^{81}As β^- decay 1974Ch11,1975Kr08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 199,271 (2025)	1-Sep-2024

Parent: ^{81}As: E=0; J^π=3/2$^-$; $T_{1/2}$=33.3 s *10*; Q(β^-)=3855.7 *28*; %β^- decay=100

^{81}As-Q(β^-): from 2021Wa16.

Others: 1960Mo01, 1972De43, 1990Ru05.

1974Ch11: ^{81}As produced by ^{82}Se(γ,p), Ge(Li) detectors (FWHM=1.6 keV at 574 keV for Ge(Li) used for Eγ<1300); measured Eγ, Iγ, $T_{1/2}$.

1975Kr08: ^{81}As produced in ^{233,235}U(thermal n,f) or ^{82}Se(n,pn), Ge(Li) detectors, FWHM=2.1 to 2.8 keV at Eγ=1332; measured Eγ, Iγ.

1960Mo01: Measured $T_{1/2}$ of ^{81}As, β endpoint energy.

1972De43: ^{81}As was obtained from ^{81}Ge decay, the latter was produced from fast radiochemical separation at short time intervals from fission products in ^{235}U(n,f). NaI(Tl) crystal. Reported partial level scheme.

^{81}Se Levels

E(level)†	J^π#	$T_{1/2}$#	E(level)†	J^π#
0	1/2$^-$	18.5 min *1*	2179.18 *19*	
102.86 *13*	7/2$^+$	57.28 min *2*	2332.49 *13*	5/2$^+$
467.66 *11*	3/2$^-$		2569.86 *13*	(1/2$^-$,3/2$^-$,5/2$^-$)
490.82 *11*	(5/2$^-$)		2659.65 *20*	(5/2)$^-$
623.89 *16*	5/2$^-$		2769.61 *19*	(5/2$^-$)
1052.83 *20*	5/2$^+$		2935.12 *18*	(5/2)$^-$
1303.48 *20*	5/2$^+$		2965.01 *21*	(5/2$^-$)
1406.13 *13*	3/2$^-$		3222.6?‡ *15*	(5/2)$^-$
2029.60 *16*	1/2$^-$,3/2$^-$			

† From a least-squares fit to Eγ.

‡ Level proposed by 1974Ch11. However, the two deexciting Eγ yield poor fit, differing by at least 5σ from the least-squares adjusted value. E=3221.1 *2* based on 3118γ alone and E=3224.2 *2* based on 2733γ alone. Evaluator adopts unweighted average (3222.7 *16*) in preference to the least-squares adjusted value of 3222.75 *17*.

From Adopted Levels.

β^- radiations

Measured average Eβ=1600 *30* (1990Ru05).

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(633.1# *33*)	3222.6?	<0.13	>4.9	av Eβ=209.2 *12*
(890.7 *30*)	2965.01	≈0.21	≈5.19	av Eβ=312.6 *12*
(920.6 *30*)	2935.12	≈0.46	≈4.90	av Eβ=325.0 *12*
(1086.1 *30*)	2769.61	≈0.33	≈5.32	av Eβ=394.9 *12*
(1196.1 *30*)	2659.65	≈0.154	≈5.81	av Eβ=442.3 *12*
(1285.8 *30*)	2569.86	≈0.61	≈5.33	av Eβ=481.5 *12*
(1523.2 *30*)	2332.49	≈0.25	≈6.01	av Eβ=586.8 *13*
(1826.1 *30*)	2029.60	≈0.60	≈5.95	av Eβ=724.1 *13*
(2449.6 *30*)	1406.13	≈1.44	≈6.10	av Eβ=1013.2 *13*
(2552.2 *30*)	1303.48	≈0.20	≈7.03	av Eβ=1061.5 *13*
(2802.9 *30*)	1052.83	≈0.36	≈6.95	av Eβ=1179.7 *13*
(3231.8 *30*)	623.89	≈1.58	≈6.57	av Eβ=1383.3 *13*
(3364.9 *30*)	490.82	≈8.94	≈5.90	av Eβ=1446.7 *13*
(3388.0 *30*)	467.66	≈17.89	≈5.61	av Eβ=1457.8 *13*

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^{81}As β^- decay 1974Ch11,1975Kr08 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(3752.8[#] *30*)	102.86	<1.3	>8.5[1u]	av Eβ=1632.4 *13* Iβ^-: as required for log $f^{1u}t$>8.5 and expected I(103γ)<2.7 assuming α(103γ)=6.8. See footnote for 103γ.
(3855.7 *32*)	0	≈65.7	≈5.29	av Eβ=1681.6 *13* E(decay): 3800 *200* (1960Mo01 − from 3.8 MeV *2*). Iβ^-: from 100 − ΣI$_\beta$ to excited states, assuming 0.65% *65* β^- feeding of 7/2$^+$, 102.86-keV level.

† Uncertainty shown excludes unknown (and possibly large) uncertainty in Iγ normalization. Consequently, log *ft* values are shown as approximate.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

^{81}As β^- decay 1974Ch11,1975Kr08 (continued)

$\gamma(^{81}Se)$

Iγ normalization: from %I(468γ)≈20% deduced in 1972De43. For details, see comment on Iγ(468γ).
Measured average Eγ=2040 *100* (1990Ru05).
1974Ch11 report additional γ rays whose Iγ is very weak or whose $T_{1/2}$ differs somewhat from that for ^{81}As(g.s.), as follows: 744.6, 788.8, 910, 992.5, 998, 1050.5, 1352.6. Also, impurity lines would have masked ^{81}As lines with Eγ≈400 or 264, were they present.

E$_\gamma$[†]	I$_\gamma$[†][b]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[a]	δ[a]	α[c]	Comments
103.0 *2*	&	102.86	7/2$^+$	0	1/2$^-$	E3(+M4)	<0.0056	6.80 *11*	α(K)=5.30 *8*; α(L)=1.287 *21*; α(M)=0.201 *4*; α(N+..)=0.01350 *22* α(N)=0.01350 *22* E$_\gamma$: weighted average of 103.0 *2* (1974Ch11) and 102.9 *2* (1975Kr08).
156.0 *2*	1.42 *20*	623.89	5/2$^-$	467.66	3/2$^-$	[M1,E2]		0.10 *7*	α(K)=0.08 *6*; α(L)=0.010 *7*; α(M)=0.0015 *11*; α(N+..)=0.00012 *9* α(N)=0.00012 *9*
388.1[‡] *2*	4.3[‡] *5*	490.82	(5/2$^-$)	102.86	7/2$^+$				
467.7 *2*	100[@]	467.66	3/2$^-$	0	1/2$^-$				E$_\gamma$: weighted average of 467.6 *2* (1974Ch11) and 467.8 *2* (1975Kr08).
491.2 *2*	42.5 *5*	490.82	(5/2$^-$)	0	1/2$^-$	(E2)		0.00291	α(K)=0.00258 *4*; α(L)=0.000279 *4*; α(M)=4.33×10^{-5} *6*; α(N+..)=3.64×10^{-6} *6* α(N)=3.64×10^{-6} *6* E$_\gamma$: weighted average of 491.1 *2* (1974Ch11) and 491.3 *2* (1975Kr08). I$_\gamma$: weighted average of 42.5 *5* (1974Ch11) and 42.7 *23* (1975Kr08).
521.1 *2*	7.0 *7*	623.89	5/2$^-$	102.86	7/2$^+$				E$_\gamma$: weighted average of 521.1 *2* (1974Ch11) and 521.1 *2* (1975Kr08). I$_\gamma$: weighted average of 7.3 *7* (1974Ch11) and 6.0 *13* (1975Kr08).
756.0 *2*	0.86 *10*	2935.12	(5/2)$^-$	2179.18					
836.1 *2*	1.64 *20*	1303.48	5/2$^+$	467.66	3/2$^-$				
[x]874.9 *2*	0.69 *10*								
915.0 *2*	0.51 *10*	1406.13	3/2$^-$	490.82	(5/2$^-$)				
938.9 *2*	1.66 *30*	1406.13	3/2$^-$	467.66	3/2$^-$				
949.7 *2*	1.75 *30*	1052.83	5/2$^+$	102.86	7/2$^+$				
1406.0 *2*	4.99 *6*	1406.13	3/2$^-$	0	1/2$^-$				
1561.9 *2*	1.88 *20*	2029.60	1/2$^-$,3/2$^-$	467.66	3/2$^-$				
1661.8 *2*	0.66 *10*	2965.01	(5/2$^-$)	1303.48	5/2$^+$				
1688.4 *2*	0.56 *6*	2179.18		490.82	(5/2$^-$)				
1842.1 *2*	0.35 *5*	2332.49	5/2$^+$	490.82	(5/2$^-$)				

$^{81}_{34}Se_{47}$-3

^{81}As β^- decay 1974Ch11,1975Kr08 (continued)

$\gamma(^{81}Se)$ (continued)

E_γ [†]	I_γ [†b]	E_i(level)	J_i^π	E_f	J_f^π	E_γ [†]	I_γ [†b]	E_i(level)	J_i^π	E_f	J_f^π
1864.5 *2*	0.57 *6*	2332.49	$5/2^+$	467.66	$3/2^-$	2332.3 *2*	0.33 *5*	2332.49	$5/2^+$	0	$1/2^-$
1882.0 *2*	<0.04	2935.12	$(5/2)^-$	1052.83	$5/2^+$	2340.8 *2*	0.39 *6*	2965.01	$(5/2^-)$	623.89	$5/2^-$
2029.6 *2*	1.12 *10*	2029.60	$1/2^-,3/2^-$	0	$1/2^-$	2569.5 *2*	0.86 *10*	2569.86	$(1/2^-,3/2^-,5/2^-)$	0	$1/2^-$
2079.3 *2*	0.34 *5*	2569.86	$(1/2^-,3/2^-,5/2^-)$	490.82	$(5/2^-)$	2659.6 *2*	0.77 *9*	2659.65	$(5/2)^-$	0	$1/2^-$
2102.2 *2*	1.83 *20*	2569.86	$(1/2^-,3/2^-,5/2^-)$	467.66	$3/2^-$	2733.3[#d] *2*	0.48 *7*	3222.6?	$(5/2)^-$	490.82	$(5/2^-)$
2145.8 *2*	0.28 *5*	2769.61	$(5/2^-)$	623.89	$5/2^-$	2832.4 *2*	1.42 *15*	2935.12	$(5/2)^-$	102.86	$7/2^+$
2301.8 *2*	1.37 *14*	2769.61	$(5/2^-)$	467.66	$3/2^-$	3118.2[#d] *2*	0.18 *5*	3222.6?	$(5/2)^-$	102.86	$7/2^+$

[†] From 1974Ch11, except where otherwise noted.

[‡] From 1975Kr08; absent in 1974Ch11.

[#] γ placement in 1974Ch11. However, Eγ differs from the least squares adjusted value by at least 5σ. At least one γ deexciting the 3223 level is presumably misplaced.

[@] Absolute I(468γ)≈20% deduced by 1972De43 based on measured I(336γ, ^{81}As), I(277γ, ^{78}As) and I(336γ, ^{81}As)/I(468γ, ^{81}Se)=0.83 *5*, assuming I(277γ, ^{78}As)=95% and an estimated relative fission yield of 6.5 *2* for ^{81}Ge/^{78}Ge (1972De43).

[&] 1975Kr08 report Iγ=15 *10* for a $T_{1/2}$=57 min 103γ which grows into their As fraction with $T_{1/2}$=30 s *10* (1974Ch11 do not report I(103γ) because the isomeric state was produced directly via the (γ,n) reaction during their source preparation). However, if Iβ(103)<1.3% as required for log $f^{1u}t$>8.5, I(103γ)<2.7 is expected, assuming α(103γ)=6.8.

[a] From Adopted Gammas.

[b] For absolute intensity per 100 decays, multiply by ≈0.20.

[c] 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.

[d] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

$^{81}_{34}Se_{47}$-4

^{81}As β^- decay 1974Ch11,1975Kr08

Decay Scheme

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