^{62}Ge $\varepsilon+\beta^+$ decay (73.5 ms) 2021Or01,2014Gr10

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Huang Xiaolong, and Wang Xianghan	NDS 204,1 (2025)	30-Jun-2023

Parent: ^{62}Ge: E=0.0; $J^\pi=0^+$; $T_{1/2}$=73.5 ms *1*; Q(ε)=9850 *syst*; %ε+%β^+ decay=100

^{62}Ge-$T_{1/2}$: From ^{62}Ge Adopted Levels, where the value is adopted from (implant)β-correlated decay curve with high statistics (2021Or01).

^{62}Ge-Q($\varepsilon+\beta^+$): 9850 *140* (syst,2021Wa16). Other: 9730 *140* (syst,2021Or01).

2021Or01: ^{62}Ge isotope produced in ^{9}Be(^{78}Kr,X),E(^{78}Kr)=345 MeV/nucleon reaction at the RIBF-RIKEN facility. Fragments were separated, selected and identified in mass and charge by the BigRIPS separator according to Bρ-ΔE-tof, and transported and implanted into the WAS3ABi array consisting of three double-sided silicon-strip detectors (DSSSDs) at the exit of the ZeroDegree spectrometer. The γ rays were detected using the EURICA array of HPGe detectors. Measured Eγ, Iγ, implant-decay time correlations. Deduced parent levels, J^π, and Gamow-Teller strengths. See also 2023OrZZ.

Additional information 1.

2014Gr10: study of Gamow-Teller decay of T=1, $J^\pi=0^+$ ^{62}Ge g.s. to N=Z ^{62}Ga nucleus. The ^{62}Ge source was formed in fragmentation of 750 MeV/nucleon ^{78}Kr beam impinging a ^{9}Be target, followed by Bρ-ΔE-Bρ and time-of-flight analysis by using FRS fragment separator and various scintillation and ionization detectors at GSI facility. The ions of ^{62}Ga were implanted into a pack of six 1 mm thick double-sided silicon strip detectors (DSSSDs). Measured Eγ, Iγ, (particle)γ-coin, (fragment)β- and $\beta\gamma$-coin, half-life of ^{62}Ge ground state. Deduced levels, J^π, ε feedings, log *ft* values, B(GT) strengths. Comparison with shell model and QRPA calculations.

^{62}Ga Levels

1247.2- and 2413.9-keV levels proposed by 2014Gr10 are omitted as the respective ground-state transitions of 1247.2 keV and 2413.9 keV have not been seen in better statistics experiment by by 2021Or01.

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	0^+	116.123 ms *25*	$T_{1/2}$: from the Adopted Levels.
571.3 *1*	1^+		
978.3 *1*	1^+		
1017.1 *1*	1^+		
1117.4 *2*	1^+		
1359.7 *2*	1^+		
1899.3 *4*	1^+		
2010.9 *4*	1^+		
2164.1 *4*	1^+		
2641.9 *5*	1^+		
2966.9 *5*	1^+		
3339.7 *5*	1^+		
3594.8 *4*	1^+		

† From γ-ray energies.

‡ As given in 2021Or01, based on allowed log *ft* values from 0^+ parent (^{62}Ge g.s.). Values are the same in the Adopted Levels.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
(6255 *syst*)	3594.8	0.6 *1*	0.0033 *6*	4.61 *9*	0.6 *1*	av Eβ=2.41×10^3 *7*; εK=0.00487 *42*; εL=5.53×10^{-4} *48*; εM+=1.00×10^{-4} *8* B(GT)=0.07 *1* (2021Or01).
(6510 *syst*)	3339.7	0.30 *6*	0.0015 *3*	5.01 *10*	0.30 *6*	av Eβ=2.54×10^3 *7*; εK=0.00424 *35*; εL=4.82×10^{-4} *40*; εM+=8.7×10^{-5} *7*

Continued on next page (footnotes at end of table)

^{62}Ge $\varepsilon+\beta^+$ decay (73.5 ms) 2021Or01,2014Gr10 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
						B(GT)=0.030 *7* (2021Or01).
(6883 *syst*)	2966.9	0.35 *6*	0.0014 *3*	5.08 *9*	0.35 *6*	av Eβ=2.72×10^3 *7*; εK=0.00351 *27*; εL=3.99×10^{-4} *31*; εM+=7.3×10^{-5} *5*
						B(GT)=0.028 *5* (2021Or01).
(7208 *syst*)	2641.9	0.4 *1*	0.0014 *4*	5.13 *12*	0.4 *1*	av Eβ=2.88×10^3 *7*; εK=0.00300 *22*; εL=3.41×10^{-4} *25*; εM+=6.17×10^{-5} *41*
						B(GT)=0.029 *7* (2021Or01).
(7686 *syst*)	2164.1	2.6 *2*	0.0071 *7*	4.46 *6*	2.6 *2*	av Eβ=3.11×10^3 *7*; εK=0.00242 *16*; εL=2.76×10^{-4} *19*; εM+=4.99×10^{-5} *31*
						B(GT)=0.13 *1* (2021Or01), 0.17 *5* (2014Gr10).
(7839 *syst*)	2010.9	0.96 *8*	0.0025 *3*	4.94 *6*	0.96 *8*	av Eβ=3.18×10^3 *7*; εK=0.00227 *15*; εL=2.58×10^{-4} *17*; εM+=4.67×10^{-5} *28*
						B(GT)=0.045 *5* (2021Or01).
(7951 *syst*)	1899.3	0.58 *6*	0.00143 *18*	5.20 *6*	0.58 *6*	av Eβ=3.24×10^3 *7*; εK=0.00217 *14*; εL=2.46×10^{-4} *16*; εM+=4.46×10^{-5} *26*
						B(GT)=0.025 *3* (2021Or01).
(8490 *syst*)	1359.7	0.70 *5*	0.00139 *13*	5.27 *5*	0.70 *5*	av Eβ=3.50×10^3 *7*; εK=0.00175 *11*; εL=1.99×10^{-4} *12*; εM+=3.60×10^{-5} *20*
						B(GT)=0.022 *2* (2021Or01).
(8733 *syst*)	1117.4	0.41 *4*	0.00074 *7*	5.56 *6*	0.41 *4*	av Eβ=3.62×10^3 *7*; εK=0.00160 *9*; εL=1.82×10^{-4} *11*; εM+=3.28×10^{-5} *17*
						B(GT)=0.011 *2* (2021Or01).
(8833 *syst*)	1017.1	2.6 *1*	0.0046 *3*	4.79 *4*	2.6 *1*	av Eβ=3.67×10^3 *7*; εK=0.00154 *9*; εL=1.75×10^{-4} *10*; εM+=3.17×10^{-5} *17*
						B(GT)=0.067 *6* (2021Or01), 0.054 *+13−19* (2014Gr10).
(8872 *syst*)	978.3	1.8 *1*	0.0031 *7*	4.96 *5*	1.8 *1*	av Eβ=3.69×10^3 *7*; εK=0.00152 *9*; εL=1.73×10^{-4} *10*; εM+=3.12×10^{-5} *16*
						B(GT)=0.047 *4* (2021Or01), 0.050 *+15−17* (2014Gr10).
(9279 *syst*)	571.3	3.4 *1*	0.005 *5*	4.79 *4*	3.4 *1*	av Eβ=3.89×10^3 *7*; εK=0.00131 *7*; εL=1.49×10^{-4} *8*; εM+=2.71×10^{-5} *13*
						B(GT)=0.068 *6* (2021Or01), 0.070 *17* (2014Gr10).
(9850 *syst*)	0.0	85.19 *33*	0.105 *15*	3.525 *34*	85.30 *33*	av Eβ=4.17×10^3 *7*; εK=0.00109 *6*; εL=1.24×10^{-4} *6*; εM+=2.23×10^{-5} *10*
						I($\varepsilon+\beta^+$): from 100 − summed Iγ to g.s.
						B(F)=2.0 (2021Or01).
						Value of log *ft*=3.525 *34* probably suggests this β transition to be superallowed as it overlaps unweighted averaged log *ft* of 3.485 *1*, deduced from 15 precise (uncertainties of ≤6.9) *ft* values of superallowed β transitions listed in Table XVI of 2020Ha30 evaluation. If Q(ε)=9730 *140*, as suggested by 2021Or01 is used, then log *ft*=3.49 *4*.

† From 2021Or01, deduced from %Iγ of the single transition to g.s. from each level, unless otherwise noted.
‡ Absolute intensity per 100 decays.

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$\gamma(^{62}Ga)$

Iγ normalization: Absolute γ-ray intensities (i.e. per 100 decays) are given by 2021Or01.
1247.2-keV γ ray with Iγ=2.1 *+9–7* and 2413.9-keV γ ray with Iγ=1.8 *+8–7* reported by 2014Gr10 are omitted as these have not been seen in better statistics data in 2021Or01.

E_γ [†]	I_γ [†‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [#]	Comments
571.3 *1*	3.4 *1*	571.3	1^+	0.0	0^+	[M1]	9.22×10^{-4} *13*	α(K)=0.000825 *12*; α(L)=8.38×10^{-5} *12*; α(M)=1.226×10^{-5} *17*; α(N)=6.64×10^{-7} *9* Other: Eγ=571.3 *2*, Iγ=3.9 *+8–6* (2014Gr10).
978.3 *1*	1.8 *1*	978.3	1^+	0.0	0^+	[M1]	2.92×10^{-4} *4*	α(K)=0.000261 *4*; α(L)=2.63×10^{-5} *4*; α(M)=3.85×10^{-6} *5*; α(N)=2.091×10^{-7} *29* Other: Eγ=978.0 *4*, Iγ=2.1 *+7–6* (2014Gr10).
1017.1 *1*	2.6 *1*	1017.1	1^+	0.0	0^+	[M1]	2.69×10^{-4} *4*	α(K)=0.0002413 *34*; α(L)=2.429×10^{-5} *34*; α(M)=3.55×10^{-6} *5*; α(N)=1.931×10^{-7} *27* Other: Eγ=1017.1 *4*, Iγ=2.2 *+8–6* (2014Gr10).
1117.4 *2*	0.41 *4*	1117.4	1^+	0.0	0^+	[M1]	2.24×10^{-4} *3*	α(K)=0.0001996 *28*; α(L)=2.007×10^{-5} *28*; α(M)=2.94×10^{-6} *4* α(N)=1.596×10^{-7} *22*; α(IPF)=9.50×10^{-7} *14*
1359.7 *2*	0.70 *5*	1359.7	1^+	0.0	0^+	[M1]	1.84×10^{-4} *3*	α(K)=0.0001357 *19*; α(L)=1.362×10^{-5} *19*; α(M)=1.992×10^{-6} *28* α(N)=1.084×10^{-7} *15*; α(IPF)=3.21×10^{-5} *5*
1899.3 *4*	0.58 *6*	1899.3	1^+	0.0	0^+	[M1]	2.97×10^{-4} *4*	α(K)=7.28×10^{-5} *10*; α(L)=7.28×10^{-6} *10*; α(M)=1.064×10^{-6} *15* α(N)=5.80×10^{-8} *8*; α(IPF)=0.0002157 *30*
2010.9 *4*	0.96 *8*	2010.9	1^+	0.0	0^+	[M1]	3.37×10^{-4} *5*	α(K)=6.57×10^{-5} *9*; α(L)=6.57×10^{-6} *9*; α(M)=9.60×10^{-7} *13* α(N)=5.23×10^{-8} *7*; α(IPF)=0.000264 *4*
2164.1 *4*	2.6 *2*	2164.1	1^+	0.0	0^+	[M1]	3.95×10^{-4} *6*	α(K)=5.77×10^{-5} *8*; α(L)=5.76×10^{-6} *8*; α(M)=8.43×10^{-7} *12* α(N)=4.59×10^{-8} *6*; α(IPF)=0.000331 *5* Other: Eγ=2162.4 *6*, Iγ=3.5 *+9–10* (2014Gr10).
2641.8 *5*	0.4 *1*	2641.9	1^+	0.0	0^+	[M1]	5.87×10^{-4} *8*	α(K)=4.10×10^{-5} *6*; α(L)=4.09×10^{-6} *6*; α(M)=5.98×10^{-7} *8* α(N)=3.26×10^{-8} *5*; α(IPF)=0.000541 *8*
2966.8 *5*	0.35 *6*	2966.9	1^+	0.0	0^+	[M1]	7.17×10^{-4} *10*	α(K)=3.38×10^{-5} *5*; α(L)=3.37×10^{-6} *5*; α(M)=4.93×10^{-7} *7* α(N)=2.69×10^{-8} *4*; α(IPF)=0.000679 *10*
3339.6 *5*	0.30 *6*	3339.7	1^+	0.0	0^+	[M1]	8.60×10^{-4} *12*	α(K)=2.79×10^{-5} *4*; α(L)=2.78×10^{-6} *4*; α(M)=4.07×10^{-7} *6* α(N)=2.217×10^{-8} *31*; α(IPF)=0.000829 *12*
3594.7 *4*	0.6 *1*	3594.8	1^+	0.0	0^+	[M1]	9.54×10^{-4} *13*	α(K)=2.484×10^{-5} *35*; α(L)=2.475×10^{-6} *35*; α(M)=3.62×10^{-7} *5* α(N)=1.973×10^{-8} *28*; α(IPF)=0.000927 *13*

[†] From 2021Or01. Available values from 2014Gr10 are listed under comments. Intensities are per 100 decays of ^{62}Ge.
[‡] Absolute intensity per 100 decays.
[#] 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.

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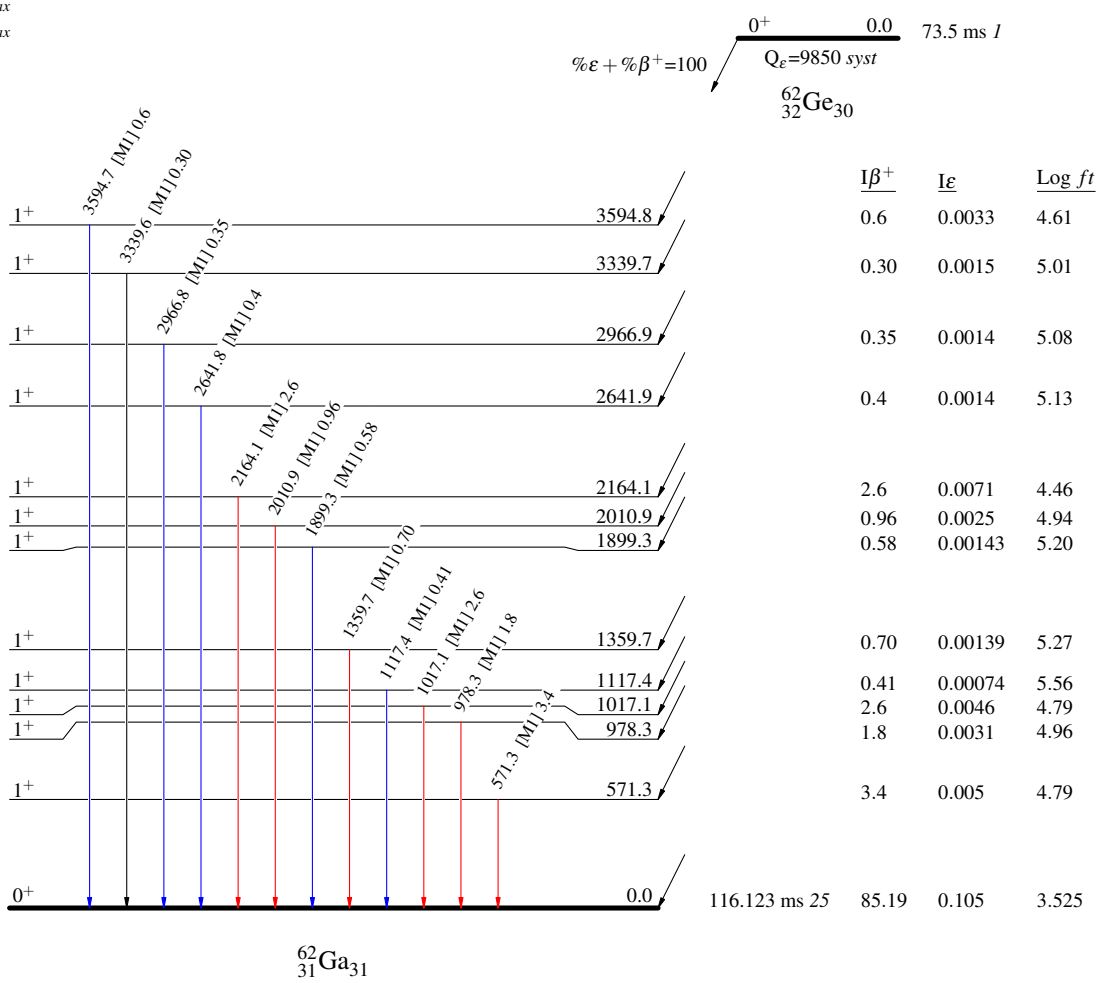
Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



		Iβ+	Iε	Log *ft*
3594.8		0.6	0.0033	4.61
3339.7		0.30	0.0015	5.01
2966.9		0.35	0.0014	5.08
2641.9		0.4	0.0014	5.13
2164.1		2.6	0.0071	4.46
2010.9		0.96	0.0025	4.94
1899.3		0.58	0.00143	5.20
1359.7		0.70	0.00139	5.27
1117.4		0.41	0.00074	5.56
1017.1		2.6	0.0046	4.79
978.3		1.8	0.0031	4.96
571.3		3.4	0.005	4.79
0.0	116.123 ms *25*	85.19	0.105	3.525