^{82}Zn β^- decay 2016Al10

History

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

Parent: ^{82}Zn: E=0.0; $J^\pi=0^+$; $T_{1/2}$=166 ms *11*; Q(β^-)=10617 *4*; %β^- decay=100.0

^{82}Zn-Q(β^-): From 2017Wa10.

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

2016Al10: ^{82}Zn produced in the fission of ^{238}U target of 6 g/cm^2 thickness by a 50 MeV proton beam from the Holifield Radioactive Ion Beam Facility (hribf) at Oak Ridge National Laboratory, followed by two-step high-resolution mass separation. Measured Eγ, Iγ, $\beta\gamma$ coin, $\gamma\gamma$ coin, half-life of ^{82}Zn decay, and %β^-n. Deduced level scheme of ^{82}Ga.

^{82}Ga Levels

E(level)	J^π[†]	$T_{1/2}$[#]	Comments
0.0	(2$^-$)	0.600 s *2*	J^π: 2016Al10 assigned firm 2$^-$ by citing the laser spectroscopy work of 2012Ch51; however, this assignment is tentative as J=1 and 3 were not ruled out, and the parity is based only on a comparison of measured magnetic moment with shell-model predictions.
34.5 *1*	(2$^-$)	<10 ns	J^π: See Adopted Levels, Gammas for J^π=(2$^-$,3$^-$) Assignment.
140.7 *3*	(4$^-$)	89 ns *9*	
366.3 *2*	(1$^-$,0$^-$)[‡]		
529.7 *3*	(0$^-$,1$^-$)[‡]		
2978.6 *4*	(1$^+$)		
3374+x			E(level): S(n)(^{82}Ga)=3374 *4* (2017Wa10); x<7243 *4* from Q(β^-)(^{82}Zn decay)=10617 *4*.

[†] Adopted values as proposed in 2016Al10, based on allowed or forbidden nature of the β transitions.

[‡] Possible first-forbidden β decay from $J^\pi=0^+$ parent nuclide.

[#] From Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(4×10^3[@] *4*)	3374+x	69 *7*		Iβ^-: from measured %β^-n=69 *7* in 2016Al10.
(7638 *4*)	2978.6	18 *6*	4.84 *15*	av Eβ=3526.4 *20*
(10087 *4*)	529.7	6.7 *16*	5.83 *11*	av Eβ=4715.2 *20*
(10251 *4*)	366.3	4 *3*	6.1 *4*	av Eβ=4794.4 *20*
(10476 *4*)	140.7	<1.2	>6.7	av Eβ=4903.7 *20*
(10583 *4*)	34.5	<3	>6.3	av Eβ=4955.1 *20*
(10617[#] *4*)	0.0	<1.0	>9.2[1u]	av Eβ=4980.8 *20*
				Iβ^-: estimated by 2016Al10 from expected average log *ft* value of 9.5 *8* for first-forbidden unique β transition.

[†] Values should be considered as approximate feedings since some γ rays from higher energy levels may have been missed.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

[@] Estimated for a range of levels.

^{82}Zn β^- decay 2016Al10 (continued)

$\gamma(^{82}Ga)$

Iγ normalization: Summed γ-ray transition intensity to g.s. = 30% *7*, using measured %β^-n=69% *7* (2016Al10) for ^{82}Zn decay, and <1% β^- feeding to the ^{82}Ga g.s.

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[‡]	$I_{(\gamma+ce)}$[#]	Comments
34.5 *1*	10.1 *10*	34.5	(2$^-$)	0.0	(2$^-$)	[M1]	1.394 *23*	24.2 *25*	%Iγ=5.0 *13* α(K)=1.239 *21*; α(L)=0.1344 *22*; α(M)=0.0197 *4* α(N)=0.001030 *17* $I_{(\gamma+ce)}$: from the γ-transition intensity balance at 34.5. It appears to the evaluatorrs that Iγ=24.2 *25* listed in Table I and Fig. 7 of 2016Al10 is Iγ+ce value, with the assumption of mult=M1 for 34.5γ. Mult.: M1 is consistent with short half-life (<10 ns) of 34.5 level.
^{x}42[†]									
^{x}49[†]									
^{x}60[†]									
^{x}72[†]									
^{x}85[†]									
140.7 *3*	1.4 *6*	140.7	(4$^-$)	0.0	(2$^-$)	[E2]	0.193 *4*	1.7 *7*	%Iγ=0.7 *4* α(K)=0.171 *3*; α(L)=0.0197 *4*; α(M)=0.00286 *5* α(N)=0.0001318 *22* $I_{(\gamma+ce)}$: from the γ-transition intensity balance at 140.7. It appears to the evaluators that Iγ=1.7 *7* listed in Table I and Fig. 7 of 2016Al10 is Iγ+ce value, with the assumption of mult=E2 for 140.7γ. Mult.: E2 is consistent with isomer half-life.
163.3 *2*	3.5 *4*	529.7	(0$^-$,1$^-$)	366.3	(1$^-$,0$^-$)	[M1+E2]	0.065 *46*		%Iγ=1.72 *24* α(K)=0.057 *41*; α(L)=0.0064 *47*; α(M)=9.3×10^{-4} *67* α(N)=4.5×10^{-5} *31*
^{x}168[†]									
^{x}247[†]									
^{x}340[†]									
366.3 *2*	22.7 *30*	366.3	(1$^-$,0$^-$)	0.0	(2$^-$)	[M1,E2]	0.0043 *17*		%Iγ=11 *3* α(K)=0.0038 *16*; α(L)=4.0×10^{-4} *17*; α(M)=5.8×10^{-5} *24* α(N)=3.0×10^{-6} *12*
530.0 *5*	10.0 *10*	529.7	(0$^-$,1$^-$)	0.0	(2$^-$)	[M1,E2]	0.0014 *4*		%Iγ=4.9 *13* α(K)=0.0013 *4*; α(L)=1.33×10^{-4} *34*; α(M)=1.95×10^{-5} *50* α(N)=1.03×10^{-6} *25*
2612.9 *11*	11.5 *50*	2978.6	(1$^+$)	366.3	(1$^-$,0$^-$)				%Iγ=5.7 *25*

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^{82}Zn β^- decay 2016Al10 (continued)

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

E_γ	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Comments
2943.8 *4*	23.7 *49*	2978.6	(1^+)	34.5	(2^-)	%Iγ=12 *3*
2978.7 *6*	2.4 *19*	2978.6	(1^+)	0.0	(2^-)	%Iγ=1.2 *10*

† γ ray in coin with 85γ but could not be assigned to any specific nuclide.
‡ Additional information 1.
# For absolute intensity per 100 decays, multiply by 0.49 *11*.
x γ ray not placed in level scheme.

^{82}Zn β^- decay 2016Al10

Decay Scheme

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