$ keV

$^{65}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^\pi$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.		
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]			
1192(5)								1174	5116(5)	87Vi01	93Bh04	03Vi0A
1317(1)	1,3,5							1298	5240(5)	87Vi01	93Bh04	03Vi0A
1325									5248			03Vi0A
1354									5277			03Vi0A
1376									5298			03Vi0A
1382									5303			03Vi0A
1388									5310			03Vi0A
1395									5316			03Vi0A
1405									5327			03Vi0A
1416									5337			03Vi0A
1418(5)*								1396	5339(5)	87Vi01		
1431(1)	1 ⁺							1409	5352(5)	87Vi01	93Bh04	03Vi0A
1444									5365			03Vi0A
1451									5371			03Vi0A
1464(1)	1,3,5								5384	87Vi01	93Bh04	03Vi0A
1472									5393			03Vi0A
1481(1)	1,3,5							1458	5393(5)	87Vi01	93Bh04	03Vi0A
1483									5403			03Vi0A
1487									5407			03Vi0A
1489									5409			03Vi0A
1502*									5422			03Vi0A
1503									5423			03Vi0A
1510*									5430			03Vi0A
1515									5435			03Vi0A
1519(5)								1496	5438(5)*	87Vi01	93Bh04	03Vi0A
1533									5453			03Vi0A
1538									5457			03Vi0A
1540									5459			03Vi0A
1543									5463			03Vi0A
1545									5464			03Vi0A
1548(5)								1525	5467(5)*	87Vi01	93Bh04	03Vi0A
1553									5472			03Vi0A
1562									5481			03Vi0A
1564									5483			03Vi0A
1572									5491			03Vi0A
1573									5492			03Vi0A
1579									5497			03Vi0A
1582									5501			03Vi0A
1584									5503			03Vi0A
1589(1)	1,3,5								5507			03Vi0A
1591									5509			03Vi0A
1600*									5518			03Vi0A
1611									5529			03Vi0A
1618									5537			03Vi0A
1619									5538			03Vi0A

(continued)

 $^{65}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^{\pi}$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]	
1628*									5546	03Vi0A
1634									5552	03Vi0A
1636*									5554	03Vi0A
1640									5558	03Vi0A
1642									5560	03Vi0A
1652									5569	03Vi0A
1654*									5571	03Vi0A
1659									5577	03Vi0A
1661									5578	03Vi0A
1664									5582	03Vi0A
1667									5584	03Vi0A
1669									5586	03Vi0A
1674									5592	03Vi0A
1681									5598	03Vi0A
1684									5601	03Vi0A
1687									5604	03Vi0A
1693									5610	03Vi0A
1706									5623	03Vi0A
1707									5624	03Vi0A
1709									5626	03Vi0A
1714									5631	03Vi0A
1718									5635	03Vi0A
1724									5641	03Vi0A
1727(5)								1701	5643(5)*	87Vi01 03Vi0A
1730									5646	03Vi0A
1731									5648	03Vi0A
1735									5652	03Vi0A
1737									5653	03Vi0A
1739									5655	03Vi0A
1743									5659	03Vi0A
1745									5661	03Vi0A
1751									5667	03Vi0A
1754									5670	03Vi0A
1761	1,3,5								5677	03Vi0A
1764									5680	03Vi0A
1767									5683	03Vi0A
1769									5686	03Vi0A
1774									5690	03Vi0A
1777									5693	03Vi0A
1782									5697	03Vi0A
1784									5700	03Vi0A
1791									5706	03Vi0A
1793									5709	03Vi0A
1799									5714	03Vi0A
1805									5721	03Vi0A

(continued)

 $^{65}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^{\pi}$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]	
1813									5728	03Vi0A
1814									5730	03Vi0A
1816									5731	03Vi0A
1823									5738	03Vi0A
1827									5742	03Vi0A
1829									5744	03Vi0A
1832									5747	03Vi0A
1834									5749	03Vi0A
1838									5752	03Vi0A
1839									5754	03Vi0A
1842									5757	03Vi0A
1845.4(7)							$\langle 54 \rangle$	1817	5759(5)	93Bh04 03Vi0A
1854									5769	03Vi0A
1858									5772	03Vi0A
1860									5774	03Vi0A
1867									5781	03Vi0A
1869									5783	03Vi0A
1871									5785	03Vi0A
1876									5790	03Vi0A
1880									5794	03Vi0A
1886(5)								1857	5799(5)*	87Vi01 03Vi0A
1890									5804	03Vi0A
1891									5805	03Vi0A
1906.9(6)							$\langle 54 \rangle$	1878	5819(5)	93Bh04 03Vi0A
1908									5822	03Vi0A
1911									5825	03Vi0A
1912									5826	03Vi0A
1915									5828	03Vi0A
1917									5831	03Vi0A
1924									5837	03Vi0A
1928									5841	03Vi0A
1931(5)								1902	5844(5)*	87Vi01 03Vi0A
1934									5848	03Vi0A
1938									5851	03Vi0A
1940.5(6)							$\langle 54 \rangle$	1911	5853.0(7)	93Bh04 03Vi0A
1947									5860	03Vi0A
1949									5862	03Vi0A
1954									5867	03Vi0A
1957									5870	03Vi0A
1958									5871	03Vi0A
1961									5874	03Vi0A
1962									5875	03Vi0A
1965									5878	03Vi0A
1967									5879	03Vi0A
1972									5885	03Vi0A

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 $^{65}_{31}\text{Ga}(\text{p})$

E_o	$2J^\pi$	$2T$	Γ_p	γ_p^2	Γ	$\Gamma_p \Gamma_\gamma / \Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]	
1974								5886		03Vi0A
1977								5889		03Vi0A
1980								5892		03Vi0A
1982								5894		03Vi0A
1986								5898		03Vi0A
1988(5)								1958 5900(5)*		87Vi01 03Vi0A
1995								5907		03Vi0A
2000								5912		03Vi0A
2001								5914		03Vi0A
2006								5918		03Vi0A
2009								5922		03Vi0A
2012								5924		03Vi0A
2016(5)								1985 5927(5)*		87Vi01 03Vi0A
2021								5933		03Vi0A
2023.9(7)							$\langle 54 \rangle$	1992 5935(1)		93Bh04 03Vi0A
2032								5943		03Vi0A
2034								5946		03Vi0A
2037								5949		03Vi0A
2040								5951		03Vi0A
2041								5953		03Vi0A
2045								5957		03Vi0A
2047								5959		03Vi0A
2051								5962		03Vi0A
2053								5964		03Vi0A
2058								5969		03Vi0A
2059								5970		03Vi0A
2065								5976		03Vi0A
2073								5984		03Vi0A
2075								5986		03Vi0A
2080								5991		03Vi0A
2083(5)								2051 5993(5)*		87Vi01 03Vi0A
2085								5996		03Vi0A
2091								6002		03Vi0A
2561.8(20)	1^+		50(10)	1.91				2522 6464(5)		81Sa24 81SaZW
2566.6(20)	1^+		35(7)	1.27				2527 6469(5)		81Sa24 81SaZW
2626.2(20)	1^+		50(10)	1.57				2586 6528(5)		81Sa24 81SaZW
2631.8(20)	1^+		30(10)	0.93				2591 6533(5)		81Sa24 81SaZW
2639.8(20)	1^+		25(8)	0.75				2599 6541(5)		81Sa24 81SaZW
2650.9(20)	1^+		25(8)	0.73				2610 6552(5)		81Sa24 81SaZW
2677.1(20)	1^+		30(10)	0.81				2636 6578(5)		81Sa24 81SaZW
2696.7(20)	1^+		60(12)	1.54				2655 6597(5)		81Sa24 81SaZW
2748.1(20)	1^-		50(10)	2.29				2706 6648(5)		81Sa24 81SaZW
2749.0(20)	1^+		80(16)	1.77				2707 6649(5)		81Sa24 81SaZW
2760.9(20)	1^+		80(16)	1.72				2718 6660(5)		81Sa24 81SaZW
2772.6(20)	1^-		240(50)	10.3				2730 6672(5)		81Sa24 81SaZW

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 $^{65}_{31}\text{Ga}(\text{p})$

E_o	$2J^\pi$	$2T$	Γ_p	γ_p^2	Γ	$\Gamma_p \Gamma_\gamma / \Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.	
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]		
2780.4(20)	1^+		45(9)	0.92				2738	6680(5)	81Sa24	81SaZW
2781.9(20)	1^-		70(14)	2.92				2739	6681(5)	81Sa24	81SaZW
2791.6(20)	1^+		25(8)	0.49				2749	6691(5)	81Sa24	81SaZW
2815.4(20)	3^-		40(8)	1.52				2772	6714(5)	81Sa24	81SaZW
2818.6(20)	1^+		60(12)	1.11				2775	6717(5)	81Sa24	81SaZW
2820.2(20)	3^-		40(8)	1.50				2777	6719(5)	81Sa24	81SaZW
2876.4(20)	1^+		70(14)	1.11				2832	6774(5)	81Sa24	81SaZW
2905.4(20)	1^+		150(30)	2.22				2861	6803(5)	81Sa24	81SaZW
2917(5)	$\langle 9^+ \rangle$					31(10)	$\langle 1066 \rangle$	2872	6814(5)	93Bh04	79Ra12
2926(5)	$\langle 9^+ \rangle$					77(20)	$\langle 1066 \rangle$	2881	6823(4)	72Sz01	93Bh04 79Ra12
2937(5)	$\langle 9^+ \rangle$					40(10)	$\langle 1066 \rangle$	2892	6834(4)	72Sz01	93Bh04 79Ra12
2942(5)	$\langle 9^+ \rangle$					35(10)	$\langle 1066 \rangle$	2897	6839(5)	82Ra11	93Bh04 79Ra12
2966.9(20)	1^+		70(14)	0.89				2921	6863(5)	81Sa24	81SaZW
3016.7(20)	1^+		90(18)	1.03				2970	6912(5)	81Sa24	81SaZW
3039.9(20)	1^+		50(10)	0.54				2993	6935(5)	81Sa24	81SaZW
3046.3(20)	1^+		45(9)	0.48				2999	6941(5)	81Sa24	81SaZW
3057.2(20)	1^+		200(40)	2.08				3010	6952(5)	81Sa24	81SaZW
3070.9(20)	1^+		70(14)	0.71				3024	6966(5)	81Sa24	81SaZW
3074.2(20)	1^+		60(12)	0.60				3027	6969(5)	81Sa24	81SaZW
3095.8(20)	1^+		70(14)	0.67				3048	6990(5)	81Sa24	81SaZW
3123.4(20)	1^+		120(25)	1.08				3075	7017(5)	81Sa24	81SaZW
3134.2(20)	1^+		300(60)	2.64				3086	7028(5)	81Sa24	81SaZW
3156.1(20)	1^+		50(10)	0.42				3107	7049(5)	81Sa24	81SaZW
3170.6(20)	1^+		40(8)	0.33				3122	7064(5)	81Sa24	81SaZW
3177.1(20)	1^+		200(40)	1.61				3128	7070(5)	81Sa24	81SaZW
3196.9(20)	1^+		50(10)	0.39				3148	7090(5)	81Sa24	81SaZW
3210.5(20)	1^+		50(10)	0.38				3161	7103(5)	81Sa24	81SaZW
3220.3(20)	5^+		280(56)	14.6				3171	7113(5)	81Sa24	81SaZW
3223.1(20)	5^+		80(16)	4.13				3173	7115(5)	81Sa24	81SaZW
3225.1(20)	1^+		110(22)	0.81				3175	7117(5)	81Sa24	81SaZW
3235.0(20)	1^+		60(12)	0.43				3185	7128(5)	81Sa24	81SaZW
3245(5)	$\langle 3 \rangle$						$\langle 1370 \rangle$	3195	7137(5)	82Ra11	93Bh04
3249(5)	$\langle 5 \rangle$						$\langle 1370 \rangle$	3199	7141(5)	82Ra11	93Bh04
3253(5)	$\langle 5 \rangle$						$\langle 1370 \rangle$	3203	7145(5)	82Ra11	93Bh04
3259(5)	>1						$\langle 1370 \rangle$	3209	7151(5)	82Ra11	93Bh04
3774.6	1^+		12000(2400)		16		1911	3732	7660(20)	66Ga14	93Bh04 81Ra23
3805.3	$\langle 1^- \rangle$						1941	3747	7689	81Ra23	
4733.7	$\langle 5^- \rangle$						2880	4661	8603	81Ra23	

(continued)

 $^{65}_{31}\text{Ga}(\text{p})$

E_o	$2J^\pi$	$2T$	Γ_p	γ_p^2	Γ	$\Gamma_p \Gamma_\gamma / \Gamma$	E_{analog}^*	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]	[keV]	[keV]	
4965.4	$\langle 3^+ \rangle$						3104	4889	8831	81Ra23
5021.4	$\langle 5^- \rangle$						3170	4944	8887	81Ra23

Additional data on this isotope can be found in [87Ni14, 81Es02, 74Ro16, 73Ne07, 71Ne06].

* E^* and E_o are from the table and figure in [87Vi01]

For the resonances at $E_o=2926\text{--}2937$ keV $\Gamma_p \Gamma_\gamma / \Gamma=290(50)$ and $200(50)$ meV were obtained [72Sz01].

For the resonance at $E_o=3775$ keV the parameter $(2J+1)\Gamma_p$ is given instead of Γ_p , and values $(2J+1)S_{pp}=0.18$ and $(2J+1)S_{dp}=0.22$ are presented in [66Ga14].

Energy resolution in measurements [81Sa24, 81SaZW] is estimated as 2 keV.

Branching ratios of γ -transitions [75We24, 82Ra11]. $^{65}_{31}\text{Ga}(\text{p})$

E^*	$2J^\pi$	E_o	Branching ratios												$\Gamma_p \Gamma_\gamma / \Gamma$	Ref.
[keV]		[keV]	Percentage												[meV]	
E^*		0.0	62	191	650	809	815	1083	1135	1286	2037	2207	2820			
$2J_f^\pi$		3^-	$\langle 1 \rangle^-$	5^-	X^-	X^-	3^-	X^+	$\langle 7^- \rangle$	$\langle 9 \rangle^-$	9^+	5^-	$3^+, 5^+$			
61.97(13)	$\langle 1 \rangle^-$	100														75We24
190.80(14)	5^-	100														75We24
649.68(14)	$1^-, 3^-$	86(3)	8(3)	6(3)												75We24
809.26(13)	$1^-, 3^-$	90(3)	5(3)	5(3)												75We24
814.89(20)	3^-	30(5)	70(20)													75We24
1075.76(22)	7	55(5)		45(5)												75We24
1084(8)	$7^+, 9^+$															
1135																
1287.3(4)	$\langle 9 \rangle^-$															
1298.60(24)		5(3)	70(5)	25(5)												75We24
1326.2(8)																
1352.9(5)		100														75We24
1370.9(10)																
1377.4(3)	$5^-, 7^-$	70(5)	30(5)													75We24
1469																
1521.4(4)	$\langle 5^- \rangle$															
1661.97(17)	$1^-, 3^-$	6(2)	43(2)	14(2)		37(2)										75We24
1807																
1864(7)	$1^-, 3^-$															
1879.41(20)				x												75We24
1902(2)																
1966.7(3)		100														75We24
1983.1(5)			15(5)	70(5)		15(5)										75We24
2037.7(3)	9^+															

(continued)

 $^{65}_{31}\text{Ga}(\text{p})$

E^*	$2J^\pi$	E_o	Branching ratios											$\Gamma_p \Gamma_\gamma / \Gamma$	Ref.
[keV]		[keV]	Percentage											[meV]	
E^*		0.0	62	191	650	809	815	1083	1135	1286	2037	2207	2820		
$2J^\pi_f$		3^-	$\langle 1 \rangle^-$	5^-	X^-	X^-	3^-	X^+	$\langle 7^- \rangle$	$\langle 9 \rangle^-$	9^+	5^-	$3^+, 5^+$		
2046.3(4)															
2161.7(4)		15(10)	65(10)		20(20)										75We24
2206.6(5)	5^-	70(10)		30(10)											75We24
2213(15)															
2323.8(5)		100													75We24
2357															
2388															
2427(1)		15(5)	30(5)		15(5)	40(5)									75We24
2447.0(5)		100													75We24
2470															
2502.9(5)			70(10)		$\langle 10 \rangle$	$\langle 10 \rangle$	$\langle 10 \rangle$								75We24
2704(2)		60(10)													75We24
2811(1)	$\langle 3, 5 \rangle$	20(10)		80(10)											75We24
6815(1)		2917											31(10)		79Ra12
6824(10)	$[9^+]$	2926		< 2			< 4	< 4	93(6)				77(20)		79Ra12
6834*		2937											40(10)		79Ra12
6839*		2942											35(10)		79Ra12
6839(10)															
7039(2)															
7113	5^+														
7136(5)	$[3, 5^+]$	3249			21(2)							55(4)	24(2)		82Ra11
7141(3)	$[5^+]$	3253			< 8							> 80	< 12		82Ra11

* Not included in ENSDF [02Nu0A].

Target isotope: $^{66}_{30}\text{Zn}$ $I^\pi_o = 0^+$ Abundance: 27.90(27) % $S_p = 5269.3(13)$ keV $^{67}_{31}\text{Ga}(\text{p})$

E_o	$2J^\pi$	$2T$	Γ_p	γ_p^2	Γ	$\Gamma_p \Gamma_\gamma / \Gamma$	E^*_{analog}	S_{pp}	S_{dp}	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]			[keV]	[keV]	
2609.7(20)	1^+		20(6)	0.63						2570	7840	81Sa24 81SaZW
2648.8(20)	1^+		60(12)	1.67						2609	7878	81Sa24 81SaZW
2663.8(20)	1^+		23(7)	0.62						2624	7893	81Sa24 81SaZW
2665.4(20)	1^+		25(8)	0.66						2625	7895	81Sa24 81SaZW
2671.3(20)	1^+		17(5)	0.44						2631	7900	81Sa24 81SaZW
2679.1(20)	1^+		25(8)	0.64						2639	7908	81Sa24 81SaZW
2690.5(20)	1^+		12(5)	0.30						2650	7919	81Sa24 81SaZW
2694.2(20)	1^+		25(8)	0.61						2654	7923	81Sa24 81SaZW
2709.8(20)	1^+		20(6)	0.47						2669	7938	81Sa24 81SaZW
2711.5(20)	1^+		12(5)	0.28						2671	7940	81Sa24 81SaZW

(continued)

 $^{67}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^{\pi}$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	S_{pp}	S_{dp}	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]			[keV]	[keV]	
2713.2(20)	1 ⁺		10(5)	0.23						2672	7942	81Sa24 81SaZW
2720.0(20)	1 ⁺		12(5)	0.27						2679	7949	81Sa24 81SaZW
2738.5(20)	1 ⁺		28(8)	0.61						2697	7967	81Sa24 81SaZW
2760(10)	5 ⁻						0.0			2719	7988	71Lo22 83Mo26
2760.6(20)	1 ⁺		20(6)	0.41						2719	7988	81Sa24 81SaZW
2762.5(20)	1 ⁺		15(5)	0.31						2721	7990	81Sa24 81SaZW
2780.7(20)	1 ⁺		10(5)	0.19						2739	8008	81Sa24 81SaZW
2782.6(20)	1 ⁺		20(6)	0.39						2741	8010	81Sa24 81SaZW
2799.0(20)	1 ⁺		12(5)	0.22						2757	8027	81Sa24 81SaZW
2802.3(20)	1 ⁻		25(8)	0.93						2760	8029	81Sa24 81SaZW
2804.8(20)	1 ⁺		40(8)	0.73						2762	8032	81Sa24 81SaZW
2809.0(20)	1 ⁻		30(6)	1.10						2767	8036	81Sa24 81SaZW
2812.6(20)	1 ⁺		30(6)	0.53						2770	8040	81Sa24 81SaZW
2816.6(20)	1 ⁻		30(6)	1.74						2774	8043	81Sa24 81SaZW
2822.2(20)	1 ⁺		17(5)	0.30						2780	8049	81Sa24 81SaZW
2822.8(20)	1 ⁻		35(7)	1.23						2780	8050	81Sa24 81SaZW
2826.1(20)	1 ⁺		22(7)	0.38						2783	8053	81Sa24 81SaZW
2823.6(20)	1 ⁻		16(5)	0.56						2781	8050	81Sa24 81SaZW
2825.8(20)	1 ⁻		35(8)	1.22						2783	8053	81Sa24 81SaZW
2828.6(20)	1 ⁻		110(22)	3.81			$\langle 93 \rangle$			2786	8055	81Sa24 81SaZW
2832.8(20)	1 ⁻		50(10)	1.71						2790	8059	81Sa24 81SaZW
2841.2(20)	1 ⁺		35(8)	0.58						2798	8068	81Sa24 81SaZW
2848.0(20)	1 ⁺		25(8)	0.41						2805	8075	81Sa24 81SaZW
2868.5(20)	1 ⁺		20(6)	0.31						2825	8095	81Sa24 81SaZW
2869.6(20)	1 ⁺		40(8)	0.62						2826	8096	81Sa24 81SaZW
2871.4(20)	1 ⁺		20(6)	0.31						2828	8097	81Sa24 81SaZW
2877.4(20)	1 ⁺		25(8)	0.38						2834	8103	81Sa24 81SaZW
2893.2(20)	1 ⁺		40(8)	0.58						2850	8119	81Sa24 81SaZW
2894.5(20)	1 ⁺		10(5)	0.15						2851	8120	81Sa24 81SaZW
2902.6(20)	1 ⁺		45(9)	0.64						2859	8128	81Sa24 81SaZW
2904.1(20)	1 ⁻ 3 ⁻		7(5)	0.20						2860	8130	81Sa24 81SaZW
2909.6(20)	1 ⁺		10(5)	0.14						2866	8135	81Sa24 81SaZW
2913.1(20)	1 ⁺		85(17)	1.18						2869	8139	81Sa24 81SaZW
2925.9(20)	1 ⁺		40(8)	0.54						2882	8151	81Sa24 81SaZW
2934.3(20)	1 ⁺		65(13)	0.86						2890	8159	81Sa24 81SaZW
2936.5(20)	1 ⁺		15(5)	0.20						2892	8162	81Sa24 81SaZW
2942.4(20)	1 ⁻ 3 ⁻		8(5)	0.21						2898	8167	81Sa24 81SaZW
2946.5(20)	1 ⁺		20(6)	0.26						2902	8171	81Sa24 81SaZW
2949.3(20)	1 ⁻ 3 ⁻		10(5)	0.25						2905	8174	81Sa24 81SaZW
2954.2(20)	1 ⁻ 3 ⁻		9(5)	0.23						2910	8179	81Sa24 81SaZW
2957.1(20)	1 ⁺		35(7)	0.44						2913	8182	81Sa24 81SaZW
2957.6(20)	1 ⁺		18(6)	0.22						2913	8182	81Sa24 81SaZW
2959.3(20)	1 ⁺		7(5)	0.09						2915	8184	81Sa24 81SaZW
2963.5(20)	1 ⁺		20(6)	0.25						2919	8188	81Sa24 81SaZW
2973.5(20)	1 ⁺		50(10)	0.60						2929	8198	81Sa24 81SaZW

(continued)

 $^{67}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^{\pi}$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	S_{pp}	S_{dp}	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]			[keV]	[keV]	
2978.0(20)	1^+		22(6)	0.26						2934	8203	81Sa24 81SaZW
2982.7(20)	1^+		15(5)	0.18						2938	8207	81Sa24 81SaZW
2985.1(20)	1^+		45(9)	0.53						2940	8209	81Sa24 81SaZW
2985.5(20)	$1^-, 3^-$		7(5)	0.16						2940	8210	81Sa24 81SaZW
2986.0(20)	$1^-, 3^-$		7(5)	0.16						2941	8211	81Sa24 81SaZW
2986.2(20)	1^+		13(5)	0.15						2941	8211	81Sa24 81SaZW
3004.2(20)	1^+		25(8)	0.28						2959	8228	81Sa24 81SaZW
3005.1(20)	1^+		13(5)	0.15						2960	8229	81Sa24 81SaZW
3014.6(20)	1^+		22(6)	0.24						2969	8239	81Sa24 81SaZW
3016.2(20)	$1^-, 3^-$		8(5)	0.17						2971	8240	81Sa24 81SaZW
3017.7(20)	1^+		35(7)	0.38						2972	8242	81Sa24 81SaZW
3020.5(20)	$1^-, 3^-$		10(5)	0.21						2975	8244	81Sa24 81SaZW
3048.2(20)	1^+		30(7)	0.30						3002	8272	81Sa24 81SaZW
3056.4(20)	1^+		35(7)	0.35						3010	8280	81Sa24 81SaZW
3058.8(20)	1^+		50(10)	0.50						3013	8282	81Sa24 81SaZW
3064.0(20)	1^+		25(7)	0.25						3018	8288	81Sa24 81SaZW
3069.9(20)	1^+		20(6)	0.19						3024	8293	81Sa24 81SaZW
3071.6(20)	$1^-, 3^-$		15(5)	0.28						3025	8295	81Sa24 81SaZW
3077.4(20)	1^+		50(10)	0.48						3031	8300	81Sa24 81SaZW
3082.3(20)	1^+		30(7)	0.28						3036	8305	81Sa24 81SaZW
3084.9(20)	1^+		40(8)	0.37						3038	8308	81Sa24 81SaZW
3091.0(20)	1^+		8(5)	0.07						3045	8314	81Sa24 81SaZW
3092.0(20)	1^+		8(5)	0.07						3046	8315	81Sa24 81SaZW
3094.3(20)	1^+		45(9)	0.41						3048	8317	81Sa24 81SaZW
3095.2(20)	1^+		35(7)	0.32						3049	8318	81Sa24 81SaZW
3103.2(20)	1^+		25(7)	0.23						3056	8326	81Sa24 81SaZW
3106.0(20)	1^+		55(11)	0.49						3060	8329	81Sa24 81SaZW
3109.0(20)	1^+		30(7)	0.27						3063	8332	81Sa24 81SaZW
3110.9(20)	1^+		35(7)	0.31						3064	8333	81Sa24 81SaZW
3123.1(20)	3^-		13(5)	0.22						3076	8345	81Sa24 81SaZW
3124.0(20)	3^-		8(5)	0.13						3077	8347	81Sa24 81SaZW
3126.9(20)	1^+		75(15)	0.64						3080	8349	81Sa24 81SaZW
3128.9(20)	1^+		40(8)	0.34						3082	8351	81Sa24 81SaZW
3130.3(20)	1^+		15(5)	0.13						3083	8352	81Sa24 81SaZW
3130.8(20)	3^-		35(7)	0.58						3084	8353	81Sa24 81SaZW
3134.0(20)	1^+		80(16)	0.67						3087	8357	81Sa24 81SaZW
3132.1(20)	3^-		15(5)	0.25						3085	8354	81Sa24 81SaZW
3135.2(20)	3^-		22(7)	0.36						3088	8357	81Sa24 81SaZW
3136.2(20)	3^-		30(7)	0.49						3089	8358	81Sa24 81SaZW
3137.4(20)	3^-		30(7)	0.49						3090	8359	81Sa24 81SaZW
3137.9(20)	1^+		55(11)	0.46						3091	8360	81Sa24 81SaZW
3139.9(20)	3^-		25(7)	0.40						3093	8362	81Sa24 81SaZW
3142.0(20)	3^-		15(5)	0.24						3095	8364	81Sa24 81SaZW
3144.3(20)	1^+		10(5)	0.08						3097	8366	81Sa24 81SaZW
3145.0(20)	3^-		50(10)	0.80						3098	8367	81Sa24 81SaZW

(continued)

 $^{67}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^{\pi}$	$2T$	Γ_{p}	γ_{p}^2	Γ	$\Gamma_{\text{p}}\Gamma_{\gamma}/\Gamma$	E_{analog}^*	S_{pp}	S_{dp}	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]			[keV]	[keV]	
3145.7(20)	3^{-}		12(5)	0.19			388			3098	8368	81Sa24 81SaZW
3148.0(20)	1^{+}		25(7)	0.21						3101	8370	81Sa24 81SaZW
3146.7(20)	3^{-}		20(6)	0.32						3099	8369	81Sa24 81SaZW
3149.9(20)	3^{-}		155(31)	2.45						3102	8372	81Sa24 81SaZW
3150.8(20)	3^{-}		60(12)	0.95						3103	8373	81Sa24 81SaZW
3150.9(20)	3^{-}		20(6)	0.32						3103	8373	81Sa24 81SaZW
3151.2(20)	1^{+}		20(6)	0.16						3104	8373	81Sa24 81SaZW
3151.5(20)	3^{-}		18(6)	0.28						3104	8373	81Sa24 81SaZW
3152.0(20)	3^{-}		25(8)	0.39						3105	8374	81Sa24 81SaZW
3152.6(20)	3^{-}		40(8)	0.63						3105	8374	81Sa24 81SaZW
3153.6(20)	1^{+}		40(8)	0.32						3106	8375	81Sa24 81SaZW
3154.0(20)	1^{+}		30(8)	0.24						3107	8376	81Sa24 81SaZW
3154.4(20)	1^{+}		75(15)	0.61						3107	8376	81Sa24 81SaZW
3156.4(20)	3^{-}		27(8)	0.42						3109	8378	81Sa24 81SaZW
3159.1(20)	3^{-}		20(6)	0.31						3111	8381	81Sa24 81SaZW
3160.7(20)	3^{-}		18(6)	0.28						3113	8382	81Sa24 81SaZW
3162.7(20)	1^{+}		115(21)	0.91						3115	8384	81Sa24 81SaZW
3166.9(20)	1^{+}		22(6)	0.17						3119	8389	81Sa24 81SaZW
3172.4(20)	1^{+}		22(6)	0.17						3125	8394	81Sa24 81SaZW
3172.9(20)	$1^{-}, 3^{-}$		13(5)	0.20						3125	8394	81Sa24 81SaZW
3182.0(20)	1^{+}		17(5)	0.13						3135	8404	81Sa24 81SaZW
3182.5(20)	1^{+}		45(9)	0.34						3135	8404	81Sa24 81SaZW
3186.3(20)	1^{+}		35(7)	0.26						3138	8408	81Sa24 81SaZW
3190.9(20)	1^{+}		75(15)	0.56						3143	8412	81Sa24 81SaZW
3193.2(20)	$1^{-}, 3^{-}$		8(5)	0.12						3145	8414	81Sa24 81SaZW
3196.8(20)	1^{+}		45(9)	0.33						3149	8418	81Sa24 81SaZW
3198.5(20)	$1^{-}, 3^{-}$		13(5)	0.18						3150	8420	81Sa24 81SaZW
3200.1(20)	1^{+}		18(6)	0.13						3152	8421	81Sa24 81SaZW
3201.4(20)	1^{+}		10(5)	0.07						3153	8423	81Sa24 81SaZW
3209.5(20)	1^{+}		28(6)	0.20						3161	8430	81Sa24 81SaZW
3210.6(20)	1^{+}		40(8)	0.29						3162	8432	81Sa24 81SaZW
3212.8(20)	1^{+}		30(6)	0.22						3164	8434	81Sa24 81SaZW
3215.5(20)	1^{+}		75(15)	0.54						3167	8436	81Sa24 81SaZW
3217.7(20)	1^{+}		60(12)	0.43						3169	8439	81Sa24 81SaZW
3220.3	1^{+}		30(6)	0.21						3172	8441	81Sa24 81SaZW
3224.5	1^{+}		60(12)	0.42						3176	8445	81Sa24 81SaZW
3229.7	$1^{-}, 3^{-}$		8(5)	0.11						3181	8450	81Sa24 81SaZW
3230.7	1^{+}		15(5)	0.10						3182	8451	81Sa24 81SaZW
3238.9	$1^{-}, 3^{-}$		10(5)	0.13						3190	8459	81Sa24 81SaZW
3241.0	1^{+}		15(5)	0.10						3193	8462	81Sa24 81SaZW
3243.1	1^{+}		15(5)	0.10						3194	8464	81Sa24 81SaZW
3247.0	1^{+}		80(16)	0.54						3199	8468	81Sa24 81SaZW
3250.7	1^{+}		15(5)	0.10						3202	8471	81Sa24 81SaZW
3254.6	1^{+}		30(6)	0.20						3206	8475	81Sa24 81SaZW
3255.8	1^{+}		45(9)	0.30						3207	8476	81Sa24 81SaZW

(continued)

 $^{67}_{31}\text{Ga}(\text{p})$

E_o	$2J^\pi$	$2T$	Γ_p	γ_p^2	Γ	$\Gamma_p\Gamma_\gamma/\Gamma$	E_{analog}^*	S_{pp}	S_{dp}	E_{cm}	E^*	Ref.
[keV]			[eV]	[keV]	[keV]	[meV]	[keV]			[keV]	[keV]	
3258.9	1 ⁺		85(17)	0.56						3210	8479	81Sa24
3335(4)	9 ⁺					170(39)	602			3285	8555	72Sz01
3348(5)						60(29)				3298	8567	79Ra12
3740(10)	5 ⁺		8(3)·10 ³		17		978	1.30	1.53	3684	8954	73Si30
3950(10)	1 ⁻		9(3)·10 ³		33			0.33	0.42	3891	9160	68Go21
4210(10)	3 ⁻						1444			4147	9417	73Si30
4425(10)	1 ⁺		13·10 ³		45			0.31	0.23	4359	9628	73Si30
5060(10)	5 ⁺		3·10 ³		40			0.52	0.22	4984	10254	73Si30
5230(10)	5 ⁺		10·10 ³		48			0.16	0.12	5152	10421	73Si30
5410(10)										5329	10599	73Si30
5575(10)	5 ⁺		4·10 ³		32			0.42	0.25	5492	10761	73Si30

Additional data on this isotope can be found in [78Bo34, 77BoYI, 73Ne07, 73BoXF, 73BuYY, 73Si30, 71Lo22, 71MoZS, 71Ne06, 68Go21, 66Ga14, 59Va03].

For the resonance at $E_o=3335$ keV $\Gamma_p\Gamma_\gamma/\Gamma=320(60)$ meV is given in [72Sz01].

For the resonances at $E_o=3740$ and 3950 keV parameters $(2J^\pi+1)\Gamma_p$, $(2J^\pi+1)S_{\text{pp}}$, $(2J^\pi+1)S_{\text{dp}}$ are given instead of Γ_p , S_{pp} and S_{dp} , respectively [66Ga14].

For the resonance at $E_o=3700(10)$ keV $\Gamma_{p'}/\Gamma_p=0.0162$, $(2J^\pi+1)\Gamma_p\Gamma_{p'}/\Gamma=130.6$ eV [68Go21].

Narrow resonance structures at $E_o=4.11$, 4.22 , 4.27 , 4.29 , 4.38 , 4.42 and 4.46 MeV were observed in [73BoXF].

Branching ratios of γ -transitions [79Ra12]. $^{67}_{31}\text{Ga}(\text{p})$

E^*	$2J^\pi$	E_o	Branching ratios									Com.
[keV]		[keV]	Percentage									
			0.0	167	359	828	911	1202	1413	1520	2074	E^* , keV
			3 ⁻	1 ⁻	5 ⁻	3 ⁻	X ⁻	7 ⁻	7 ⁻	9 ⁻	9 ⁺	$2J_f^\pi$
166.98(3)	1 ⁻		100									
359.12(2)	5 ⁻											
828.08(3)	3 ⁻											
910.93(2)	5 ⁻		x									
1081.62(4)	1 ⁻											
1202.27(2)	7 ⁻		13(3)		26(3)							
1240(5)	$\langle 13 \rangle$											
1412.71(2)	7 ⁻		5(3)		8(3)							
1519.17(3)	9 ⁻				x							
2073.75(3)	9 ⁺							31(3)		42(3)		
8552(5)	$\langle 9^+ \rangle$	3333					6(2)	8(2)	13(2)		73(4)	
8567(5)	$\langle 9^+ \rangle$											

Target isotope: $^{68}_{30}\text{Zn}$ $I^\pi_o = 0^+$ Abundance: 18.75(51) % $S_p = 6605.9(29)$ keV											$^{69}_{31}\text{Ga}(p)$		
E_o	$2J^\pi$	Γ_p	Γ	Γ_γ	E^*_{analog}	$S_{pp'}$	S_{dp}	E_{cm}	E^*	Ref.			
[keV]		[keV]	[keV]	[eV]	[keV]			[keV]	[keV]				
3240(10)**	1^-	7.2(14)*	31(10)	0.88	0.0	1.13*	0.95*	3193	9809	68Go21	73Ne07	78Ra06	89Bh08
3690(10)***	$\langle 9^+ \rangle$				439			3637	10243(10)	73Ne07	78Ra06		
3695(10)***	$\langle 9^+ \rangle$				439			3641	10247(10)	73Ne07	78Ra06		
3700(10)***	$\langle 9^+ \rangle$				439			3646	10252(10)	73Ne07	78Ra06		
4035(10)	$\langle 3^- \rangle$	0.03	0.5					3977	10581	89Bh08			
4046		0.10	2.5					3987	10592	89Bh08			
4070(10)**	3^-	2.0	32(10)		834	0.28		4011	10615	71St27	68Go21		89Bh08
4105	$\langle 5^+ \rangle$	1.1	30		872	0.73	1.64*	4046	10650	71St27	66Vo02	66Lo06	89Bh08
4136	$\langle 5^+ \rangle$	0.07	2.5					4076	10681	71St27	89Bh08		
4148	$\langle 5^+ \rangle$	0.07	2.5					4088	10692	71St27	89Bh08		
4167	$\langle 5^+ \rangle$	0.07	2.5					4107	10711	71St27	89Bh08		
4865(20)	5^+	2.2	30		1633	0.55		4794	11399	71St27	66Vo02		89Bh08
4945(20)	1^+	20	60		1696	0.47		4873	11478	71St27	66Vo02	66Lo06	89Bh08
5065	$\langle 1^- \rangle$	2.0	30		1828	0.05		4992	11596	71St27	89Bh08		
5498(20)	1^+	4.0	40		2262	0.08		5418	12023	71St27	66Vo02		89Bh08
5650(20)	5^+	4.0	30		2377	0.52		5568	12172	71St27	66Vo02	66Lo06	89Bh08
5805(20)	5^+	2.3	30		2554	0.27		5721	12325	71St27	66Vo02	66Lo06	89Bh08
5910(20)	1^+	24	50		2663	0.43		5824	12429	71St27	66Vo02	66Lo06	89Bh08
6200(20)	$3^+, 5^+$				2910			6110	12716	66Vo02	66Lo06		
6280(20)	$3^+, 5^+$				2990			6189	12795	66Vo02	66Lo06		
6650(20)	1^+							6554	13159	66Vo02			
6790(20)	$\langle 1^+ \rangle$				3400			6692	13297	66Vo02	66Lo06		
6970(20)	$\langle 1^+ \rangle$				3650			6869	13475	66Vo02	66Lo06		

Additional data on this isotope can be found in [81Es02, 75Le03, 73Ne07, 71Ne06, 59Va03].

* $(2J+1)\Gamma_p$, $(2J+1)S_{pp}$, $(2J+1)S_{dp}$ instead of Γ_p , $S_{pp'}$ and S_{dp} , respectively [66Ga14].

** $(2J+1)\Gamma_p\Gamma_{p'}/(\Gamma_p+\Gamma_{p'})=42.7$ eV and $\Gamma_{p'}/\Gamma_p=0.006$ for the resonance at 3240 keV and $(2J+1)\Gamma_p\Gamma_{p'}/(\Gamma_p+\Gamma_{p'})=406.1$ eV for the resonance at 4080 keV [68Go21].

*** γ decay properties of these IAR fragments of ^{69}Zn are given in [78Ra06].

All parameters $S_{pp'}$ are represented by the values $(2J+1)S_{pp'}$ [71St27].

9 resonances were used in [66Lo06] for determination of Coulomb displacement energies Δ_c as a part of the systematic study of mass dependence of Δ_c in many heavy nuclei.

Resonances at $E_o=4080(10)$ keV observed in [68Go21] and $E_o=4110(20)$ keV observed in [66Vo02] are considered to be the same resonance.

Branching ratios of γ -transitions [78Ra06, 81Pa12, 02Nu0A]. $^{69}_{31}\text{Ga}(\text{p})$

E^*	$2J^\pi$	E_o	Branching ratios										Ref.
[keV]		[keV]	Percentage										
E^*		0.0	319	574	872	1029	1107	1337	1488	1526	1972	2564	
$2J^\pi_f$		3^-	1^-	5^-	3^-	$\langle 1 \rangle^-$	5^-	7^-	7^-	3^-	$9^{(+)}$	X^+	
318.69(2)	1^-	100											
574.21(2)	5^-												
872.13(2)	3^-	x	x										
1028.58(4)	$\langle 1 \rangle^-$	x	x										
1107.03(4)	5^-	96.4			x								81Pa12
1134(15)													
1336.69(3)	7^-	x		6.3									81Pa12
1488.14(4)	7^-	x		36.5			15						81Pa12
1525.76(4)	3^-	32	51	4			13						81Pa12
1723.70(4)	5^-	42	16	28	5		9						81Pa12
1764.77(4)	9^-												
1891.63(6)	3^-	65	35										81Pa12
1924.23(4)	7^-	9		27	38			23					81Pa12
1972.39(5)	$9^{(+)}$	67	33										81Pa12
1973.10(9)	$\langle 1 \rangle^-$												
2007.65(5)	$3^{(-)}, 5^{(-)}$	81.5			18.5								81Pa12
2023.84(9)	5^-	90		10									81Pa12
2045.22(8)	5^-	41		34	25								81Pa12
2198(3)													
2219.27(19)		29	71										81Pa12
2250.98(10)	$\langle 1, 3 \rangle^-$	67	33										81Pa12
2319.54(20)	$\langle 5^+, 7^+ \rangle$						100						81Pa12
2353.29(24)	5	31		21	27		21						81Pa12
2423.32(7)													
2428.68(21)	$5^-, 7^-$												
2458.83(11)	$7^{(-)}$			100									81Pa12
2485.7(1)	$5^{(+)}$	100											81Pa12
2529.80(9)	$\langle 3 \rangle^-$	76			24								81Pa12
9858	1^-	3250	49		22					28			78Ra06
			880(200)	<100	480(110)					520(140)			78Ra06
10242.8(7)													
10246.8(7)													
10251.8(7)													
10298	9^+	3690							13		65	22	78Ra06
									2.4(6)		12	4(1)	78Ra06
10303	9^+	3695							18		67	14	78Ra06
									4(1)		15	3(1)	78Ra06
10308	9^+	3700							15		57	27	78Ra06
									4(1)		15	7(1)	78Ra06

Partial radiative widths (in meV) are given in the second line after the branching ratios.

Target isotope: $^{70}_{30}\text{Zn}$ $I^\pi_{\text{o}} = 0^+$ Abundance: 0.62(3) % $S_{\text{p}} = 7866.4(34)$ keV

$^{71}_{31}\text{Ga}(\text{p})$

E_{o}	$2J^\pi$	$2T$	Γ_{p}	Γ	E^*_{analog}	S_{pp}	E_{cm}	E^*	Ref.	
[keV]			[keV]	[keV]	[keV]		[keV]	[keV]		
3781(10)	1^-		4.1(3)	20(5)	0.0	0.66(6)	3728(10)	11598(11)	74Ik01	88Bh01 67Co04
3863(2)	$\langle 3^+ \rangle$		0.075(25)	2.0(2)			3809(2)	11679(4)		88Bh01
3894(2)	$\langle 3^+ \rangle$		0.600(200)	7.0(7)			3839(2)	11710(4)		88Bh01
3921(2)	$\langle 3^+ \rangle$		0.035(5)	0.50(5)			3866(2)	11736(4)		88Bh01
3933(2)	$\langle 3^+ \rangle$		0.15(5)	4.0(4)			3878(2)	11748(4)		88Bh01
4080(10)				23(5)	280		4023(10)	11893(11)		88Bh01 67Co04
4265(10)				34(5)	470		4205(10)	12075(11)		88Bh01 67Co04
4464(10)	3^-		2.2(5)	39(4)	673	0.24(2)	4401(10)	12272(11)	74Ik01	88Bh01 67Co04
4656(10)	5^+		1.1(2)	15(2)	853	0.58(4)	4590(10)	12461(11)	74Ik01	88Bh01 67Co04
5071(10)	5^+		0.6(2)	19(1)	1261	0.17(6)	5000(10)	12870(11)	74Ik01	88Bh01
5223(10)	3^-		1.6(2)	11(1)	1421	0.064(8)	5149(10)	13020(11)	74Ik01	88Bh01
5429(10)	1^+		13.7(3)	42(2)	1625	0.370(10)	5353(10)	13223(11)	74Ik01	88Bh01
5482(10)	5^+		5.0(1)	38(1)	1661	0.972(18)	5405(10)	13275(11)	74Ik01	88Bh01
5995(10)	5^+		3.3(6)	35(5)	2180	0.46(6)	5911(10)	13781(11)	74Ik01	88Bh01
6142(10)	1^+		10.1(15)	55(15)	2377	0.25(3)	6055(10)	13926(11)	74Ik01	88Bh01

Additional data on this isotope can be found in [72Te0A, 81Ab03, 02Nu0A].