Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	31-Aug-2014

Q(β^-)=10312 *4*; S(n)=4747 *3*; S(p)=13080 *4*; Q(α)=−10673 *7* 2012Wa38

S(2n)=11660 *3*, S(2p)=29300 *500*, Q(β^-n)=2230 *40* (2012Wa38).

1974Gr29: production and identification of ^{80}Ga from fission. Later studies: 1976Ru01, 1981Gi17, 1991Kr15, 1993Ru01. Isomerism in ^{80}Ga discovered by 2010Ch50 and 2013Ve03.

Additional information 1.

2010Ch50: source of ^{80}Ga produced by irradiation of uranium carbide target with a proton beam at ISOLDE, CERN facility. Collinear laser spectroscopic techniques used on the extracted 30-keV mass separated ion beam. Selective Ga yield was provided by resonance ionization laser ion source (RILIS). Measured hyperfine structure, deduced spins, magnetic moments and quadrupole moments. Known moments for ^{71}Ga were used for calibration. See also 2012Pr11 and 2011Ma45 for hyperfine structure measurements and rms charge radii.

2013Ve03: ^{80}Ga isotope produced in electrofission of uranium. Target of UC_x was bombarded by 50-MeV electron primary beam followed by mass separation using PARRNe mass separator installed on-line to the ALTOISOL facility at IPN-Orsay. Measured Eγ, Iγ, β events using an HPGe detector from Phase 1 type EUROGAM, and a small EXOGAM Clover Ge detector. Measured half-lives from the decay curves of 67 γ rays. Evidence for a second long-lived activity in ^{80}Ga.

Mass measurements: 2008Ha23, 2008Su19.

Structure calculations of levels, spins: 2012Sr11, 2009Ho14.

^{80}Ga Levels

Cross Reference (XREF) Flags

A ^{80}Zn β^- decay (0.54 s)
B ^{81}Zn β^-n decay (303.5 ms)

E(level)[†]	J$^\pi$	$T_{1/2}$	XREF	Comments
0	6$^{(-)}$	1.9 s *1*	A	%β^-=100; %β^-n=0.86 *7* μ=+0.036 *4* (2010Ch50) Q=+0.478 *27* (2010Ch50) δ<r^2>(charge)(^{71}Ga,^{80}Ga)=+0.242 fm^2 *91* (2012Pr11); 0.010 fm^2 is statistical uncertainty, 0.091 fm^2 is systematic. $\delta\nu$(IS)(^{71}Ga,^{80}Ga)=−239 MHz *16* (2012Pr11); 4 MHz is statistical uncertainty, 16 MHz is systematic. E(level): shell-model predictions suggest 6$^-$ to be the g.s. J$^\pi$: spin from hyperfine structure (2010Ch50), parity from shell-model predictions and comparison with measured moments. $T_{1/2}$: measured by 2013Ve03 from decay curves for many γ rays. Others: much greater than 200 ms (2010Ch50), 1.65 s *1* (1993Ru01), 1.706 s *10* (1991Kr15), 1.67 s *10* (1982FoZZ), 1.7 s (1981Gi17), 1.66 s *2* (1976Ru01) 1.7 s *2* (1974Gr29). All measured values prior to 1994 are most likely for a combined mixture of the 1.9-s, 6$^{(-)}$ and 1.3-s, 3$^{(-)}$ activities. See detailed discussion in 2013Ve03. %β^-n: weighted average of 0.97 *6* (1993Ru01), 0.69 *8* (1986Wa17), 0.84 *6* (1980Lu04). Here all of %β^-n is assigned to g.s., but most likely it is for a mixture of the 1.9-s and 1.3-s activities. Other measurements: 1986ReZU and 1986ReZS (same group as 1986Wa17); 1982Ru01, 1981Ho07, 1977Ru09 (also 1977Ru10) (same group as 1980Lu04) Compilation and other analyses of %β^-n values: 1989BrZI, 1984Ma39, 1984Ha58, 1984KoYR, 1979RuZQ. μ,Q: from collinear laser spectroscopic technique (2010Ch50). For any spin value, magnitudes of moments are: μ=0.123 to 0.182 *4* or <0.055 *4*; Q<0.050 *12* or Q=0.182 *11* to 0.510 *28* (2010Ch50).
22.4	3$^{(-)}$	1.3 s *2*	A	%β^-=100; %β^-n=?; %IT=?

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Adopted Levels, Gammas (continued)

^{80}Ga Levels (continued)

E(level)[†]	J^π	$T_{1/2}$	XREF	Comments
				μ=−1.425 *5* (2010Ch50) Q=+0.375 *21* (2010Ch50) %β^-n=0.86 *7* assigned to the ground state decay is most likely for a mixture of the two activities of 1.9 s and 1.3 s. δ<r^2>(charge)(^{71}Ga,^{80}Ga)=+0.260 fm^2 *92* (2012Pr11); 0.007 fm^2 is statistical uncertainty, 0.092 fm^2 is systematic. $\delta\nu$(IS)(^{71}Ga,^{80}Ga)=−232.0 MHz *160* (2012Pr11); 2.5 MHz is statistical uncertainty, 16.0 MHz is systematic. E(level): from 2014Li32. J^π: spin from hyperfine structure (2010Ch50), parity from shell-model considerations and comparison with measured moments. Nordheim's rule also suggests 3^-. J^π=3^+ with configuration= $\pi f_{5/2}\otimes\nu\ p_{1/2}$ is suggested by 1987Wi13. $T_{1/2}$: measured by 2013Ve03 from decay curves for many γ rays. See also comment for half-life of g.s. μ,Q: from collinear laser spectroscopic technique (2010Ch50).
97.20 *8*	(4)		A	J^π: dipole γ to $3^{(-)}$.
403.48 *3*			A	
577.42 *8*			A	
707.90 *11*	(1$^+$)	18.3 ns *5*	A	J^π: probable (M2) γ to $3^{(-)}$. $T_{1/2}$: from β(685γ)(t) (2014Li32).
734.76 *10*			A	
911.39 *10*			A	
951.34 *12*	(1$^-$,2$^-$)		A	J^π: possible β feeding from 0^+ parent; γ to $3^{(-)}$.
987.20 *10*	(1$^-$,2$^-$)		A	J^π: possible β feeding from 0^+ parent; γ to $3^{(-)}$.
990.15 *11*			A	
1141.79 *11*			A	
1152.79 *11*			A	
1193.90 *10*			A	
1213.95 *10*			A	
1290.32 *12*			A	
1300.39 *13*			A	
1356.47 *10*			A	
1449.92 *10*	1$^+$		A	J^π: log *ft*=4.6 from 0^+ parent.
1526.06 *10*			A	
2044.42 *11*			A	
2092.21 *10*	1$^+$		A	J^π: log *ft*=4.61 from 0^+ parent.
2560.40 *12*	(1$^+$)		A	J^π: log *ft*=4.90 from 0^+ parent.
2676.94 *12*	1$^+$		A	J^π: log *ft*=4.59 from 0^+ parent.
2822.11 *16*	(1$^+$)		A	J^π: log *ft*=5.3 from 0^+ parent.
3329.5 *4*			A	
3380.0 *4*			A	

† From least-squares fit to Eγ data.

γ(^{80}Ga)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f	Mult.	α[†]	Comments
97.20	(4)	74.8 *1*	100	22.4	$3^{(-)}$	D	0.154	α: from BrIcc code, value overlaps for E1 and M1.
403.48		306.4 *1*	4.7 *23*	97.20	(4)			
		403.47 *3*	100 *12*	0	$6^{(-)}$			
577.42		174.0 *1*	100 *11*	403.48				
		480.1 *1*	12.5 *18*	97.20	(4)			

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Adopted Levels, Gammas (continued)

$\gamma(^{80}Ga)$ (continued)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f	Mult.	Comments
577.42		577.7 *2*	3.6 *18*	0	$6^{(-)}$		
707.90	(1^+)	685.4 *1*	100	22.4	$3^{(-)}$	(M2)	B(M2)(W.u.)=0.60 *2* (2014Li32)
734.76		712.3 *1*	100	22.4	$3^{(-)}$		
911.39		176.6 *1*	100 *10*	734.76			
		814.2 *1*	15.8 *20*	97.20	(4)		
		888.9 *1*	56 *6*	22.4	$3^{(-)}$		
951.34	$(1^-,2^-)$	243.5 *1*	6.6 *15*	707.90	(1^+)		
		928.8 *2*	100 *11*	22.4	$3^{(-)}$		
987.20	$(1^-,2^-)$	964.8 *2*	100	22.4	$3^{(-)}$		
990.15		282.21 *5*	100	707.90	(1^+)		
1141.79		151.7‡ *1*	<8.7	990.15			
		154.7 *1*	13 *4*	987.20	$(1^-,2^-)$		
		190.5 *1*	100 *9*	951.34	$(1^-,2^-)$		
		406.9 *2*	35 *9*	734.76			
		433.9 *1*	96 *17*	707.90	(1^+)		
1152.79		575.3 *1*	100	577.42			
1193.90		203.6 *1*	7.7 *26*	990.15			
		282.7 *1*	15 *5*	911.39			
		1171.5 *2*	100 *13*	22.4	$3^{(-)}$		
1213.95		636.6 *1*	50 *6*	577.42			
		1116.7 *2*	100 *11*	97.20	(4)		
1290.32		1267.9 *2*	100	22.4	$3^{(-)}$		
1300.39		723.2‡ *8*	<18	577.42			
		1203.3 *2*	100 *18*	97.20	(4)		
1356.47		444.9 *1*	8.1 *10*	911.39			
		621.8 *1*	17 *3*	734.76			
		1334.0 *2*	100 *11*	22.4	$3^{(-)}$		
1449.92	1^+	93.4 *1*	4.2 *8*	1356.47			
		159.5 *1*	1.6 *4*	1290.32			
		308.3 *1*	0.52 *13*	1141.79			
		459.9‡ *1*	<0.26	990.15			
		462.72 *2*	14.4 *7*	987.20	$(1^-,2^-)$		
		715.2 *1*	100 *10*	734.76			
		742.0 *1*	27.3 *26*	707.90	(1^+)		
		1427.5 *2*	4.9 *10*	22.4	$3^{(-)}$	[M2]	
1526.06		75.8‡ *1*	<1.5	1449.92	1^+		
		169.6 *1*	10.5 *23*	1356.47			
		225.7 *1*	9.0 *15*	1300.39			
		312.13 *5*	93.2 *15*	1213.95			
		332.17 *5*	20 *3*	1193.90			
		373.2 *1*	1.5 *8*	1152.79			
		538.87 *5*	9.8 *15*	987.20	$(1^-,2^-)$		
		614.66 *5*	100 *3*	911.39			
		791.3 *1*	30 *5*	734.76			
		818.2 *1*	8.3 *23*	707.90	(1^+)		
		1503.6 *3*	72 *8*	22.4	$3^{(-)}$		
2044.42		518.3 *1*	56 *11*	1526.06			
		594.9‡ *1*	17 *6*	1449.92	1^+		
		688.0 *1*	100 *17*	1356.47			
		1057.3 *3*	33 *11*	987.20	$(1^-,2^-)$		
		2021.8 *3*	72 *17*	22.4	$3^{(-)}$		
2092.21	1^+	566.20 *5*	33 *3*	1526.06			
		642.3 *1*	100 *10*	1449.92	1^+		
		735.6 *1*	7.3 *13*	1356.47			

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Adopted Levels, Gammas (continued)

$\gamma(^{80}\mathrm{Ga})$ (continued)

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f
2092.21	1^+	802.0 *1*	2.7 *7*	1290.32	
		878.2 *2*	3.3 *7*	1213.95	
		950.5 *2*	4.3 *10*	1141.79	
		1104.9 *2*	18.0 *23*	987.20	$(1^-,2^-)$
		1357.2 *2*	7.0 *13*	734.76	
		1384.3 *2*	4.7 *10*	707.90	(1^+)
2560.40	(1^+)	468.3 *1*	24 *7*	2092.21	1^+
		1034.3 *2*	100 *11*	1526.06	
		1110.3 *2*	20 *7*	1449.92	1^+
		1366.4 *2*	11 *4*	1193.90	
		1418.4 *2*	8.7 *11*	1141.79	
		1570.2 *3*	17.4 *22*	990.15	
		1573.5 *3*	4.4 *22*	987.20	$(1^-,2^-)$
		1608.8‡ *3*	<2.2	951.34	$(1^-,2^-)$
2560.40	(1^+)	1825.5 *3*	7.6 *22*	734.76	
2676.94	1^+	632.5 *1*	15.9 *18*	2044.42	
		1150.9 *2*	100 *9*	1526.06	
		1226.9 *2*	15 *4*	1449.92	1^+
		1320.6 *2*	9.1 *23*	1356.47	
		1386.6 *2*	8.6 *18*	1290.32	
		1726.5‡ *3*	<0.9	951.34	$(1^-,2^-)$
2822.11	(1^+)	1296.2 *2*	65 *23*	1526.06	
		1372.0 *2*	62 *12*	1449.92	1^+
		1834.9 *3*	100 *8*	987.20	$(1^-,2^-)$
		1871.3‡ *3*	<7.7	951.34	$(1^-,2^-)$
3329.5		2378.1 *3*	100	951.34	$(1^-,2^-)$
3380.0		2428.6 *3*	100	951.34	$(1^-,2^-)$

† Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

‡ Placement of transition in the level scheme is uncertain.

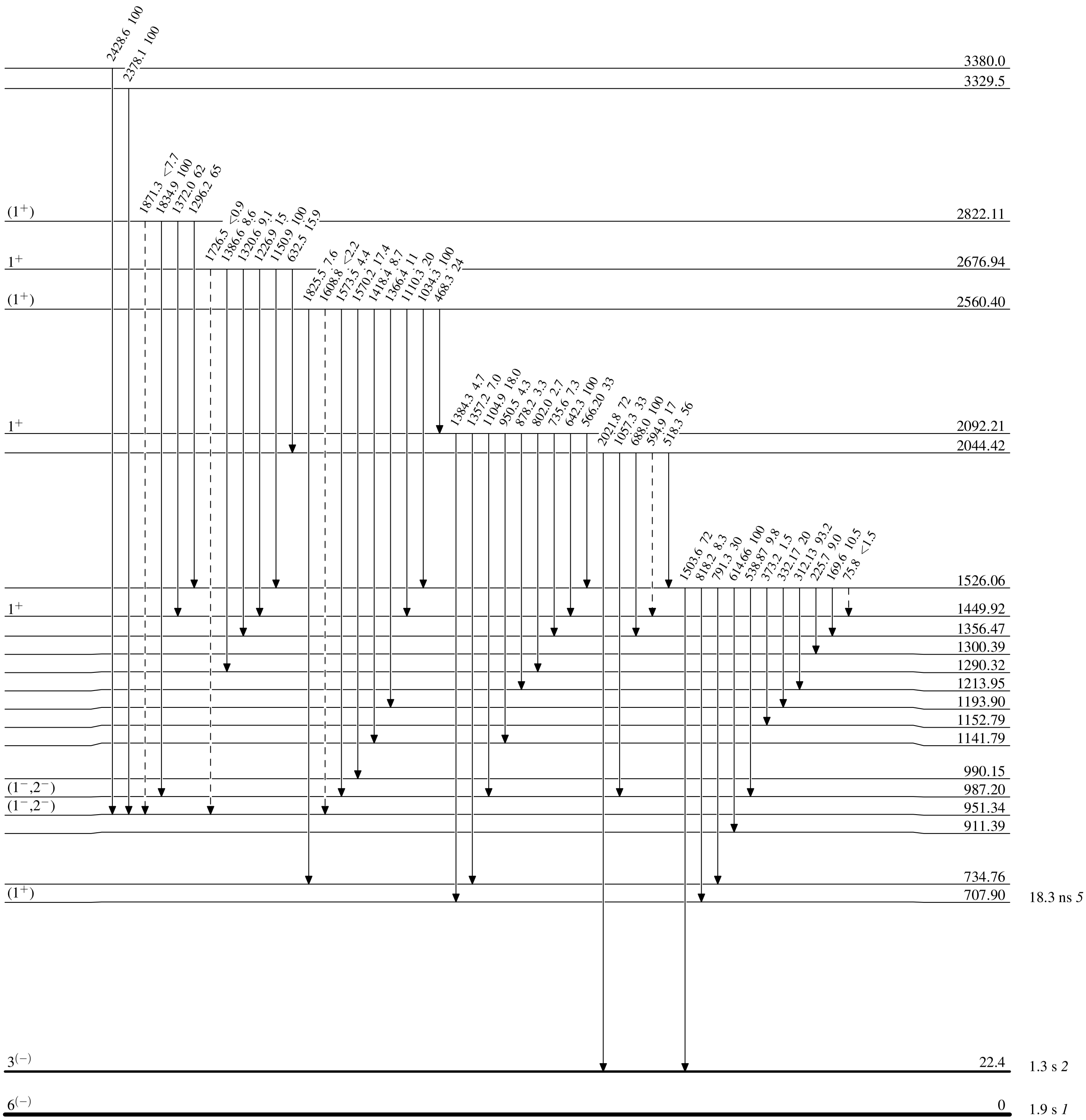
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{80}_{31}Ga_{49}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level