^{35}K $\varepsilon+\beta^+$ decay (175 ms)   **1980Ew02**

Parent: ^{35}K: E=0; J^π=3/2$^+$; $T_{1/2}$=175 ms 2; Q(ε)=11874.4 9; %ε+%β^+ decay=100

^{35}K-J^π,$T_{1/2}$: From Adopted Levels of ^{35}K.

^{35}K-$T_{1/2}$: Weighted average of 175 ms 2 (2018Sa54), 178 ms 8 (1998Sc19), and 190 ms 30 (1980Ew02).

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

1980Ew02,1979Ca15: A 600-MeV proton beam was produced from the synchrocyclotron at CERN-ISOLDE and bombard a ScC$_2$ target. The ^{45}Sc(p,8n3p) spallation reaction products diffused out of the target and reached a tungsten surface ionization source where potassium isotopes were selectively ionized. The beam was extracted from the ion source, separated by the ISOLDE analyzing magnet, and collected by a mylar foil for γ-ray measurements and then a carbon foil for proton measurements. γ rays were detected using a Ge(Li) detector. Time for positron activities were determined using a 700$-\mu$m thick silicon detector. Protons were detected using a 20$-\mu$m-700$-\mu$m thick ΔE-E telescope of silicon surface barrier detectors with FWHM=50 keV. Measured Eγ<4.8 MeV, Iγ, E$_p$>0.9 MeV, I$_p$. Deduced Deduced levels, J, π, decay branching ratios, log ft, parent ^{35}K $T_{1/2}$, and coeffcients of the isobaric multiplet mass equation for A=36, T=2 quartets. Comparisons with shell-model calculations and the mirror nucleus ^{35}Cl. Also see abstracts 1979HaZY, 1979HaZT.

2018Sa54: A 36-MeV/nucleon ^{36}Ar primary beam was produced from the K500 cyclotron at Texas A&M University. The secondary ^{35}K beam was produced via the ^{1}H(^{36}Ar,^{35}K)2n reaction of ^{36}Ar bombarding a LN$_2$-cooled hydrogen gas target, separated by MARS, and implanted into a 45$-\mu$m DSSD sandwiched between a 140$-\mu$m SSSD and a 1-mm Si-pad detector in a pulsed-beam mode. $\varepsilon+\beta^+$-delayed protons were detected by the implantation detector. γ rays were detected by two HPGe detectors. Measured E$_p$>300 keV, I$_p$, Eγ, Iγ, pγ-coin, $\gamma\gamma$-coin. Deduced parent ^{35}K $T_{1/2}$.

2019ChZU: Same beam production as 2018Sa54. ^{35}K was implanted into the AstroBox2 detector filled with 800-Torr P5 gas. $\varepsilon+\beta^+$-delayed protons were detected by the implantation detector. γ rays were detected by 4 Clover Ge detectors. Measured E$_p$>100 keV, I$_p$, Eγ, Iγ, pγ-coin, $\gamma\gamma$-coin.

1998Sc19: A polarized ^{35}K beam was produced via the fragmentation of 500-MeV/nucleon ^{40}Ca impinging on a ^{9}Be target at GSI, separated using ΔE-tof by FRS, momentum-selected by slits, and implanted into a KBr single crystal placed in the central region of a magnet. Positrons were detected using plastic scintillators. γ rays were detected using a Ge detector. Measured β-decay asymmetry and $\beta\gamma$-coin. Deduced polarization and g-factor of ^{35}K ground state from β-NMR and ^{35}K $T_{1/2}$ from $\beta\gamma$-decay time spectra.

2006Me04: A polarized ^{35}K beam was produced via the proton-pickup reaction ^{36}Ar(^{9}Be,^{10}Li)^{35}K, separated by NSCL-A1900, and implanted into a KBr crystal. Positrons were detected using plastic scintillators. Deduced the magnetic dipole moment and g-factor of ^{35}K ground state from β-NMR.

^{35}K also decays to ^{34}Cl by εp (0.37% 15) (1980Ew02).

Theoretical studies involving ^{35}K decay: shell model (1985Br29, 2003Sm02, Surender et al., Annals of Physics 470, 169772 (2024)).

^{35}Ar Levels

E(level)[†]	J^{π}[#]	Comments
0	3/2$^+$	
1184.01 *25*	1/2$^+$	
1750.7 *3*	(5/2)$^+$	
2638.0 *3*	3/2$^+$,5/2$^+$	
2982.79 *12*	3/2$^+$,5/2$^+$	
4065.0? *4*	1/2$^+$,3/2$^+$,5/2$^+$	
4528.2 *4*	1/2$^+$,3/2$^+$,5/2$^+$	
4725.9 *6*	1/2$^+$	
4785.8 *11*	1/2$^+$	
5572.66 *15*	3/2$^+$	T=3/2
7510?[‡] *20*	1/2$^+$,3/2$^+$,5/2$^+$	
8395?[‡] *20*	1/2$^+$,3/2$^+$,5/2$^+$	

[†] From a least-squares fit to γ-ray energies in 1980Ew02.

[‡] Tentative identification based on proton groups by authors in 1980Ew02.

[#] From Adopted Levels.

^{35}K $\varepsilon+\beta^+$ **decay (175 ms)**   **1980Ew02 (continued)**

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ †	Iε†	Log ft	I($\varepsilon+\beta^+$)†	Comments
(3479 20)	8395?	0.06 3	0.00044 18	4.57 19	0.062 26	
(4364 20)	7510?	0.15 6	0.00042 17	4.79 18	0.15 6	
(6301.7 14)	5572.66	36 3	0.026 2	3.31 5	36 3	
(7088.6 18)	4785.8	1.0 4		5.15 18	1.0 4	
(7148.5 15)	4725.9	2.1 4		4.85 9	2.1 4	
(7346.2 14)	4528.2	0.7 4		5.39 25	0.7 4	
(7809.4 14)	4065.0?	0.55 30		5.64 24	0.55 30	
(8891.6 14)	2982.79	26 3	0.0057 7	4.27 6	26 3	
(9236.4 14)	2638.0	≤0.4		≥6.2	≤0.4	
(10123.7 14)	1750.7	11.9 9	0.00171 13	4.91 4	11.9 9	
(10690.4 14)	1184.01	2.2 7		5.77 14	2.2 7	
(11874.4 17)	0	19 4	0.0016 3	5.07 10	19 4	I($\varepsilon+\beta^+$): deduced from mirror ^{35}S to ^{35}Cl g.s. log ft=5.01 2 correcting for asymmetry systematics (1980Ew02).

† Absolute intensity per 100 decays.

$\gamma(^{35}$Ar)

E$_\gamma$	I$_\gamma$†‡	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
886.8 5	0.9 3	2638.0	3/2$^+$,5/2$^+$	1750.7	(5/2)$^+$	
1044.4 4	1.3 4	5572.66	3/2$^+$	4528.2	1/2$^+$,3/2$^+$,5/2$^+$	
1184.0 3	14.3 7	1184.01	1/2$^+$	0	3/2$^+$	
1426.8 4	3.0 5	4065.0?	1/2$^+$,3/2$^+$,5/2$^+$	2638.0	3/2$^+$,5/2$^+$	
1507.4 5	1.9 4	5572.66	3/2$^+$	4065.0?	1/2$^+$,3/2$^+$,5/2$^+$	
1750.5 3	28 1	1750.7	(5/2)$^+$	0	3/2$^+$	
1798.9 5	3.5 6	2982.79	3/2$^+$,5/2$^+$	1184.01	1/2$^+$	
2589.8 1	52 2	5572.66	3/2$^+$	2982.79	3/2$^+$,5/2$^+$	
2638.0 4	5.5 7	2638.0	3/2$^+$,5/2$^+$	0	3/2$^+$	
^{x}2697.7 6						Unplaced γ ray, accounts for 1.2% β-feeding (1980Ew02).
2934.5 5	3.5 6	5572.66	3/2$^+$	2638.0	3/2$^+$,5/2$^+$	
2982.68 13	100 4	2982.79	3/2$^+$,5/2$^+$	0	3/2$^+$	
3542.0 6	2.9 6	4725.9	1/2$^+$	1184.01	1/2$^+$	
3821.7 7	3.5 7	5572.66	3/2$^+$	1750.7	(5/2)$^+$	
4387.2 9	3.5 8	5572.66	3/2$^+$	1184.01	1/2$^+$	
4527.9 7	2.6 7	4528.2	1/2$^+$,3/2$^+$,5/2$^+$	0	3/2$^+$	
4724.5 11	1.2 5	4725.9	1/2$^+$	0	3/2$^+$	
4785.4 11	1.9 7	4785.8	1/2$^+$	0	3/2$^+$	
5572.3 10	6.1 16	5572.66	3/2$^+$	0	3/2$^+$	1980Ew02 only observed its double escape peak at 4550 keV.

† From 1980Ew02.
‡ For absolute intensity per 100 decays, multiply by 0.50 2.
^{x} γ ray not placed in level scheme.

^{35}K $\varepsilon+\beta^+$ decay (175 ms)   1980Ew02

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

$I_\gamma < \ 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

$3/2^+$ 0   175 ms 2

$\%\varepsilon + \%\beta^+ = 100$ $Q_\varepsilon = 11874.4\ 9$

$^{35}_{19}$K$_{16}$

	Iβ^+	Iε	Log ft
$1/2^+,3/2^+,5/2^+$ 8395	0.06	0.00044	4.57
$1/2^+,3/2^+,5/2^+$ 7510	0.15	0.00042	4.79

5572.3 3.1
4387.2 1.8
3821.7 1.8
2934.5 1.75
2589.8 26.0
1507.4 0.95
1044.4 0.65

4785.4 1.0
4724.5 0.60
3542.0 1.45
4527.9 1.3
1426.8 1.50

2982.68 50.0
1798.9 1.75
2638.0 2.8
886.8 0.45

1750.5 14.0
1184.0 7.2

Level	J^π	Iβ^+	Iε	Log ft
5572.66	$3/2^+$	36	0.026	3.31
4785.8	$1/2^+$	1.0		5.15
4725.9	$1/2^+$	2.1		4.85
4528.2	$1/2^+,3/2^+,5/2^+$	0.7		5.39
4065.0	$1/2^+,3/2^+,5/2^+$	0.55		5.64
2982.79	$3/2^+,5/2^+$	26	0.0057	4.27
2638.0	$3/2^+,5/2^+$	≤0.4		≥6.2
1750.7	$(5/2)^+$	11.9	0.00171	4.91
1184.01	$1/2^+$	2.2		5.77
0	$3/2^+$	19	0.0016	5.07

$^{35}_{18}$Ar$_{17}$