^{86}Ge β^- decay (221.6 ms) 2015Ma61

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	A. Negret and B. Singh	NDS 203,283 (2025)	20-Jan-2025

Parent: ^{86}Ge: E=0; $J^\pi=0^+$; $T_{1/2}$=221.6 ms *11*; Q(β^-)=9.56×10^3 *44*; %β^- decay=100

^{86}Ge-$T_{1/2}$: from ^{86}Ge Adopted Levels.

^{86}Ge-Q(β^-): From 2021Wa16.

^{86}Ge-%β^- decay: %β^-n=24.5 *12* from ^{86}Ge Adopted Levels. Other: 45 *15* (2013Mi19).

Dataset adapted from a compiled dataset from 2015Ma61 by A.A. Sonzogni (NNDC, BNL), Dec 01, 2015, and made available in the XUNDL database.

2015Ma61: ^{86}Ge beam produced in U(p,F),E=50 MeV at the Holifield Radioactive Ion Beam facility (HRIBF) in ORNL, followed by electromagnetic separation of the fission fragments. The radioactive ion beam pf 18% ^{86}Ge and 82% ^{86}As was implanted on a moving tape collector (MTC). Measured Eγ, Iγ, $\beta\gamma\gamma$-coin, $\gamma\gamma$-coin using four HPGe clover detectors for γ rays and two plastic scintillators for β radiation. Comparison with shell-model calculations. In an earlier study by 2013Ma22 from the same experimental group at ORNL, $T_{1/2}$ of ^{86}Ge decay and energies of two γ rays of 111.7 and 118.9 keV were measured.

Theory references for $T_{1/2}$ of ^{86}Ge decay: 2022Qu03, 2016Sh39, 2016So03, 2015Sa14, 2012Ch48, 2005Bo19, 1981Al25.

The decay scheme is considered incomplete by the evaluators as at least two strong γ rays remain unassigned and unplaced. In addition, large difference between Q(β^-)=9560 *440* and the highest level at 2917 keV in the present decay scheme allows the possibility of unobserved γ transitions from higher levels.

^{86}As Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[‡]	Comments
0.0	(1$^-$,2$^-$)	0.945 s *8*	
7.1 *4*			J^π: (0$^-$,1$^-$,2$^-$) proposed by 2015Ma61.
21.3 *6*			J^π: (0$^-$,1$^-$,2$^-$) proposed by 2015Ma61.
118.9 *3*			J^π: (0$^-$,1$^-$) proposed by 2015Ma61.
244.3 *4*			J^π: (0$^-$,1$^-$) proposed by 2015Ma61.
309.2 *4*			
402.5 *6*			
447.4 *6*			
481.8 *6*			
2084.3 *4*	(1$^+$)		
2916.9 *10*			
3844+x			E(level): x<5716 *444* from Q(β^-)(^{86}Ge)=9560 *440* and S(n)(^{86}As)=3844 *5* (2021Wa16).

[†] From least-squares fit to Eγ data.

[‡] From Adopted Levels, Gammas.

β^- radiations

E(decay)	E(level)	Iβ^-[†]	Comments
(2.6×10^3[#] *26*)	3844+x	24.5 *12*	Iβ^-: from %β^-n=24.5 *12* for ^{86}Ga decay.
(6.6×10^3[‡] *5*)	2916.9		Apparent Iβ=4% *2* (2015Ma61). Evaluators deduce 5.9% *23* using revised γ-normalization factor.
(7.5×10^3 *5*)	2084.3		Apparent Iβ=11% *4* (2015Ma61). Evaluators deduce 19% *5* using revised γ-normalization factor.
(9.1×10^3[‡] *5*)	481.8		Apparent Iβ=2.0% *9* (2015Ma61). Evaluators deduce 3.4% *11* using revised γ-normalization factor.
(9.1×10^3[‡] *5*)	447.4		Apparent Iβ=2.4% *10* (2015Ma61). Evaluators deduce 4.0% *14* using revised γ-normalization factor.
(9.2×10^3[‡] *5*)	402.5		Apparent Iβ=0.9% *5* (2015Ma61). Evaluators deduce 1.7% *7* using revised γ-normalization factor.

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^{86}Ge β^- decay (221.6 ms) 2015Ma61 (continued)

β^- radiations (continued)

E(decay)	E(level)	Comments
(9.3×10^3‡ 5)	309.2	Apparent Iβ=1.3% 5 (2015Ma61). Evaluators deduce 2.3% 7 using revised γ-normalization factor.
(9.3×10^3‡ 5)	244.3	Apparent Iβ=4% 2 (2015Ma61). Evaluators deduce 6.8% 17 using revised γ-normalization factor.
(9.4×10^3‡ 5)	118.9	Iβ=3.6% 33 (2015Ma61). Evaluators deduce 6% 6 using revised γ-normalization factor.
(9.5×10^3 5)	21.3	Iβ$^-$: 2015Ma61 assumed Iβ=0.4% to 4% from expected log *ft*=6.0 to 7.0 for first-forbidden transitions.
(9.6×10^3 5)	7.1	Iβ$^-$: 2015Ma61 assumed Iβ=0.4% to 4% from expected log *ft*=6.0 to 7.0 for first-forbidden transitions.
(9.6×10^3‡ 5)	0.0	Iβ$^-$: 2015Ma61 assumed Iβ=0.4% to 4% from expected log *ft*=6.0 to 7.0 for first-forbidden transitions.

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.
# Estimated for a range of levels.

γ(^{86}As)

From the decay scheme in 2015Ma61, evaluators deduce γ-normalization factor of 0.283 *51* from I(γ+ce)(97.6γ) + I(γ+ce)(111.8γ) + I(γ+ce)(118.9γ) + I(γ+ce)(178.1γ, for mult=M1,E2,E1) + I(γ)(441.1γ)=64 *11* from 100−%β$^-$n (adopted %β$^-$n=24.5 *12*), and estimated 12% *11* (2015Ma61) feeding to the three lowest levels: g.s., 7 keV and 21 keV. However, as the decay scheme is incomplete, no meaningful normalization factor can be adopted.

Eγ‡	Iγ@	E$_i$(level)	E$_f$	J$^\pi_f$	Mult.	α[b]	I(γ+ce)#	Comments
97.6 *5*	10.9 *27*	118.9	21.3		[M1][a]	0.0961 *20*	12 *3*	
111.8 *3*	94 *7*	118.9	7.1		[M1][a]	0.0665 *11*	100 *7*	Eγ=111.7γ from ^{86}Ge β$^-$ decay reported by 2013Ma22. The 111.7γ and 118.9γ in 2013Ma22 were reported to be in coincidence, but in 2015Ma61, gate at 112γ shows no evidence for a 119γ.
118.9 *3*	57 *8*	118.9	0.0	(1$^-$,2$^-$)	[M1][a]	0.0563 *9*	60 *8*	Eγ=118.9γ from ^{86}Ge β$^-$ decay reported by 2013Ma22. The 111.7γ and 118.9γ in 2013Ma22 were reported to be in coincidence, but in 2015Ma61, gate at 112γ shows no evidence for a 119γ.
125.4 *3*	22.9 *38*	244.3	118.9		[M1][a]	0.0488 *8*	24 *4*	
x178.1† *3*	53 *8*							178γ in coin with 240.5γ and 295.2γ. 2015Ma61 mention that this γ is most likely in ^{86}As from ^{86}Ga β$^-$ decay.
190.3& *3*	7.9 *20*	309.2	118.9		[M1][a]	0.01635 *24*	8 *2*	
x240.5† *5*								240.5γ in coin with 178.1γ.
283.6& *5*	6 *2*	402.5	118.9					
x295.2† *5*								295.2γ in coin with 178.1γ.
328.5& *5*	14 *4*	447.4	118.9					
362.9& *5*	12 *3*	481.8	118.9					
x441.1† *3*	30 *5*							2015Ma61 mention that this γ is most likely in ^{86}As from ^{86}Ga β$^-$ decay.
1965.4 *3*	67 *11*	2084.3	118.9					Eγ: doublet resolved from βγγ-coin data (2015Ma61). Iγ: from γγ-coin data.
2798& *1*	21 *7*	2916.9	118.9					

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^{86}Ge β^- decay (221.6 ms) 2015Ma61 (continued)

$\gamma(^{86}As)$ (continued)

† This γ either from β decay or βn decay of ^{86}As. 2015Ma61 state that the 178γ and 441γ most likely originate from the β decay of ^{86}As, but could not be placed in the level scheme.
‡ From 2015Ma61.
# From 2015Ma61, with assumed mult=M1.
@ For low-energy (Eγ<200 keV) transitions, 2015Ma61 provided transition intensity. Relative Iγ values have been deduced by evaluators using conversion coefficients for assumed mult=M1.
& γ observed only in coincidence data.
a 2015Ma61 assumed M1 in contrast to E1 from shell-model considerations, and mult=Q or higher multipolarity for low-energy (E$\gamma\leq$150 keV) transitions are expected to lead to level half-lives of several hundred ns. In the present level scheme there is no evidence for such long-lived isomeric states. Evaluators note, however, that in Fig. 8 of 2015Ma61, agreement is poor between the experimental levels in the present decay scheme and the theoretical levels from shell-model calculations, and it seems that only the negative-parity levels were calculated from shell model.
b Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with "Frozen Orbitals" approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
x γ ray not placed in level scheme.

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Decay Scheme

Intensities: Relative I_γ