^{85}As β^- decay (2.021 s)   1991Om02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 116, 1 (2014)	31-Dec-2013

Parent: ^{85}As: E=0.0; J^π=(3/2$^-$); $T_{1/2}$=2.021 s 12; Q(β^-)=9224 4; %β^- decay=100.0

^{85}As-J^π,$T_{1/2}$: From ^{85}As Adopted Levels.

^{85}As-Q(β^-): From 2012Wa38.

1991Om02: ^{85}As from thermal neutron fission of ^{235}U followed by mass separation, measured Eγ, Iγ, $\gamma\gamma$ coin. 1991Om01 (same group as 1991Om02) measured isotopic half-life, delayed neutron decay and absolute intensities of two γ rays.

2012Ku06: ^{85}As from thermal neutron fission of ^{235}U followed by mass/charge separation using Lohengrin separator at Grenoble. Measured Eγ, Iγ, $\gamma\gamma$ and $\beta\gamma$ coin using three β scintillators and three Ge detectors (two clovers and a coaxial detector).

Others:

1979Kr03: ^{3}He ionization chambers, measured delayed neutron spectra. FWHM=12 keV for thermal neutrons and 20 keV for 1 MeV neutrons. Source of ^{85}As prepared by fission followed by chemical separation.

1975Kr08: ^{3}He counters, measured γ spectra in coincidence with delayed neutrons. No neutron spectra reported. Source of ^{85}As prepared by fission followed by chemical separation.

See also ^{85}As β^-n decay dataset.

1983Sk05: production of ^{85}As in fission of ^{235}U and ^{239}Pu.

Others: 1983Sk05, 1982Re10, 1967De01, 1966To02.

Level scheme in 2012Ku06 is in agreement with that from 1991Om02, except for the addition of a new level at 2779.9 keV. In 2012Ku06, gamma-ray intensities are not given.

Additional information 1.

^{85}Se Levels

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
0.0	(5/2)$^+$	32.9 s 3	$T_{1/2}$: from Adopted Levels.
461.9 3	1/2$^+$		
1115.01 10	(7/2)$^+$		
1436.69 17	(9/2$^+$)		E(level): 1436.66 16 (2012Ku06).
1444.42 20	(3/2$^+$,5/2$^+$)		
1610.1 4	(1/2,3/2,5/2$^+$)		
1635.2 3			
1804.8 3			
1990.1 3			
2003.4 4	(1/2,3/2,5/2$^+$)		
2137.8 8			
2145.9 5			
2451.0 5			
2781.0[@] 4			
3058.4 4			
3954.0 5			
4126.0 5			
4219.1 4			
4283.0 5			
4291.3 4			
4369.0 3			
4498.0 5			
4557.5 4			
4560.4 4			
4636.1 3			
4654.0 6			
4666.9 5			
4709.23 25			
4792.2 4			

Continued on next page (footnotes at end of table)

^{85}As β^- decay (2.021 s)   **1991Om02** (continued)

^{85}Se Levels (continued)

E(level)[†]	J$^\pi$[‡]	Comments
5164.81 *21*		
6055?[#] *7*	(5/2$^-$)[&]	
6931?[#] *4*	(3/2$^-$)[&]	
7160?[#] *6*	(1/2$^-$)[&]	
7187?[#] *5*	(1/2$^-$)[&]	
7377?[#] *4*	(5/2$^-$)[&]	
8090?[#] *8*	(3/2$^-$)[&]	
4537+x		E(level): group of neutron-decaying levels above S(n)(^{85}Se)=4537 keV, including 6055, 6931, 7160, 7187, 7377 and 8090 listed above.

[†] From least-squares fit to Eγ data, assuming 0.5 keV uncertainty when not given.
[‡] From Adopted Levels.
[#] Deduced from neutron transitions to ^{84}Se levels in ^{85}As β^-n decay (1979Kr03) and level energies of ^{84}Se, using Sn(^{85}Se)=4537 *3* (2012Wa38). This level decays to ^{84}Se through delayed neutron emission. This level has not been included in Adopted Levels due to its uncertain nature as suggested by the disagreement of population intensity of first 2$^+$ and 4$^+$ states in ^{84}Se from delayed neutron decay. From the absolute intensities of 667.0γ and 1454.6γ in 1991Om02, only $\approx$4% of the total decay populates these states whereas data of 1979Kr03 suggested a much stronger population, indicating some incorrect assignments of the neutron groups in in 1979Kr03.
[@] Level from 2012Ku06 only.
[&] As proposed by 1979Kr03 based on allowed log *ft* value from (3/2$^-$) and expected L transfer.

β^- radiations

The β strength functions were deduced by 1979Kr03 based on delayed neutron spectra. 1991Om02, however, point out that these strengths are probably incorrect due to disagreements in the population of first 2$^+$ and 4$^+$ states in ^{84}Se in the two works and thus indicating problems with assignment of neutron groups by 1979Kr03 to level scheme of ^{85}As β^--n decay to ^{84}Se.

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(2.3×10^3[@] *24*)	4537+x	62.9 *20*		Iβ^-: total β^-n decay branch.
(4059 *4*)	5164.81	0.84 *16*	6.1 *1*	av Eβ=1783.0 *20*
(4432 *4*)	4792.2	0.08 *3*	7.2 *2*	av Eβ=1962.6 *20*
(4515 *4*)	4709.23	0.36 *8*	6.6 *1*	av Eβ=2002.7 *20*
(4557 *4*)	4666.9	0.28 *6*	6.8 *1*	av Eβ=2023.1 *20*
(4570 *4*)	4654.0	0.20 *4*	6.9 *1*	av Eβ=2029.4 *20*
(4588 *4*)	4636.1	0.48 *10*	6.5 *1*	av Eβ=2038.0 *20*
(4664 *4*)	4560.4	0.16 *4*	7.0 *1*	av Eβ=2074.6 *20*
(4667 *4*)	4557.5	0.12 *3*	7.2 *1*	av Eβ=2076.0 *20*
(4726 *4*)	4498.0	0.28 *6*	6.8 *1*	av Eβ=2104.7 *20*
(4855 *4*)	4369.0	0.55 *12*	6.6 *1*	av Eβ=2167.1 *20*
(4933 *4*)	4291.3	0.24 *5*	7.0 *1*	av Eβ=2204.6 *20*
(4941 *4*)	4283.0	0.32 *7*	6.9 *1*	av Eβ=2208.6 *20*
(5005 *4*)	4219.1	0.32 *7*	6.9 *1*	av Eβ=2239.6 *20*
(5098 *4*)	4126.0	0.16 *4*	7.2 *1*	av Eβ=2284.6 *20*
(5270 *4*)	3954.0	0.58 *12*	6.7 *1*	av Eβ=2367.8 *20*
(6166 *4*)	3058.4	0.60 *12*	7.0 *1*	av Eβ=2801.6 *20*
(6773 *4*)	2451.0	0.12 *3*	7.9 *1*	av Eβ=3096.0 *20*
(7078 *4*)	2145.9	0.14 *4*	7.9 *1*	av Eβ=3243.9 *20*

^{85}As β^- decay (2.021 s)   **1991Om02** (continued)

β^- radiations (continued)

E(decay)	E(level)	I$\beta^{-\dagger\ddagger}$	Log ft	Comments
(7086 *4*)	2137.8	0.06 *4*	8.3 *3*	av Eβ=3247.9 *20*
(7221 *4*)	2003.4	0.16 *4*	7.9 *1*	av Eβ=3313.0 *20*
(7234 *4*)	1990.1	0.24 *10*	7.7 *2*	av Eβ=3319.4 *20*
(7419 *4*)	1804.8	1.6 *4*	6.9 *1*	av Eβ=3409.3 *20*
(7589 *4*)	1635.2	0.04 *2*	8.6 *2*	av Eβ=3491.4 *20*
(7614[#] *4*)	1610.1	≈0.02	≈8.9	av Eβ=3503.6 *20*
(7780 *4*)	1444.42	1.2 *3*	7.2 *1*	av Eβ=3583.9 *20*
(7787[#] *4*)	1436.69	0.14 *10*	8.1 *4*	av Eβ=3587.6 *20*
(8109 *4*)	1115.01	2.0 *6*	9.2^{1u} *1*	av Eβ=3742.9 *20*
(8762 *4*)	461.9	0.36 *10*	7.9 *1*	av Eβ=4059.7 *20*
(9224 *4*)	0.0	24 *3*	6.2 *1*	av Eβ=4283.1 *20*

Iβ^-: 1991Om02 give 50% where %β^-n=40 was used. The evaluators have adjusted this value corresponding to Adopted %β^-n=62.9 *20* for ^{85}As decay.

[†] Deduced by the evaluators from intensity balance and using normalization factor of 0.0397 as suggested by 1991Om02. These are consistently higher by ≈16% from those given by 1991Om02 in their figure 2.
[‡] Absolute intensity per 100 decays.
[#] Existence of this branch is questionable.
[@] Estimated for a range of levels.

$\gamma(^{85}$Se)

Iγ normalization: From %Iγ=4.0 *7* for 1114.9γ and %Iγ=0.60 *10* for 461.9γ (1991Om01). Iγ normalization=0.0397 is quoted by 1991Om01. %β^-n=62.9 *20*.

The following γ rays have been reported by 1975Kr08 only where the source of ^{85}As was prepared by chemical separation. These have not been confirmed in mass-separated sources studied by 1991Om02, thus have been omitted: 694.3 *5* (Iγ=1.3 *4*), 1111.5 *5* (Iγ=12 *4*), 3345.0 *5* (Iγ=1.7 *2*), 3749.4 *7* (Iγ=2.7 *4*). These intensities are relative to 100 for 1455γ from ^{84}As to ^{84}Se decay.

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Intensities of γ  rays from 85As    decay to 84Se    by β⁻-n     mode
          (From 1991Om02)
     Energy        Relative intensity (100 for 1114.9γ)
   667.0 10           6.7 7    (first 4⁺ to first 2⁺ in 84Se)
  1454.6 10            94 9    (first 2⁺ to g.s. in 84Se)

  Note: Iγ(1115)/Iγ(1455)=1.76   25   in 2012Ku06 as compared to
  1.07 15   in 1991Om02.
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E$_\gamma$	I$_\gamma$[a]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Comments
147.6 *10*	1.0 *5*	2137.8		1990.1		
156.5 *10*	1.0[#] *5*	2145.9		1990.1		
321.60 *14*	3.0 *5*	1436.69	(9/2$^+$)	1115.01	(7/2)$^+$	E$_\gamma$: from 2012Ku06. Other: 322.0 *7* (1991Om02).
329.4 *3*	6.0 *6*	1444.42	(3/2$^+$,5/2$^+$)	1115.01	(7/2)$^+$	E$_\gamma$: 328.9 (2012Ku06).
461.9 *4*	15.1[†] *15*	461.9	1/2$^+$	0.0	(5/2)$^+$	E$_\gamma$: 462.0 (2012Ku06). Additional information 2.
527.8 *10*	1.0[#] *5*	2137.8		1610.1	(1/2,3/2,5/2$^+$)	
545.8 *5*	3.0 *5*	1990.1		1444.42	(3/2$^+$,5/2$^+$)	

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^{85}As β^- decay (2.021 s)   **1991Om02** (continued)

$\gamma(^{85}$Se) (continued)

E_γ	$I_\gamma{}^a$	E_i(level)	J_i^π	E_f	J_f^π	Comments
789$^{\&b}$		2781.0		1990.1		
875.1 3	5.0 5	1990.1		1115.01	$(7/2)^+$	E_γ: 875.2 (2012Ku06).
982.5 5	4.0 5	1444.42	$(3/2^+,5/2^+)$	461.9	$1/2^+$	E_γ: 982.4 (2012Ku06).
1115.0 1	100‡ 10	1115.01	$(7/2)^+$	0.0	$(5/2)^+$	E_γ: from 2012Ku06. Other: 1114.9 2 (1991Om02).
1148.2 3	1.0 5	1610.1	$(1/2,3/2,5/2^+)$	461.9	$1/2^+$	
1335.7$^\&$		2781.0		1444.42	$(3/2^+,5/2^+)$	
1336.0 5	3.0 5	2451.0		1115.01	$(7/2)^+$	
1437.6 10	18.7 19	1436.69	$(9/2^+)$	0.0	$(5/2)^+$	E_γ: 1437 (2012Ku06).
1444.0 10	43 4	1444.42	$(3/2^+,5/2^+)$	0.0	$(5/2)^+$	E_γ: 1443.4 (2012Ku06).
1541.5 4	1.0 5	2003.4	$(1/2,3/2,5/2^+)$	461.9	$1/2^+$	
1615.1 7	2.0 5	3058.4		1444.42	$(3/2^+,5/2^+)$	
1621.5 3	13.1 13	3058.4		1436.69	$(9/2^+)$	
1635.2 3	1.0 5	1635.2		0.0	$(5/2)^+$	
1666.9$^\&$		2781.0		1115.01	$(7/2)^+$	
1804.8 3	40 4	1804.8		0.0	$(5/2)^+$	
2003.4 5	3.0 5	2003.4	$(1/2,3/2,5/2^+)$	0.0	$(5/2)^+$	
2145.7 5	3.0 5	2145.9		0.0	$(5/2)^+$	
2510$^{\&b}$		3954.0		1444.42	$(3/2^+,5/2^+)$	
2646.8 10	2.0$^\#$ 5	4636.1		1990.1		
2774.6 3	8.0 8	4219.1		1444.42	$(3/2^+,5/2^+)$	
2838.9 5	14.6 15	3954.0		1115.01	$(7/2)^+$	E_γ: 2839.3 (2012Ku06).
3060.5 10	5.0 5	4498.0		1436.69	$(9/2^+)$	
3191.0 6	4.0 5	4636.1		1444.42	$(3/2^+,5/2^+)$	
3264.9 3	5.0 5	4709.23		1444.42	$(3/2^+,5/2^+)$	E_γ: 3263.8 (2012Ku06).
3594.0 5	2.0 5	4709.23		1115.01	$(7/2)^+$	E_γ: 3592.8 (2012Ku06).
4049.7 2	15.9 16	5164.81		1115.01	$(7/2)^+$	E_γ: 4048.9 (2012Ku06).
4125.9$^@$ 5	4.0$^@$ 5	4126.0		0.0	$(5/2)^+$	
4282.9 5	8.0 8	4283.0		0.0	$(5/2)^+$	
4291.2 4	6.0 6	4291.3		0.0	$(5/2)^+$	
4368.9 3	13.7 14	4369.0		0.0	$(5/2)^+$	
4498.1 5	2.0 5	4498.0		0.0	$(5/2)^+$	
4557.4 4	3.0 5	4557.5		0.0	$(5/2)^+$	
4560.3 4	4.0 5	4560.4		0.0	$(5/2)^+$	
4636.0 3	7.0 7	4636.1		0.0	$(5/2)^+$	
4653.9 6	5.0 5	4654.0		0.0	$(5/2)^+$	
4666.8$^@$ 5	7.0$^@$ 5	4666.9		0.0	$(5/2)^+$	
4708.9 4	2.0 5	4709.23		0.0	$(5/2)^+$	
4792.1 4	2.0 5	4792.2		0.0	$(5/2)^+$	
5164.6 5	5.0 5	5164.81		0.0	$(5/2)^+$	

† 0.60 10 from 1991Om01.

‡ 4.0 7 from 1991Om01.

$^\#$ Upper limit of intensity (1991Om02).

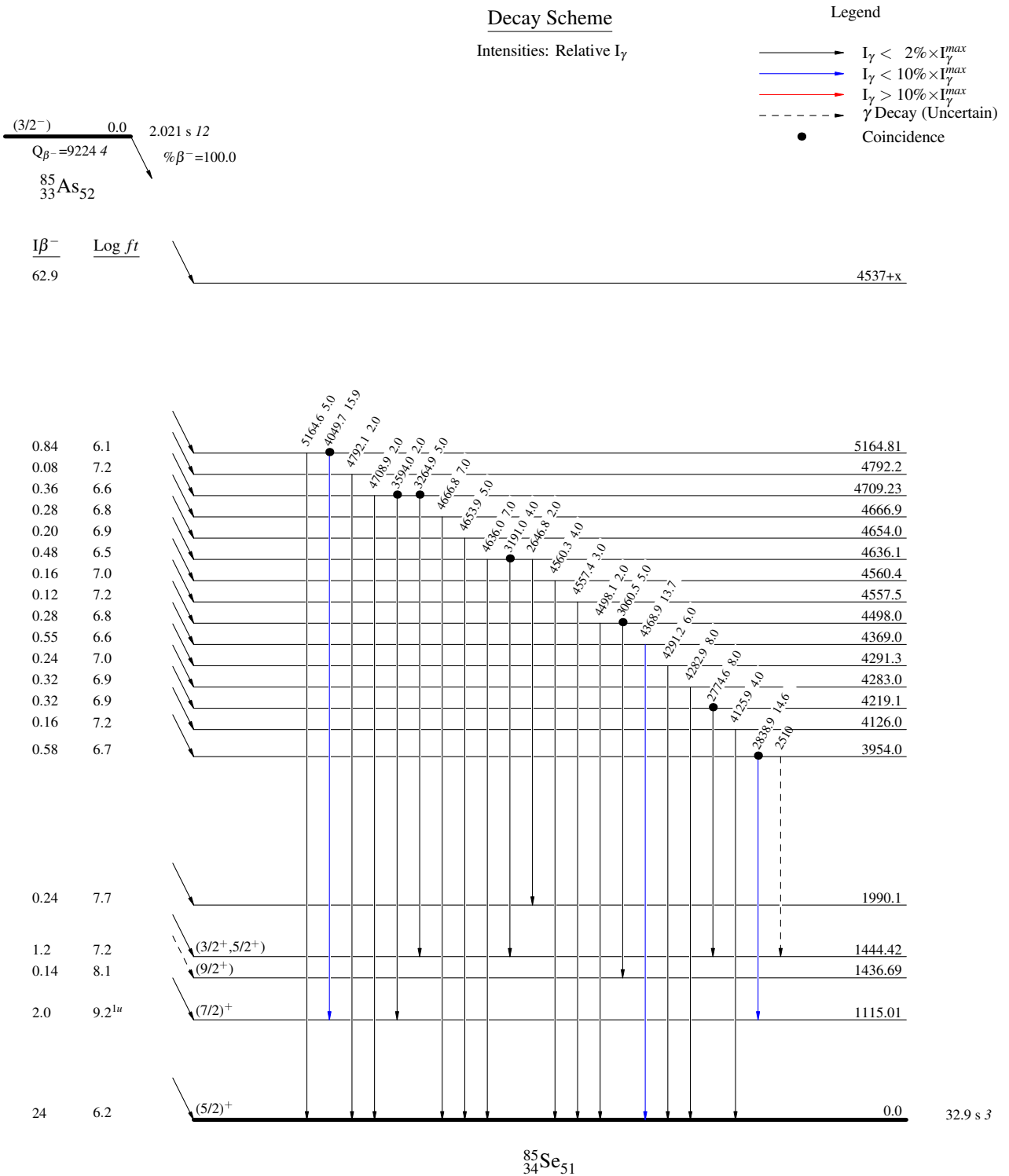$^@$ Missing In table 1 of 1991Om02, values are from level-scheme figure, uncertainties estimated by the evaluators In comparison with other γ rays.

$^\&$ The γ transition is from 2012Ku06.

^{a} For absolute intensity per 100 decays, multiply by 0.040 7.

^{b} Placement of transition in the level scheme is uncertain.

^{85}As β^- decay (2.021 s)   1991Om02

Decay Scheme

Intensities: Relative I$_\gamma$

Legend

→	I$_\gamma$ < 2%×I$_\gamma^{max}$
→	I$_\gamma$ < 10%×I$_\gamma^{max}$
→	I$_\gamma$ > 10%×I$_\gamma^{max}$
- - →	γ Decay (Uncertain)
●	Coincidence

(3/2$^-$)   0.0   2.021 s *12*

Q$_{\beta-}$=9224 *4*   %β^-=100.0

$^{85}_{33}$As$_{52}$

<u>Iβ^-</u>   <u>Log *ft*</u>

62.9   4537+x

Iβ^-	Log *ft*		Level
0.84	6.1		5164.81
0.08	7.2		4792.2
0.36	6.6		4709.23
0.28	6.8		4666.9
0.20	6.9		4654.0
0.48	6.5		4636.1
0.16	7.0		4560.4
0.12	7.2		4557.5
0.28	6.8		4498.0
0.55	6.6		4369.0
0.24	7.0		4291.3
0.32	6.9		4283.0
0.32	6.9		4219.1
0.16	7.2		4126.0
0.58	6.7		3954.0

γ-ray labels: 5164.6 *5.0*, 4049.7 *15.9*, 4792.1 *2.0*, 4708.9 *2.0*, 3594.0 *2.0*, 3264.9 *5.0*, 4666.8 *7.0*, 4653.9 *5.0*, 4636.0 *7.0*, 3191.0 *4.0*, 2646.8 *2.0*, 4560.3 *4.0*, 4557.4 *3.0*, 4498.1 *2.0*, 3060.5 *5.0*, 4368.9 *13.7*, 4291.2 *6.0*, 4282.9 *8.0*, 2774.6 *8.0*, 4125.9 *4.0*, 2838.9 *14.6*, 2510

Iβ^-	Log *ft*		Level
0.24	7.7		1990.1
1.2	7.2	(3/2$^+$,5/2$^+$)	1444.42
0.14	8.1	(9/2$^+$)	1436.69
2.0	9.2^{1u}	(7/2)$^+$	1115.01
24	6.2	(5/2)$^+$	0.0 32.9 s *3*

$^{85}_{34}$Se$_{51}$

^{85}As β^- decay (2.021 s)   1991Om02

Decay Scheme (continued)

Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
Coincidence