^{82}Ge β^- decay 2015Et01,2014Mi16

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. K. Tuli, E. Browne	NDS 157, 260 (2019)	1-Mar-2019

Parent: ^{82}Ge: E=0.0; $J^\pi=0^+$; $T_{1/2}$=4.0 s *7*; Q(β^-)=4688 *5*; %β^- decay=100.0

^{82}Ge-$T_{1/2}$: From Adopted Levels.

^{82}Ge-Q(β^-): From 2017Wa10.

Based on 2015Et01 and 2014Mi16 compilations in XUNDL.

2015Et01 compiled by A.A. Sonzogni (BNL), June 29, 2015; edited by B. Singh (McMaster), July 1, 2015.

2014Mi16: Compiled by B. Singh (McMaster), Sept 18, 2014.

2015Et01: ^{82}Ge nuclides obtained from ^{238}U(e,F), E=50 MeV, separated by the PARRNe mass separator at the ALTO facility. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels, J, π, β feedings, log *ft* Gammas detected with two EXOGAM prototype detectors, two EUROGAM-1 type detectors and one large coaxial Ge detector. Plastic detectors were used for betas.

2014Ma16: ^{82}Ge source obtained from delayed neutron decay of ^{83}Ga, which was produced in the fission of uranium (UC_x target) by 50-MeV proton beam from HRIBF-ORNL facility. ^{83}Ga ions were extracted from the resonant ionization laser ion source (RILIS setup), followed by mass separation. Isotopically pure ^{83}Ga beam was sent to Low-energy Radioactive Ion Beam Spectroscopy Station (LeRIBSS). ^{83}Ga decays 62.8% by delayed neutron emission to ^{82}Ge. Measured Eγ, Iγ, $\gamma\gamma$-, $\beta\gamma$-, and nγ-coin using two HPGe Clover detectors for γ rays, two plastic scintillators for β particles, an array of 48 ^{3}He ionization chambers for neutron detection. Deduced levels, J, π, β feedings, log *ft* values. Comparison with shell-model calculations.

Although 2015Et01, 2014Mi16 have extended the decay scheme it continues to be incomplete; 2015Et01 suspect presence of some high- lying 1^+ states decaying directly to the g.s.. See also comment on Iβ.

Others:

1981Ho24,1980HoZN: Mass-separated fission product; measured γ, $\gamma\gamma$, ce;Ge(Li), Si(Li). Authors observed only E(levels)=843.19 *4* (Eγ=843.24 *5*), 952.16 *10* (tentative level not confirmed, 951.9γ placed elsewhere), 1091.97 *4* (Eγ=248.84 *5*, 1091.90 *3*).

1973KrZN, 1981ZeZY fast chemical separations.

^{82}As Levels

E(level)†	J^π‡	$T_{1/2}$#	Comments
0.0	(2^-)	19.1 s *5*	J^π: From 2014Mi16, 2004Ga44.
131.6 *5*	(5^-)	13.6 s *4*	E(level): 132.1 *3* obtained in 2014Mi16 is in agreement with 128 keV *6* from mass measurement (2008Ha23).
224.2 *6*	(4^-)		
516.63 *16*	$(0^-,1^-,2^-)$		E(level): note that the ordering of the 575.5-516.5 γ cascade is reversed in 2014Mi16, thus defining a level here at 516.6 keV instead of a level at 576 keV as in 2014Mi16.
553.46 *24*	$(3^-,4^-)$		
671.6 *6*	(2^-)		
843.15 *17*	(1^+)@		J^π: $(0,1)^-$ given by 2015Et01.
980.14 *24*	(2^+)		
1092.05 *15*	1^+		
1369.5 *4*	$(0^-,1)$		J^π: from log *ft*=6.67 *12* from 0^+ parent; no assignment in 2015Et01.
2044.12 *20*	(1^+)@		J^π: $(0^-,1)$ given by 2015Et01.
2291.4 *4*	(1^+)@		J^π: $(0^-,1)$ given by 2015Et01.
2420.8 *6*			J^π: $(0^-,1)$ from log *ft*=6.13 *11* from 0^+ parent in conflict with decay to (4^-); no assignment in 2015Et01.
2443.0 *4*	(1^+)@		J^π: $(0^-,1)$ given by 2015Et01.

† From least-squares fit to Eγ.

‡ Adopted values. J^π from 2015Et01 for E > 131.6, except where noted.

From ^{82}As Adopted Levels.

@ From log *ft* values, assuming allowed if less than 5.9. The values given by 2015Et01 are given as comments. The authors state that their logft values are lower limits.

^{82}Ge β^- decay 2015Et01,2014Mi16 (continued)

β^- radiations

E(decay)	E(level)	Iβ^-[†‡#]	Log *ft*	Comments
(2245 *5*)	2443.0	0.31 *7*	5.66 *13*	av Eβ=920.5 *24* Iβ^-: 0.31 *8* given by 2015Et01.
(2267 *5*)	2420.8	0.093 *18*	6.20 *12*	av Eβ=930.9 *24* Iβ^-: 0.10 *3* given by 2015Et01.
(2397 *5*)	2291.4	0.65 *18*	5.45 *15*	av Eβ=991.6 *24* Iβ^-: 0.6 *2* given by 2015Et01.
(2644 *5*)	2044.12	1.7 *4*	5.22 *13*	av Eβ=1108.2 *24* Iβ^-: 1.7 *4* given by 2015Et01.
(3319 *5*)	1369.5	0.17 *4*	6.64 *13*	av Eβ=1429.3 *24* Iβ^-: 0.17 *4* given by 2015Et01.
(3596 *5*)	1092.05	80 *8*	4.12 *9*	av Eβ=1562.3 *24* Iβ^-: 80 *20* given by 2015Et01.
(3708[@] *5*)	980.14			Iβ^-: 0.05 *11* from intensity balance. 2015Et01 give ≤0.1.
(3845 *5*)	843.15	2.7 *5*	5.72 *11*	av Eβ=1681.9 *24* Iβ^-: 2.7 *7* given by 2015Et01.
(4016 *5*)	671.6	0.18 *11*	8.6[1u] *3*	av Eβ=1767.0 *24* Iβ^-: 0.17 *7* given by 2015Et01.
(4171[@] *5*)	516.63	0.12 *11*	7.2 *4*	av Eβ=1839.3 *25* Iβ^-: 0.11 *3* given by 2015Et01.

† From gamma transition intensity balance at each level. The values reported by 2015Et01 are given as a comment and are obtained assuming β feeding of 80% *20* for the 1092-keV level.

‡ 2014Mi16 conclude that 14.6% β intensity is unaccounted. from intensity balance,evaluators find unaccounted β feeding of 14 *7*. Allowing for <0.7% β feeding to ground state, other 13% *7* must be associated with unobserved excited states in ^{82}As.

Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

$\gamma(^{82}As)$

Iγ normalization: From absolute intensity (photons per 100 decays of the parent) of 1092γ from the decay of ^{82}Ge, which was obtained by determining number of ^{83}Ga from measured absolute intensity of 1348γ from its decay (2004Ga44). This value compares well with absolute intensity of 80% *20* determined by 2004Ga44.

E$_\gamma$[†]	I$_\gamma$[†#]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.	α[@]	Comments
92.6 *4*	1.0 *5*	224.2	(4$^-$)	131.6	(5$^-$)	[M1]	0.1110 *21*	α(K)=0.0985 *19*; α(L)=0.01071 *20*; α(M)=0.00164 *3*; α(N)=0.0001233 *23* 92.6γ decay curve yields T$_{1/2}$(^{82}Ge)=3.9 s *6*.
249.1 *5*	3.6 *4*	1092.05	1$^+$	843.15	(1$^+$)			
329.3 *3*	0.5 *1*	553.46	(3$^-$,4$^-$)	224.2	(4$^-$)			329.3γ decay curve yields T$_{1/2}$(^{82}Ge)=4.1 s *11*.
420.4 *5*	0.27 *9*	1092.05	1$^+$	671.6	(2$^-$)			420.4γ decay curve yields T$_{1/2}$(^{82}Ge)=3.1 s *8*.
426.6 *2*	0.87 *9*	980.14	(2$^+$)	553.46	(3$^-$,4$^-$)			426.6γ decay curve yields T$_{1/2}$(^{82}Ge)=4.8 s *11*.
447.4 *3*	0.5 *1*	671.6	(2$^-$)	224.2	(4$^-$)			447.4γ decay curve yields T$_{1/2}$(^{82}Ge)=4.9 s *13*.
516.5[‡] *2*	1.25 *9*	516.63	(0$^-$,1$^-$,2$^-$)	0.0	(2$^-$)			516.5γ decay curve yields T$_{1/2}$(^{82}Ge)=4.5 s *16*.
526.3 *3*	0.22 *4*	1369.5	(0$^-$,1)	843.15	(1$^+$)			
553.1 *4*	0.20 *4*	553.46	(3$^-$,4$^-$)	0.0	(2$^-$)			

Continued on next page (footnotes at end of table)

^{82}Ge β^- decay 2015Et01,2014Mi16 (continued)

$\gamma(^{82}As)$ (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J_i^π	E_f	J_f^π	Comments
575.3[‡] *2*	1.1 *1*	1092.05	1^+	516.63	$(0^-,1^-,2^-)$	575.3γ decay curve yields $T_{1/2}(^{82}Ge)$=4.0 s *11*.
843.4 *2*	8.0 *3*	843.15	(1^+)	0.0	(2^-)	843.4γ decay curve yields $T_{1/2}(^{82}Ge)$=3.5 s *7*.
951.8 *3*	1.4 *4*	2044.12	(1^+)	1092.05	1^+	951.8γ decay curve yields $T_{1/2}(^{82}Ge)$=3.9 s *12*.
1063.9 *3*	0.16 *4*	2044.12	(1^+)	980.14	(2^+)	
1092.0 *2*	100 *6*	1092.05	1^+	0.0	(2^-)	1092.0γ decay curve yields $T_{1/2}(^{82}Ge)$=5.0 s *7*.
1199.1 *6*	0.5 *2*	2291.4	(1^+)	1092.05	1^+	1199.1γ decay curve yields $T_{1/2}(^{82}Ge)$=3.4 s *13*.
1201.1 *2*	0.6 *2*	2044.12	(1^+)	843.15	(1^+)	1201.1γ decay curve yields $T_{1/2}(^{82}Ge)$=3.9 s *23*.
1311.3 *3*	0.34 *7*	2291.4	(1^+)	980.14	(2^+)	1311.3γ decay curve yields $T_{1/2}(^{82}Ge)$=4.6 s *23*.
1462.4 *5*	0.31 *7*	2443.0	(1^+)	980.14	(2^+)	
1600.1 *4*	0.09 *2*	2443.0	(1^+)	843.15	(1^+)	
2196.6 *2*	0.12 *2*	2420.8		224.2	(4^-)	

[†] From 2015Et01.
[‡] Note that the ordering of the 575-515 γ cascade is reversed in 2014Mi16, thus defining a level here at 515 keV instead of 575 keV as in 2014Mi16.
[#] For absolute intensity per 100 decays, multiply by 0.774 *63*.
[@] 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.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays