Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 185, 2 (2022)	23-Aug-2022

Q(β^-)=7.39×10^3 20; S(n)=3357.0 29; S(p)=13209 13; Q(α)=−3762 11 2021Wa16
S(2n)=8709 20, S(2p)=25010 200 (syst), Q(β^-n)=1807 20 (2021Wa16).
Isotopic assignment: 1986ReZU, 1987MaZY, 1993Ru01, 2017Wu04.
2016Kn03: measurement of mass excess of ^{149}Ba g.s. using FRS-ESR-facility at GSI.
2017Wu04: The ^{149}Ba nuclide was produced at the RIBF-RIKEN facility using the ^{9}Be(^{238}U,F) reaction at E=345 MeV/nucleon.
   Two experiments, optimized for the transmission of ^{158}Nd and ^{170}Dy ions, were carried out with average beam intensities of 7
   pnA and 12 pnA, respectively. The identification of the nuclide of interest was made in the BigRIPS separator by determining the
   atomic number and the mass-to-charge ratio of the ion using the tof-Bρ-ΔE method. The reaction products were transported
   through the ZeroDegree Spectrometer and implanted into the beta-counting system WAS3ABi that was surrounded by the EURICA
   array comprising of 84 HPGe detectors. The typical implantation rate was 100 ions/s. Measured: implanted ion-β^--t, implanted
   ion-β^--γ-t and implanted ions-γ-t correlations. Deduced: T$_{1/2}$.
2020Wu04: ^{149}Ba nuclide produced at the RIBF-RIKEN facility in ^{9}Be(^{238}U,F) reaction at E=345 MeV/nucleon and an intensity
   of 5pnA. Identification of fission fragments of interest was made based on time-of-flight (tof), magnetic rigidity (Bρ), and energy
   loss (ΔE) using the BigRIPS spectrometer, determining atomic Z and mass-to-charge ratio A/Q, where Q=charge state of the ions.
   The separated nuclei were implanted at a rate of 100 ions/s in the beta counting system of the Wide range Active Silicon-Strip
   Stopper Array for Beta and ion detection (WAS3ABi), which included a stack of five Double Sided Silicon Strip Detectors
   (DSSSDs). The WAS3ABi setup was surrounded by Euroball RIken Cluster Array (EURICA) array of 84 HPGe detectors for γ
   detection. Half-life of the separated and implanted ions was determined by fitting the time distribution of β(implants)- and/or
   $\beta\gamma$(implants)-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β-delayed
   neutron daughter and grand-daughter nuclei, and a constant background. Comparison of measured half-lives with FRDM+QRPA
   (2003), FRDM+QRPA (2019), KTUY+GT2, RHB+pn-RQRPA, and DF+CQRPA theoretical calculations.
Additional information 1.
Theoretical studies: consult the NSR database at www.nndc.bnl.gov/nsr/ for five references for nuclear structure theory, listed under
   'document records' which can be accessed through web retrieval of the ENSDF database at www.nndc.bnl.gov/ensdf/.

^{149}Ba Levels

Cross Reference (XREF) Flags

A	^{149}Cs β^- decay (107 ms)
B	^{150}Cs β^-n decay (81 ms)

E(level)[†]	J$^\pi$	T$_{1/2}$[‡]	XREF	Comments
0.0	(5/2$^-$,3/2$^-$)	352 ms 6	AB	%β^-=100; %β^-n=2.2 17 (1993Ru01,1986ReZU)
				%β^-n is unweighted average of 3.9% 12 (1993Ru01) and 0.58 8 (1986ReZU, previous value was 0.43 12 in 1986Wa17).
				Theoretical T$_{1/2}$=272 ms, %β^-n=0 (2019Mo01).
				Theoretical T$_{1/2}$=177 ms, %β^-n=1.26 and 1.38 for different fission barriers (2021Mi17).
				J$^\pi$: 5/2$^-$ proposed by 2017Li06, based on comparison with J$^\pi$=(5/2$^-$) for ^{147}Ba g.s., but authors mention that 3/2$^-$ is also possible, as 2005Sy01 assigned 3/2$^-$ for g.s. of ^{147}Ba Others: 3/2$^-$ from systematic trend (2021Ko07), and Ω(n)=3/2$^-$ (2019Mo01, theory).
				T$_{1/2}$: weighted average of 368 ms 19 (2020Wu04, (implanted ions)β-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β^-n daughter and grand-daughter nuclei, and a constant background); 352 ms 6 (2017Wu04, implanted ion-β^--t spectrum using the least-squares and maximum-likelihood methods); 324 ms 18 (1993Ru01); and 356 ms 8 (1986ReZU, neutron timing, previous value was 346 ms 6 in 1986Wa17). Other: 0.4 s (γ timing,1987MaZY).

Adopted Levels, Gammas (continued)

^{149}Ba Levels (continued)

E(level)[†]	J[π]	T$_{1/2}$[‡]	XREF	Comments
46.87 *10*	(1/2 to 7/2)[$^-$]	0.6 ns *2*	A	J[π]: γ to (5/2$^-$,3/2$^-$) g.s.
68.19 *9*	(1/2 to 7/2)[$^-$]	0.6 ns *5*	A	J[π]: γ to (5/2$^-$,3/2$^-$) g.s.
124.93 *13*			A	
164.79 *20*	(1/2 to 7/2)$^{(+)}$		A	J[π]: (E1) γ to (5/2$^-$,3/2$^-$) g.s.
236.45 *10*			A	
279.27 *12*			A	
282.73 *10*			AB	
316.56 *9*			AB	
362.29 *23*			A	
389.64 *13*			A	
481.83 *25*			A	
488.05 *10*			A	
665.33 *9*			A	
682.56 *17*			A	
727.05 *16*			A	
911.3 *21*			A	
917.7 *4*			A	

[†] From a least-squares fit to Eγ values. Uncertainties of 205.9γ and 487.7γ were doubled to 0.24 and 0.22 keV, respectively to obtain a better fit for the 488-keV level.

[‡] From βγ(t) in ^{149}Cs β$^-$ decay (2017Li06), except where noted.

γ(^{149}Ba)

E$_i$(level)	J$_i^\pi$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^\pi$	Mult.	α[#]	Comments
46.87	(1/2 to 7/2)[$^-$]	46.80 *18*	100	0.0	(5/2$^-$,3/2$^-$)	[M1][‡]	8.87 *16*	B(M1)(W.u.)=0.036 +*34*−*14*
68.19	(1/2 to 7/2)[$^-$]	68.10 *13*	100	0.0	(5/2$^-$,3/2$^-$)	[M1][‡]	2.98 *4*	B(M1)(W.u.)=0.029 +*145*−*13*
124.93		78.20 *13*	100 *26*	46.87	(1/2 to 7/2)[$^-$]			
		124.70 *23*	77 *11*	0.0	(5/2$^-$,3/2$^-$)			
164.79	(1/2 to 7/2)$^{(+)}$	96.60 *18*	100	68.19	(1/2 to 7/2)[$^-$]	(E1)	0.250 *4*	Mult.: from lack of observation of Ba X-rays in coincidence with the 68.1γ.
236.45		168.10 *11*	100 *13*	68.19	(1/2 to 7/2)[$^-$]			
		189.50 *30*	41 *6*	46.87	(1/2 to 7/2)[$^-$]			
		236.70 *13*	24 *7*	0.0	(5/2$^-$,3/2$^-$)			
279.27		211.20 *11*	100 *14*	68.19	(1/2 to 7/2)[$^-$]			
		279.00 *17*	57 *8*	0.0	(5/2$^-$,3/2$^-$)			
282.73		282.90 *13*	100	0.0	(5/2$^-$,3/2$^-$)			
316.56		248.20 *46*	5.3 *10*	68.19	(1/2 to 7/2)[$^-$]			
		316.6 *1*	100 *5*	0.0	(5/2$^-$,3/2$^-$)			
362.29		294.10 *21*	100	68.19	(1/2 to 7/2)[$^-$]			
389.64		342.90 *19*	100 *15*	46.87	(1/2 to 7/2)[$^-$]			
		389.70 *21*	41 *29*	0.0	(5/2$^-$,3/2$^-$)			
481.83		356.90 *21*	100	124.93				
488.05		171.60 *13*	100 *6*	316.56				
		205.90 *12*	50 *4*	282.73				
		363.30 *21*	26 *8*	124.93				
		441.00 *12*	56 *5*	46.87	(1/2 to 7/2)[$^-$]			
		487.70 *11*	100 *7*	0.0	(5/2$^-$,3/2$^-$)			
665.33		275.90 *21*	21 *3*	389.64				
		348.60 *24*	26 *4*	316.56				
		382.60 *11*	92 *5*	282.73				

Adopted Levels, Gammas (continued)

$\gamma(^{149}$Ba) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f
665.33		665.30 *11*	100 *6*	0.0	$(5/2^-,3/2^-)$
682.56		366.00 *14*	100	316.56	
727.05		490.60 *13*	100	236.45	
911.3		594.7 *21*	100	316.56	
917.7		601.10 *32*	100	316.56	

[†] From ^{149}Cs β^- decay (2017Li06).
[‡] From analogy with ^{147}Ba structure. Pure E2 is not allowed by RUL.
[#] 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.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

601.10 100
594.7 100

490.60 100
366.00 100
665.30 100
382.60 92
348.60 26
275.90 21

487.70 100
441.00 56
363.30 26
205.90 50
171.60 100
356.90 100

389.70 41
342.90 100
294.10 100

316.6 100
248.20 5.3
282.90 100
279.00 57
211.20 100

226.70 24
189.50 41
168.10 100

96.60 (E1) 100

124.70 77
78.20 100

68.10 [M1] 100
46.80 [M1] 100

917.7
911.3

727.05
682.56
665.33

488.05
481.83

389.64
362.29

316.56
282.73
279.27

236.45

(1/2 to 7/2)$^{(+)}$ 164.79

124.93

(1/2 to 7/2)[$^-$]   68.19   0.6 ns 5
(1/2 to 7/2)[$^-$]   46.87   0.6 ns 2

(5/2$^-$,3/2$^-$)   0.0   352 ms 6

$^{149}_{56}$Ba$_{93}$