

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	31-Mar-2017

$Q(\beta^-)=5372.8\ 30$; $S(n)=6422\ 3$; $S(p)=9745\ 4$; $Q(\alpha)=-7498\ 3$ [2017Wa10](#)

$S(2n)=15604\ 3$, $S(2p)=22845\ 3$ ([2017Wa10](#)).

^{74}Ga produced and identified by [1956Mo39](#) in bombardment of natural Ge target with fast neutrons and subsequent measurement of γ radiation from the decay of ^{74}Ga . Later measurements of half-life, γ and β radiation from the decay of ^{74}Ga ground state: [1958Le26](#), [1958Ei02](#), [1959Yt23](#), [1960Ma12](#), [1962Ei02](#), [1967Vi08](#), [1971Ca06](#), [1972Er05](#), [1975Ta03](#).

[2011Ma45](#): ^{74}Ga was produced by neutron induced fission of a thick uranium carbide target. Neutrons were produced by 1.4 GeV protons on tantalum. Ga isotopes were ionized using RILIS laser ion source. Laser spectroscopy was performed on the Ga isotopes at ISOLDE, CERN. The g.s spins and moments were extracted from measured hyperfine spectra. Comparison with shell model calculations.

[2012Pr11](#): ^{74}Ga produced in 1.4 GeV-proton bombardment of UC_x at ISOLDE-CERN facility. Fragments diffused out of target and surface ionized, then accelerated to 30 keV, followed by mass separation and bunched by gas-filled Paul Trap (ISCOOL). Isotope shifts were measured by collinear laser spectroscopy using COLLAPS setup at ISOLDE-CERN. Deduced rms charge radius.

Mass measurements: [2015Ma30](#), [2011Et01](#), [2007Gu09](#), [2007Ke09](#), [2005Gu36](#).

Nuclear structure (theory) references: [2012Sr01](#).

[Additional information 1](#).

 ^{74}Ga LevelsCross Reference (XREF) Flags

A ^{74}Zn β^- decay (95.6 s)

B ^{74}Ga IT decay (9.5 s)

E(level)	J^π	$T_{1/2}$	XREF	Comments
0.0	(3 ⁻)	8.12 min 12	AB	<p>$\% \beta^- = 100$ $\mu = 0.000\ 75$ (2011Ma45, 2014StZZ) $Q = +0.549\ 40$ (2011Ma45, 2016St14) $\delta \langle r^2 \rangle (^{71}\text{Ga}, ^{74}\text{Ga}) = +0.223\ \text{fm}^2\ 5(\text{stat})\ 45(\text{syst})$ (2012Pr11). Isotope shift $\delta \nu(^{71}\text{Ga}, ^{74}\text{Ga}) = -32\ \text{MHz}\ 2(\text{stat})\ 6(\text{syst})$ (2012Pr11). J^π: from hyperfine structure measurements by 2011Ma45, $J=1$ is ruled out by the number of atomic transitions and selection rules. $J=2,3,4$ possibilities were analyzed and reduced χ^2 considered for the fitting of the hyperfine spectrum. For ^{74}Ga, $J=3$ is the most likely choice, but $J=4$ could not be completely ruled out. Spins higher than 4 gave poorer match to the observed spectra. Negative parity is suggested by the comparison of measured and theoretical magnetic dipole moments and electric quadrupole moments. Additional arguments in favor of $J=3$: $\log ft = 7.9$ to 2^+ and 4^+ levels in ^{74}Ge. Systematics suggest 3^-, 2^-, 0^+ for the 0, 56.5 and 59.6 levels, respectively, as for example in ^{72}Ga. Shell-model calculations by 2012Sr01 using JUN45 interaction support 3^- for ground state, with also reasonable agreement of theoretical and experimental static quadrupole moments. The 4^- state in these calculations is at about 225 keV excitation. μ, Q: from hyperfine structure measurements (2011Ma45). The values are for $J=3$. For $J=4$, $\mu = 0.000\ 75$, $Q = +0.604\ 42$ (2011Ma45). $T_{1/2}$: from γ-decay curves in ^{74}Ga β^- decay; unweighted average of 8.00 min 5 (1975Ta03) and 8.25 min 5 (1971Ca06). Others: 1967Vi08, 8 min 5 (1962Ei02), 7.7 min 4 (1960Ma12), 8.0 min 1 (1959Yt23), 7.8 min 2 (1958Ei02), 8 min 1 (1958Le26), ≈ 8 min (1956Mo39).</p>
56.550 9	(2 ⁻)	31 ns 5	AB	<p>$\% \text{IT} \approx 100$ J^π: dipole transition to (3⁻); γ from 1^+; systematics of neighboring nuclides support negative parity.</p>

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{74}Ga Levels (continued)

<u>E(level)</u>	<u>J^{π}</u>	<u>T_{1/2}</u>	<u>XREF</u>	<u>Comments</u>
59.571 14	(0 ⁺)	9.5 s 10	AB	T _{1/2} : from $\gamma\gamma(t)$ (1977Va01). %IT=75 25; % β^- =25 25 No β^- branch observed (1974Va08). An upper limit is suggested as 50% (1974Va08). E(level): from observation of sum peak. See ^{74}Ga IT decay (1974Va08). J ^{π} : γ to (2); positive parity is suggested by the systematics of neighboring nuclides; long lifetime of this level is consistent with this assignment. T _{1/2} : from ^{74}Ga IT decay (1974Va08).
102.276 14			A	
108.654 12	(1 ⁺) [†]		A	
141.334 15	(1 ⁻ ,2,3 ⁺)		A	J ^{π} : γ from (1 ⁺); γ to (3 ⁻).
145.032 18			A	
227.803 12	(0,1,2,3 ⁺)		A	J ^{π} : gammas to and from (1 ⁺).
251.787 14	(1 ⁺) [†]		A	
455.06 5	(1 ⁺) [†]		A	
894.11 5	(1 ⁺) [†]		A	
1085.72 9	(1 ⁺) [†]		A	

[†] Indication of strong (>2%) β feeding (probable allowed transition) from 0⁺ parent, although absolute β feedings are unknown.

Adopted Levels, Gammas (continued)

$E_i(\text{level})$	J_i^π	$\gamma(^{74}\text{Ga})$							$I_{(\gamma+ce)}$	Comments
		E_γ^\dagger	I_γ^\dagger	E_f	J_f^π	Mult. [‡]	δ	$\alpha^\#$		
56.550	(2 ⁻)	56.559 10	100	0.0	(3 ⁻)	(M1(+E2))	<0.17	0.42 8		B(M1)(W.u.)=0.0029 5 Mult.: from $\alpha(\text{K})\text{exp}$ in ^{74}Ga IT decay and nonobservation of K x-rays, ΔJ^π suggests M1.
59.571	(0 ⁺)	3.2 2		56.550	(2 ⁻)	[M2]		2.9×10^5 11	100	E_γ : from difference of sum peak at 59.7 and 56.7 γ . This transition is expected to be almost totally converted.
		(59.7)		0.0	(3 ⁻)	[E3]		71 6	<10	$I_{(\gamma+ce)}$: from $I_\gamma(59.7) < 0.04(I_\gamma(56.6\gamma))$ (1974Va08); this γ was not observed, but sum peak was observed by 1974Va08.
102.276		45.746 17	84 6	56.550	(2 ⁻)	[D]		0.64 2		
		102.25 3	100 8	0.0	(3 ⁻)	[D,Q]		0.35 29		
108.654	(1 ⁺)	49.087 10	100 2	59.571	(0 ⁺)	[D]		0.523 17		
		52.110 14	32 11	56.550	(2 ⁻)	[D]		0.440 13		
		108.635 20	1.3 11	0.0	(3 ⁻)	[M2]		0.546		
141.334	(1 ⁻ ,2,3 ⁺)	84.81 3	14 2	56.550	(2 ⁻)	[D]		0.108 2		
		141.330 21	100 8	0.0	(3 ⁻)	[D,Q]		0.11 8		
145.032		85.1 @ 4	56 11	59.571	(0 ⁺)	[D]		0.106 2		
		88.496 24	100 9	56.550	(2 ⁻)	[D]		0.095 2		
		145.02 4	29 2	0.0	(3 ⁻)					
227.803	(0,1,2,3 ⁺)	119.149 2	100 8	108.654	(1 ⁺)	[D,Q]		0.20 16		
		125.54 3	21 4	102.276						
		168.22 6	13 4	59.571	(0 ⁺)					
		171.13 7	6 2	56.550	(2 ⁻)					
251.787	(1 ⁺)	106.762 22	3.7 6	145.032		[D,Q]		0.30 25		
		110.461 24	2.6 2	141.334	(1 ⁻ ,2,3 ⁺)					
		143.137 24	100 3	108.654	(1 ⁺)	[D,Q]		0.10 8		
		149.517 24	7.4 4	102.276						
		192.212 19	71 2	59.571	(0 ⁺)					
		195.19 4	11 1	56.550	(2 ⁻)					
		251.89 @ 5	2 1	0.0	(3 ⁻)					
455.06	(1 ⁺)	346.46 5	100 5	108.654	(1 ⁺)					
		395.16 13	17 2	59.571	(0 ⁺)					
		398.30 25	9 2	56.550	(2 ⁻)					
894.11	(1 ⁺)	438.83 17	17 3	455.06	(1 ⁺)					
		642.9 3	12 3	251.787	(1 ⁺)					
		666.21 10	70 8	227.803	(0,1,2,3 ⁺)					
		749.2 3	11 3	145.032						
		752.82 7	100 7	141.334	(1 ⁻ ,2,3 ⁺)					
		785.44 12	30 3	108.654	(1 ⁺)					
		792.01 16	25 3	102.276						
		837.49 11	48 3	56.550	(2 ⁻)					

Adopted Levels, Gammas (continued)

$\gamma(^{74}\text{Ga})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\dagger	I_γ^\dagger	E_f	J_f^π	$E_i(\text{level})$	E_γ^\dagger	I_γ^\dagger	E_f	J_f^π
894.11	(1 ⁺)	894.10 [@]	3	14 3	0.0 (3 ⁻)	1085.72	983.7 3	72 17	102.276	
1085.72	(1 ⁺)	630.72 12		80 15	455.06 (1 ⁺)		1025.81 23	89 15	59.571	(0 ⁺)
		834.00 24		100 24	251.787 (1 ⁺)		1028.7 4	63 15	56.550	(2 ⁻)
		977.07 24		78 15	108.654 (1 ⁺)					

† From ⁷⁴Zn β^- decay.
‡ Non-observation of strong K x-rays of Ga suggests dipole multipolarity for low-energy transitions (less than ≈ 100 keV).
Theoretical values from BrIcc code (2008Ki07) with Frozen-orbital approximation.
@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)

