

$^{35}\text{Ar}$   $\varepsilon+\beta^+$  decay (1.7755 s) 1980Wi13,1984Ad01

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Lijie Sun and Jun Chen	NDS 211,1 (2026)	30-Sep-2025

Parent:  $^{35}\text{Ar}$ :  $E=0$ ;  $J^\pi=3/2^+$ ;  $T_{1/2}=1.7755$  s 14;  $Q(\varepsilon)=5966.2$  7;  $\% \varepsilon+\% \beta^+$  decay=100

$^{35}\text{Ar}$ - $J^\pi, T_{1/2}$ : From Adopted Levels of  $^{35}\text{Ar}$ .

$^{35}\text{Ar}$ - $Q(\varepsilon+\beta^+)$ : From 2021Wa16.

1980Wi13:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 11.0-MeV protons from the ONR-CIT tandem accelerator impinging on LiCl and PbCl<sub>2</sub> wrapped in 25- $\mu\text{m}$  Ta foil.  $\gamma$  rays were detected using a 100-cm<sup>3</sup> Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$  for 20  $\gamma$ -ray peaks. Deduced decay branching ratios for 9 levels, and  $\log ft$ . Compared with shell-model calculations.

1984Ad01:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 13-MeV protons from the University of Washington FN tandem accelerator impinging on a thick KCl target.  $\gamma$  rays were detected using a 28% Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$  for 8  $\gamma$ -ray peaks. Deduced decay branching ratios for 6 levels, and  $\log ft$ . Compared with shell-model calculations.

1985Da04:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 9-MeV protons from the Van de Graaff accelerator at the University of Pittsburgh impinging on a NaCl target.  $\gamma$  rays were detected using a Ge(Li) detector with NaI anti-Compton shielding. Measured  $E_\gamma$  and  $I_\gamma$  for 4  $\gamma$ -ray peaks. Deduced 3 levels.

1979Ha04:  $^{35}\text{Ar}$  produced via the  $^{51}\text{V}(p,6p11n)$  spallation reaction with 600-MeV protons from the CERN synchrocyclotron bombarding a 38-g/cm<sup>2</sup> vanadium target in the form of VC powder.  $\gamma$  rays were detected using a Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$  for the 1219 $\gamma$ . Deduced the decay branching ratio for the 1219-keV level.

1977Az01:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 10-13-MeV protons from the McGill synchrocyclotron impinging on CCl<sub>4</sub> and LiCl targets and 8-MeV protons from the University of Montreal impinging a thick LiCl pellet. Positrons were detected using an NE102 plastic scintillator coupled to an RCA 6342A photomultiplier tube.  $\gamma$  rays were detected using an 18% Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$  for 3  $\gamma$ -ray peaks. Deduced decay branching ratios for 3 levels and parent  $^{35}\text{Ar}$   $T_{1/2}$ . Related:  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction threshold measurement in 1978Az01.

1971Ge04:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 10-MeV protons from the Chalk River tandem accelerator impinging on PbCl<sub>2</sub> targets.  $\gamma$  rays were detected using two coaxial Ge(Li) detectors. Measured  $E_\gamma$  and  $I_\gamma$  for 4  $\gamma$ -ray peaks. Deduced 4 levels, decay branching ratios,  $\log ft$ , and parent  $^{35}\text{Ar}$   $T_{1/2}$ .

1971De05:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction on KCl targets.  $\gamma$  rays were detected using a 25 cm<sup>3</sup> Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$ . Deduced 6 levels, decay branching ratios, and  $\log ft$ .

1969Wi18,1969Fr09:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with a proton beam from the Harwell tandem accelerator impinging on 3.75-mg/cm<sup>2</sup> KCl deposited on 0.13-mm Au backings and 160-mmHg gas CCl<sub>4</sub> targets.  $\gamma$  rays were detected using a Ge(Li) detector. Measured  $E_\gamma$  and  $I_\gamma$  for 2  $\gamma$ -ray peaks. Deduced 2 levels, decay branching ratios, (p,n) reaction threshold and  $\beta$  end-point energy,  $\log ft$ , and parent  $^{35}\text{Ar}$   $T_{1/2}$ .

1960Wa04:  $^{35}\text{Ar}$  was produced at Crocker Laboratory and the Lawrence Radiation Laboratory.  $\beta$  spectra were measured with a uniform-field 180 $^\circ$ -deflection single-focusing spectrometer. Deduced Coulomb-energy differences between mirror ground-state transitions.

1956Ki29:  $^{35}\text{Ar}$  was produced via the  $^{35}\text{Cl}(p,n)^{35}\text{Ar}$  reaction with 10-MeV protons from the BNL 60-inch cyclotron impinging on a liquid CCl<sub>4</sub> target.  $\beta$  particles were detected using a conventional thin-lens, iron-free, magnetic spectrometer.  $\gamma$  rays were detected using a NaI(Tl) crystal scintillation counter. Measured  $E_\beta$  and total  $I_\beta$  for two positron decays to  $^{35}\text{Cl}$  excited states,  $E_\gamma$  and  $I_\gamma$  for two  $\gamma$ -ray peaks. Deduced two levels and decay branching ratios.

$^{35}\text{Ar}$   $\beta$  asymmetry parameter measurements: 1993Co07, 1991Na05, 1991Mi18, 1988Ga02, 1965Ca04.

 $^{35}\text{Cl}$  Levels

## Additional information 1.

$E(\text{level})^{\ddagger\ddagger}$	$J^\pi\#$	$T_{1/2}\#$	Comments
0	3/2 <sup>+</sup>	stable	
1219.2 2	1/2 <sup>+</sup>	0.119 ps 14	
1763.1 2	5/2 <sup>+</sup>	0.36 ps 3	
2645.1 10	7/2 <sup>+</sup>	0.159 ps 21	Additional information 2.
2693.9 2	3/2 <sup>+</sup>	32 fs 6	

Continued on next page (footnotes at end of table)

<sup>35</sup>Ar ε+β<sup>+</sup> decay (1.7755 s) 1980Wi13,1984Ad01 (continued)

<sup>35</sup>Cl Levels (continued)

E(level) <sup>†‡</sup>	J <sup>π</sup> <sup>#</sup>	T <sub>1/2</sub> <sup>#</sup>	Comments
3002.2 4	5/2 <sup>+</sup>	22 fs 6	
3918.3 15	3/2 <sup>+</sup>	4.9 fs 14	
3967.9 6	1/2 <sup>+</sup>	11.8 fs 28	
4624.5? 5	3/2,5/2	40 fs 17	Additional information 3.

<sup>†</sup> Additional information 4.

<sup>‡</sup> From a least-squares fit to γ-ray energies.

<sup>#</sup> From the Adopted Levels.

ε,β<sup>+</sup> radiations

av Eβ: Additional information 5.

E(decay)	E(level)	Iβ <sup>+</sup> <sup>‡</sup>	Iε <sup>‡</sup>	Log ft	I(ε+β <sup>+</sup> ) <sup>†‡</sup>	Comments
(1341.7 <sup>#</sup> 13)	4624.5?	<8.0×10 <sup>-4</sup>	<0.0035	>3.8	<0.0043	av Eβ=130.0 4; εK=0.7365 28; εL=0.06804 39; εM=0.01006 13
(1998.3 14)	3967.9	0.015 10	0.0016 10	4.5 +5-2	0.017 11	av Eβ=405.86 40; εK=0.0832 11; εL=0.00768 10; εM=0.001135 20
(2047.9 19)	3918.3	0.0096 30	8.3×10 <sup>-4</sup> 26	4.8 +2-1	0.0104 32	av Eβ=427.53 74; εK=0.0720 11; εL=0.00664 10; εM=9.83×10 <sup>-4</sup> 19
(2964.0 13)	3002.2	0.089 14	0.0011 2	5.0 1	0.090 14	av Eβ=841.16 37; εK=0.01069 13; εL=9.86×10 <sup>-4</sup> 13; εM=1.458×10 <sup>-4</sup> 25
(3272.3 13)	2693.9	0.164 9	0.00126 7	5.00 3	0.165 9	av Eβ=984.38 34; εK=0.006878 81; εL=6.341×10 <sup>-4</sup> 80; εM=9.38×10 <sup>-5</sup> 16
(3321.1 16)	2645.1	<0.00146	<2.82×10 <sup>-5</sup>	>8.3	<0.00149	av Eβ=1034.2 6; εK=0.01711 21; εL=0.001580 21; εM=2.337×10 <sup>-4</sup> 41
(4203.1 13)	1763.1	0.256 13	7.0×10 <sup>-4</sup> 4	5.47 2	0.257 13	av Eβ=1424.00 35; εK=0.002459 29; εL=2.266×10 <sup>-4</sup> 28; εM=3.351×10 <sup>-5</sup> 56
(4747.0 13)	1219.2	1.22 4	0.00208 7	5.10 2	1.22 4	av Eβ=1684.30 35; εK=0.001543 18; εL=1.422×10 <sup>-4</sup> 17; εM=2.103×10 <sup>-5</sup> 35
(5966.2 16)	0	98.17 10	0.07309 8	3.759 1	98.24 10	av Eβ=2273.33 34; εK=6.728×10 <sup>-4</sup> 76; εL=6.199×10 <sup>-5</sup> 75; εM=9.17×10 <sup>-6</sup> 15 I(ε+β <sup>+</sup> ): deduced from 100-Σ%I(ε+β <sup>+</sup> ) (excited states), where Σ%I(ε+β <sup>+</sup> ) (excited states)=1.76 5. Level scheme fed by β <sup>+</sup> decay may be complete considering the highest observed level is at 4.6 MeV. Observed Σ%I(ε)≈0.08. Evaluators assume Σ%I(ε)≤0.08 for all unobserved ε feedings to high-lying levels and include this limit in the uncertainty for Σ%I(ε+β <sup>+</sup> ) (excited states)=1.76 10 and I(ε+β <sup>+</sup> ) (gs)=98.24 10.

<sup>†</sup> Deduced from γ-ray intensity balance, relative to I<sub>γ</sub>(1219γ)=100, normalized to absolute %I<sub>γ</sub>(1219γ)=1.243 30.

<sup>‡</sup> Absolute intensity per 100 decays.

<sup>#</sup> Existence of this branch is questionable.

<sup>35</sup>Ar ε+β<sup>+</sup> decay (1.7755 s) **1980Wi13,1984Ad01 (continued)**

γ(<sup>35</sup>Cl)

I<sub>γ</sub> normalization: absolute %I<sub>γ</sub>(1219γ)=1.243 30 deduced from weighted average of 1.223 46 (1969Wi18,1969Fr09), 1.22 20 (1971Ge04), 1.55 15 (1977Az01), 1.34 8 (1979Ha04), 1.23 7 (1984Ad01), 1.228 30 (1980Wi13).

$E_\gamma$ ‡	$I_\gamma$ #a	$E_i$ (level)	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. @	$\delta$ @	$\alpha$ †	Comments
916 <sup>b</sup>		3918.3	3/2 <sup>+</sup>	3002.2	5/2 <sup>+</sup>				The intensity could not be determined due to being obscured by another peak (1980Wi13).
930.7 2	1.57 20	2693.9	3/2 <sup>+</sup>	1763.1	5/2 <sup>+</sup>	M1+E2	+0.09 3	4.69×10 <sup>-5</sup> 7	α(K)=4.31×10 <sup>-5</sup> 6; α(L)=3.43×10 <sup>-6</sup> 5; α(M)=3.14×10 <sup>-7</sup> 4 %I <sub>γ</sub> =0.0195 25 I <sub>γ</sub> : weighted average of 1.13 26 (1980Wi13) and 1.66 12 (1984Ad01).
965 <sup>b</sup>	<0.87&	3967.9	1/2 <sup>+</sup>	3002.2	5/2 <sup>+</sup>				%I <sub>γ</sub> <0.0111 Additional information 6.
1219.3 2	100.0 15	1219.2	1/2 <sup>+</sup>	0	3/2 <sup>+</sup>	M1+E2	0.093 10	3.66×10 <sup>-5</sup> 5	α(K)=2.59×10 <sup>-5</sup> 4; α(L)=2.063×10 <sup>-6</sup> 29; α(M)=1.887×10 <sup>-7</sup> 26 α(IPF)=8.42×10 <sup>-6</sup> 12 %I <sub>γ</sub> =1.24 4 I <sub>γ</sub> : others: 100.0 30 from 1984Ad01, 100 10 from 1977Az01, 100 from 1969Wi18, 1971Ge04, 1979Ha04, and 1985Da04.
1225 <sup>b</sup>		3918.3	3/2 <sup>+</sup>	2693.9	3/2 <sup>+</sup>				The intensity could not be determined due to being obscured by another peak (1980Wi13).
1239 <sup>b</sup>	<0.30&	3002.2	5/2 <sup>+</sup>	1763.1	5/2 <sup>+</sup>	[M1,E2]		4.4×10 <sup>-5</sup> 6	α(K)=2.85×10 <sup>-5</sup> 34; α(L)=2.27×10 <sup>-6</sup> 27; α(M)=2.07×10 <sup>-7</sup> 25 α(IPF)=1.35×10 <sup>-5</sup> 26 %I <sub>γ</sub> <0.00382
1274 <sup>b</sup>	<0.42&	3967.9	1/2 <sup>+</sup>	2693.9	3/2 <sup>+</sup>	[M1,E2]		4.9×10 <sup>-5</sup> 7	α(K)=2.69×10 <sup>-5</sup> 30; α(L)=2.14×10 <sup>-6</sup> 24; α(M)=1.96×10 <sup>-7</sup> 22 α(IPF)=2.0×10 <sup>-5</sup> 4 %I <sub>γ</sub> <0.00535
1474.8 3	1.02 11	2693.9	3/2 <sup>+</sup>	1219.2	1/2 <sup>+</sup>	M1+E2	-0.63 21	8.4×10 <sup>-5</sup> 4	α(K)=1.94×10 <sup>-5</sup> 5; α(L)=1.54×10 <sup>-6</sup> 4; α(M)=1.41×10 <sup>-7</sup> 4 α(IPF)=6.33×10 <sup>-5</sup> 31 %I <sub>γ</sub> =0.0127 14 I <sub>γ</sub> : weighted average of 0.83 13 (1980Wi13) and 1.08 7 (1984Ad01).
1763.0 2	22.7 4	1763.1	5/2 <sup>+</sup>	0	3/2 <sup>+</sup>	M1+E2	-2.85 10	0.0002124 30	α(K)=1.513×10 <sup>-5</sup> 21; α(L)=1.204×10 <sup>-6</sup> 17; α(M)=1.101×10 <sup>-7</sup> 15 α(IPF)=0.0001959 28 %I <sub>γ</sub> =0.282 9 I <sub>γ</sub> : weighted average of 23.4 13 (1969Wi18), 20.0 27

<sup>35</sup>Ar ε+β<sup>+</sup> decay (1.7755 s) **1980Wi13,1984Ad01 (continued)**

γ(<sup>35</sup>Cl) (continued)

<u>E<sub>γ</sub><sup>‡</sup></u>	<u>I<sub>γ</sub><sup>#a</sup></u>	<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup>π</sup></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup>π</sup></u>	<u>Mult.<sup>@</sup></u>	<u>δ<sup>@</sup></u>	<u>α<sup>†</sup></u>	<u>Comments</u>
1783 <sup>b</sup>	<0.39 <sup>&amp;</sup>	3002.2	5/2 <sup>+</sup>	1219.2	1/2 <sup>+</sup>	[E2]		0.0002267 32	(1971Ge04), 22 6 (1977Az01), 23.08 37 (1980Wi13), 21.85 67 (1984Ad01), and 21.7 9 (1985Da04). α(K)=1.501×10 <sup>-5</sup> 21; α(L)=1.193×10 <sup>-6</sup> 17; α(M)=1.091×10 <sup>-7</sup> 15 α(IPF)=0.0002104 29 %I <sub>γ</sub> <0.00497
1931 <sup>b</sup> 2155.1 15	<0.21 <sup>&amp;</sup> 0.15 6	4624.5? 3918.3	3/2,5/2 3/2 <sup>+</sup>	2693.9 1763.1	3/2 <sup>+</sup> 5/2 <sup>+</sup>	[M1,E2]		0.00036 4	%I <sub>γ</sub> <0.00267 α(K)=1.02×10 <sup>-5</sup> 5; α(L)=8.1×10 <sup>-7</sup> 4; α(M)=7.38×10 <sup>-8</sup> 34 α(IPF)=0.00035 4 %I <sub>γ</sub> =0.0019 8 I <sub>γ</sub> : from 1984Ad01. Other: <0.22 (1980Wi13).
2204 <sup>b</sup>	<0.27 <sup>&amp;</sup>	3967.9	1/2 <sup>+</sup>	1763.1	5/2 <sup>+</sup>	[E2]		0.000425 6	α(K)=1.018×10 <sup>-5</sup> 14; α(L)=8.09×10 <sup>-7</sup> 11; α(M)=7.40×10 <sup>-8</sup> 10 α(IPF)=0.000414 6 %I <sub>γ</sub> <0.00344
2645 <sup>b</sup>	<0.12 <sup>&amp;</sup>	2645.1	7/2 <sup>+</sup>	0	3/2 <sup>+</sup>	E2		0.000633 9	α(K)=7.47×10 <sup>-6</sup> 10; α(L)=5.93×10 <sup>-7</sup> 8; α(M)=5.43×10 <sup>-8</sup> 8 α(IPF)=0.000625 9 %I <sub>γ</sub> <0.00153
2693.7 2	10.96 18	2693.9	3/2 <sup>+</sup>	0	3/2 <sup>+</sup>	M1+E2	+0.26 2	0.000553 8	α(K)=6.86×10 <sup>-6</sup> 10; α(L)=5.45×10 <sup>-7</sup> 8; α(M)=4.98×10 <sup>-8</sup> 7 α(IPF)=0.000546 8 %I <sub>γ</sub> =0.136 4 I <sub>γ</sub> : weighted average of 10.2 15 (1971Ge04), 10.96 18 (1980Wi13) and 11.02 34 (1984Ad01).
2699 <sup>b</sup>	<0.33 <sup>&amp;</sup>	3918.3	3/2 <sup>+</sup>	1219.2	1/2 <sup>+</sup>	[M1,E2]		0.00060 6	α(K)=7.02×10 <sup>-6</sup> 23; α(L)=5.58×10 <sup>-7</sup> 18; α(M)=5.10×10 <sup>-8</sup> 17 α(IPF)=0.00060 5 %I <sub>γ</sub> <0.00420
2748.5 6	0.477 34	3967.9	1/2 <sup>+</sup>	1219.2	1/2 <sup>+</sup>	[M1]		0.000569 8	α(K)=6.63×10 <sup>-6</sup> 9; α(L)=5.26×10 <sup>-7</sup> 7; α(M)=4.81×10 <sup>-8</sup> 7 α(IPF)=0.000562 8 %I <sub>γ</sub> =0.0059 5 I <sub>γ</sub> : weighted average of 0.48 6 (1980Wi13) and 0.476 34 (1984Ad01).
2861 <sup>b</sup> 3002.1 4	<0.099 <sup>&amp;</sup> 7.29 14	4624.5? 3002.2	3/2,5/2 5/2 <sup>+</sup>	1763.1 0	5/2 <sup>+</sup> 3/2 <sup>+</sup>	M1+E2	+0.08 2	0.000671 9	%I <sub>γ</sub> <0.00126 α(K)=5.80×10 <sup>-6</sup> 8; α(L)=4.60×10 <sup>-7</sup> 6; α(M)=4.21×10 <sup>-8</sup> 6 α(IPF)=0.000665 9 %I <sub>γ</sub> =0.0906 28 I <sub>γ</sub> : weighted average of 9.0 15 (1971Ge04), 7.24 14 (1980Wi13), 7.45 23 (1984Ad01) and 6.9 5 (1985Da04).
3405 <sup>b</sup>		4624.5?	3/2,5/2	1219.2	1/2 <sup>+</sup>				I <sub>γ</sub> : could not be determined due to being obscured by another peak (1980Wi13).
3918	0.52 3	3918.3	3/2 <sup>+</sup>	0	3/2 <sup>+</sup>	M1+E2		0.00108 7	α(K)=4.00×10 <sup>-6</sup> 9; α(L)=3.17×10 <sup>-7</sup> 7; α(M)=2.90×10 <sup>-8</sup> 6

<sup>35</sup>Ar ε+β<sup>+</sup> decay (1.7755 s) **1980Wi13,1984Ad01** (continued)

γ(<sup>35</sup>Cl) (continued)

<u>E<sub>γ</sub><sup>‡</sup></u>	<u>I<sub>γ</sub><sup>#a</sup></u>	<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup>π</sup></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup>π</sup></u>	<u>Mult. @</u>	<u>α<sup>†</sup></u>	<u>Comments</u>
3968	0.106 25	3967.9	1/2 <sup>+</sup>	0	3/2 <sup>+</sup>	[M1,E2]	0.00109 7	α(IPF)=0.00107 7 %I <sub>γ</sub> =0.0065 4 α(K)=3.93×10 <sup>-6</sup> 8; α(L)=3.12×10 <sup>-7</sup> 7; α(M)=2.85×10 <sup>-8</sup> 6 α(IPF)=0.00109 7 %I <sub>γ</sub> =0.00132 3I
4624 <sup>b</sup>	<0.035 <sup>&amp;</sup>	4624.5?	3/2,5/2	0	3/2 <sup>+</sup>	D+Q		%I <sub>γ</sub> <4.46×10 <sup>-4</sup>

<sup>†</sup> Additional information 7.

<sup>‡</sup> From 1984Ad01, unless otherwise noted.

<sup>#</sup> from 1980Wi13, unless otherwise noted.

@ From Adopted Gammas.

& 1980Wi13 gives upper limits of I<sub>γ</sub> at 98% confidence level. These peaks are not observed in the spectra of 1980Wi13 or in 1984Ad01.

<sup>a</sup> For absolute intensity per 100 decays, multiply by 0.01243 30.

<sup>b</sup> Placement of transition in the level scheme is uncertain.

$^{35}\text{Ar}$   $\epsilon + \beta^+$  decay (1.7755 s) 1980Wi13,1984Ad01

