^{35}Ca εp decay (25.7 ms) 1999Tr04,1985Ay01

Parent: ^{35}Ca: E=0; J$^{\pi}$=1/2^{+}; $T_{1/2}$=25.7 ms *2*; Q(εp)=1.587×10^{4} *11*; %εp decay=95.8 *3*

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

^{35}Ca-Q(εp): Deduced by evaluators from mass excesses of 4777 *105* for ^{35}Ca measured by 2023La09 and −18378.289 *80* for ^{34}Ar from 2021Wa16. Q(εp) from 2021Wa16: Q(εp)=16280 *200* (syst).

^{35}Ca-%εp decay: 95.8 *3* derived from the renormalization of %ΣI(1p)+%ΣI(2p)=100.6 in 1999Tr04 to 100. The original decay branching ratios in 1999Tr04: %ΣI(1p)=96.4 *18* and %ΣI(2p)=4.2 *3*.

1999Tr04, 1998Le45: A secondary ^{35}Ca beam at 0.3 ions/s and 98% purity was produced via the projectile fragmentation of a 95-MeV/nucleon ^{40}Ca^{20+} primary beam impinging on a rotating natNi target, selected using ΔE-tof by the GANIL LISE3 spectrometer, and implanted into a 500 μm silicon detector sandwiched between two 500−μm silicon detectors for detecting β^{+} particles. 3.5×10^{4} ^{35}Ca ions were stopped at a depth of 300 μm with FWHM=70 μm (setting 1) and 2.5×10^{4} ^{35}Ca ions were stopped at a depth of 450 μm (setting 2). ε+β^{+}-delayed protons were detected by the implantation detector. γ rays were detected by three Ge detectors and two NaI detectors. Measured E_p, I_p, Eγ, Iγ, E_{2p}, I_{2p}, βp-coin, pγ-coin. Built the decay scheme consisting of 1p-emitting states in ^{35}K, a 2p-emitting state (T=5/2 IAS) in ^{35}K, 1p daughter states in ^{34}Ar, and a 2p daughter state in ^{33}Cl. Deduced decay branching ratios, B(GT) and B(F), and parent ^{35}Ca $T_{1/2}$ from implant-decay correlations.

1985Ay01: ^{35}Ca isotope discovery. ^{35}Ca was produced by bombarding a natural calcium target using a 135-MeV ^{3}He beam from the 88-inch Cyclotron at Lawrence Berkeley Laboratory. Recoiling products were slowed down, transported, and collected on a slowly rotating catcher wheel. The ε+β^{+}-delayed protons were detected using Si detector telescopes. Measured E_p, I_p, pp-coin. Built the decay scheme consisting of a 2p-emitting state (T=5/2 IAS) in ^{35}K, sequential 2p intermediate states in ^{34}Ar, and 2p daughter states in ^{33}Cl. Deduced ^{35}Ca $T_{1/2}$ and ^{35}Ca mass using the known members of A=35, T=5/2 sextuplets IMME.

Theoretical studies involving ^{35}Ca decay: 2003Sm02, 1991De26, 1990Br26.

^{34}Ar Levels

E(level)[†]	J$^{\pi}$[†]
0	0^{+}
2091.1 *3*	2^{+}
3287.7 *5*	2^{+}
3873 *3*	0^{+}

[†] From the Adopted Levels.

Delayed Protons (^{34}Ar)

Particle normalization: from the renormalization of %ΣI(1p)+%ΣI(2p)=100.6 in 1999Tr04 to 100.

E(p)[†]	E(^{34}Ar)	I(p)[†a]	E(^{35}K)[‡]	Comments
1427 *5*	0	48.5 *13*	1553	
2278[#]	2091.1	5.4 *9*	4520[@]	E(p): unresolved $E(p)_{lab}$=1909-2647 from 1999Tr04. I(p): 64.0% *93* of $\%I(p)_{tot}$=8.4 *6* from pγ coincidences in 1999Tr04.
2278[#]	3287.7	1.0 *4*	5716[@]	E(p): unresolved $E(p)_{lab}$=1909-2647 from 1999Tr04. I(p): 12.1% *49* of $\%I(p)_{tot}$=8.4 *6* from pγ coincidences in 1999Tr04.
2278[#]	3873	2.0 *7*	6302[@]	E(p): unresolved $E(p)_{lab}$=1909-2647 from 1999Tr04. I(p): 23.9% *79* of $\%I(p)_{tot}$=8.4 *6* from pγ coincidences in 1999Tr04.
2727 *13*	2091.1	6.0 *5*	4982	
3224[#]	2091.1	2.2 *3*	5493[@]	E(p): unresolved $E(p)_{lab}$=2947-3500 from 1999Tr04.
3592 *25*	0	3.0 *3*	3781	
3822 *36*	0	3.8 *3*	4018	
4041 *71*	2091.1	2.9 *3*	6335	
4570 *48*	0	2.9 *3*	4788	
4754 *38*	0	4.2 *4*	4977	
5018 *71*	0	3.9 *3*	5249	

Continued on next page (footnotes at end of table)

^{35}Ca εp decay (25.7 ms) 1999Tr04,1985Ay01 (continued)

Delayed Protons (continued)

E(p)[†]	E(^{34}Ar)	I(p)[†a]	E(^{35}K)[‡]	Comments
5294 *48*	0	0.72 *18*	5533	
5466 *48*	0	0.61 *15*	5710	
5616 *37*	0	1.43 *17*	5865	
5834 *60*	0	1.40 *19*	6089	
6316[#]	0	1.09 *17*	6585[@]	E(p): unresolved $E(p)_{lab}$=5983-6649 from 1999Tr04.
6783 *22*	2091.1	3.8 *2*	9168[&]	E(^{35}K): $E(p1)_{lab}$=6783 *22* corresponds to E(^{35}K)=9157 *23*.
7509[#]	0	1.1 *2*	7813[@]	E(p): unresolved $E(p)_{lab}$=7131-7887 from 1999Tr04.
8802 *89*	0	0.41 *6*	9168[&]	E(^{35}K): $E(p0)_{lab}$=8802 *89* corresponds to E(^{35}K)=9144 *92*.

[†] From 1999Tr04. E(p) is in lab frame. I(p) is obtained from the number of observed proton events and the total number of implants, with simulated proton-detection efficiencies.

[‡] Evaluators deduced E(level)(^{35}K)=$E(p)_{lab}$×[m(p)+m(^{34}Ar)]/m(^{34}Ar)+S(p)(^{35}K)+E(level)(^{34}Ar), with S(p)(^{35}K)=83.6 *5* (2021Wa16), E(level)(^{34}Ar) from the Adopted Levels of ^{34}Ar, and $E(p)_{lab}$ from 1999Tr04. For a ^{35}K proton-emitting level with multiple proton branches, evaluators take the weighted average for E(level)(^{35}K) values deduced from each proton branch. 1999Tr04 used S(p)(^{35}K)=78 *20* from 1993Au07, which causes a small difference between the original E(level)(^{35}K) in 1999Tr04 and the deduced E(level)(^{35}K) here.

[#] Unresolved protons.

[@] Unresolved proton-emitting levels in ^{35}K corresponding to a group of unresolved protons populating one daughter state in ^{34}Ar.

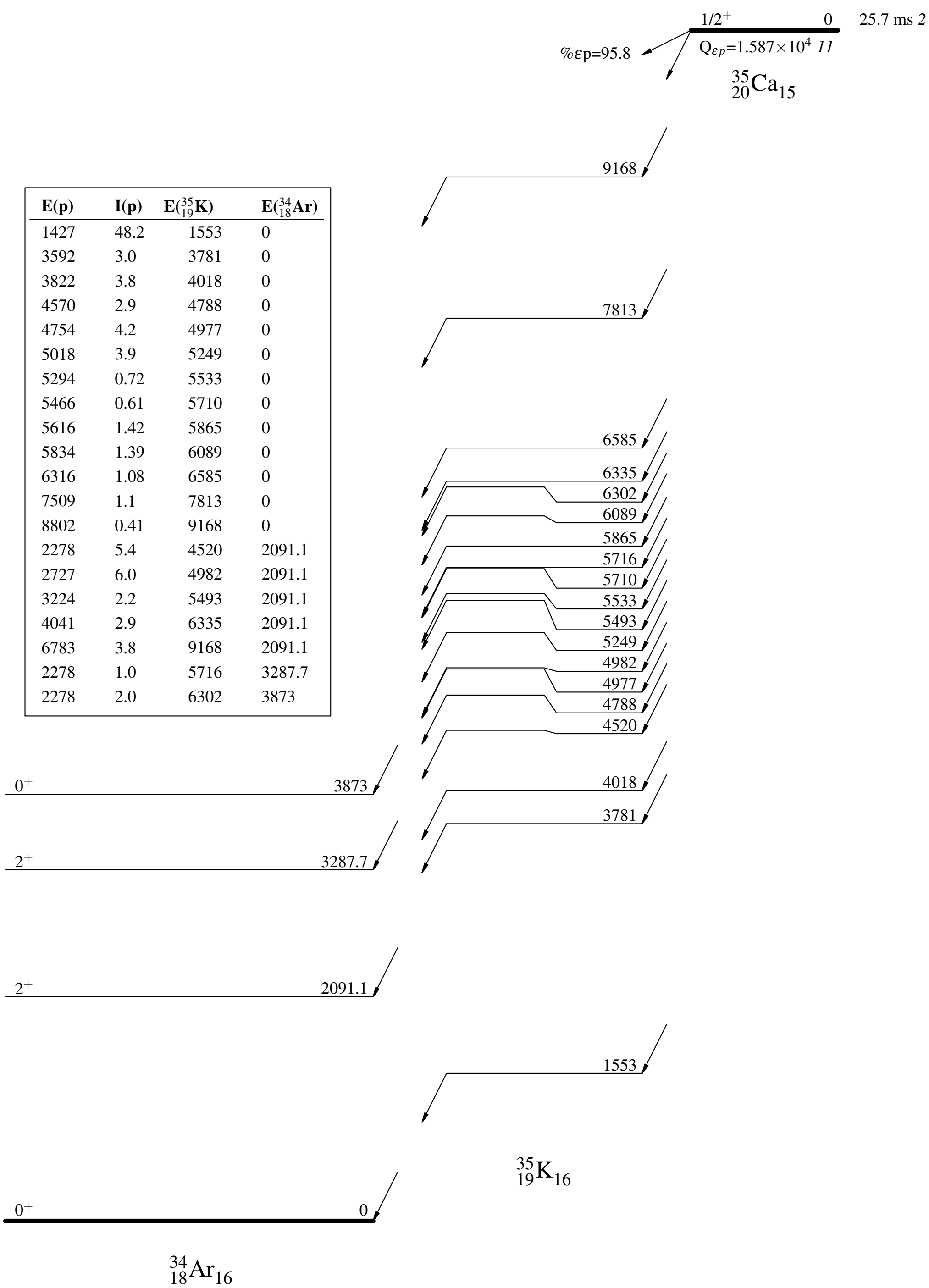
[&] T=5/2 isobaric analog state in ^{35}K, which also decays by $E(2p0)_{lab}$=4305 *26*, proton line 8 in 1999Tr04, corresponding to E(^{35}K)=9186 *27* with S(2p)(^{35}K)=4747.5 *6* (2021Wa16) and adding a +7−keV correction for the difference in the recoil effect between 1p and 2p emissions (1999Tr04). 9168 *23* is obtained from a weighted average of the three E(^{35}K) values of 9144 *92* (p0), 9157 *23* (p1), and 9186 *27* (2p0). Other: $E(2p0)_{lab}$=4089 *30*, $E(2p0)_{c.m.}$=4311 *40* (1985Ay01), corresponding to E(^{35}K)=9059 *41* with S(2p)(^{35}K)=4747.5 *6* (2021Wa16). 1985Ay01 also observed $E(2p1)_{lab}$=3287 *30* and proposed both 2p0 and 2p1 proceed via a sequential decay mechanism with the first proton $E(p)_{lab}$=2213 keV, corresponding to an intermediate state in ^{34}Ar at 6807 keV. 2p1 has been ruled out in 1999Tr04 due to the nonobservation of expected pγ coincidences. 1999Tr04 also states that the observed ratio I(2p0)/I(1p)=0.98 *9* agrees with the calculated branching ratio I(2p)/I(1p)=1 for the IAS (1991De26).

[a] For absolute intensity per 100 decays, multiply by 0.994.

^{35}Ca εp decay (25.7 ms) 1999Tr04,1985Ay01

Decay Scheme

I(p) Intensities: I(p) per 100 parent decays



E(p)	I(p)	E($^{35}_{19}$K)	E($^{34}_{18}$Ar)
1427	48.2	1553	0
3592	3.0	3781	0
3822	3.8	4018	0
4570	2.9	4788	0
4754	4.2	4977	0
5018	3.9	5249	0
5294	0.72	5533	0
5466	0.61	5710	0
5616	1.42	5865	0
5834	1.39	6089	0
6316	1.08	6585	0
7509	1.1	7813	0
8802	0.41	9168	0
2278	5.4	4520	2091.1
2727	6.0	4982	2091.1
3224	2.2	5493	2091.1
4041	2.9	6335	2091.1
6783	3.8	9168	2091.1
2278	1.0	5716	3287.7
2278	2.0	6302	3873