

^{36}Ca εp decay (100.9 ms) [1997Tr05](#),[2001Lo11](#),[2015Su01](#)

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

Parent: ^{36}Ca : $E=0$; $J^\pi=0^+$; $T_{1/2}=100.9$ ms 20; $Q(\varepsilon\text{p})=9275$ 6; $\% \varepsilon\text{p}$ decay=54.1 12

^{36}Ca - J^π : From the Adopted Levels of ^{36}Ca ([2012Ni01](#)).

^{36}Ca - $T_{1/2}$: Weighted average of 102 ms 2 ([1995Tr02](#),[1997Tr05](#)), 100.1 ms 23 ([2007Do17](#)), and 100.0 ms 24 ([2015Su01](#)). Other: 100 ms +90-40 ([1981Ay01](#)).

^{36}Ca - $Q(\varepsilon\text{p})$: Deduced by evaluators from ^{36}Ca mass excess of -6483 6; weighted average of -6483.6 56 ([2021Su04](#)), -6480 40 ([2021La04](#)), and -6450 40 ([2021Wa16](#),[1977Tr03](#)), and ^{35}Ar mass excess of -23047.3 7 ([2021Wa16](#)). $Q(\varepsilon\text{p})$ from [2021Wa16](#): 9310 40.

^{36}Ca - $\% \varepsilon\text{p}$ decay: Unweighted average of $\% \varepsilon+\beta^+$ p=56.8 13 ([1997Tr05](#)), 54.3 18 ([2001Lo11](#)), 51.2 10 ([2007Do17](#)), and 53.9 72 ([2015Su01](#)).

[1997Tr05](#),[1995Tr02](#): a-300 MeV/nucleon ^{40}Ca primary beam was produced by the GSI heavy-ion synchrotron. The secondary ^{36}Ca beam was produced via the projectile fragmentation of ^{40}Ca impinging on a ^9Be target and was selected using ΔE -tof- $B\rho$ by FRS at GSI, Darmstadt. A total of 2.8×10^4 ^{36}Ca ions were implanted into a 500- μm -thick Si detector. $\varepsilon+\beta^+$ -delayed protons were detected by the implantation detector. β particles were detected by the implantation detector and two 500- μm -thick Si counters. γ rays were detected by two Ge detectors. Measured E_p , I_p , E_γ , I_γ , βp -coin, $\beta\gamma$ -coin, and $\text{p}\gamma$ -coin. Deduced levels, decay branching ratios, $\log ft$, $B(F)$, and $B(GT)$. Deduced parent ^{36}Ca $T_{1/2}$ from the time spectrum of proton events accumulated during the beam-off in the pulsed-beam mode. Comparisons with shell-model calculations.

[2001Lo11](#): A 95-MeV ^{40}Ca primary beam was produced by the SISSI facility at GANIL. The secondary ^{36}Ca beam was produced via the projectile fragmentation of ^{40}Ca impinging on a $^{\text{nat}}\text{Ni}$ target and was selected using ΔE -tof by the LISE3 spectrometer and purified by a velocity filter. A total of 102407 ^{36}Ca ions were implanted into a 500- μm -thick Si detector. $\varepsilon+\beta^+$ -delayed protons were detected by the implantation detector. β particles were detected by two 500- μm -thick Si counters. γ rays were detected by three Ge detectors. Measured E_p , I_p , E_γ , I_γ , βp -coin, and $\beta\gamma$ -coin. Deduced levels, decay branching ratios, $\log ft$, $B(F)$, and $B(GT)$. Comparisons with shell-model calculations.

[2015Su01](#): A 69.42-MeV/nucleon ^{40}Ca primary beam was produced by the Sector Focusing Cyclotron and Separated Sector Cyclotron at the Heavy Ion Research Facility in Lanzhou (HIRFL). The secondary ^{36}Ca beam was produced via the projectile fragmentation of ^{40}Ca impinging on a ^9Be target and was selected using ΔE -tof- $B\rho$ by RIBLL. A total of 22890 ^{36}Ca ions were implanted into a 525- μm -thick DSSD. $\varepsilon+\beta^+$ -delayed protons were detected by the DSSD with a threshold of 500 keV. $\varepsilon+\beta^+$ -delayed γ rays were detected by four Clover Ge detectors surrounding the DSSD chamber. Measured E_p , I_p , E_γ , I_γ , βp -coin, $\text{p}\gamma$ -coin, and implant-decay time correlations. Deduced levels, decay branching ratios, and parent ^{36}Ca $T_{1/2}$. Also see [2016Li45](#).

[2007Do17](#): A 74.5-MeV/nucleon ^{58}Ni primary beam was produced by the SISSI facility at GANIL. The secondary ^{36}Ca beam was produced via the projectile fragmentation of ^{58}Ni impinging on a $^{\text{nat}}\text{Ni}$ target and was selected using ΔE -tof- $B\rho$ by the ALPHA-LISE3 separator. A total of 16991 ^{36}Ca ions were implanted into a 500- μm thick DSSD. $\varepsilon+\beta^+$ -delayed protons were detected by the DSSD with a threshold of 60-80 keV. $\varepsilon+\beta^+$ -delayed γ rays were detected by four Ge detectors surrounding the implantation array. A 5-mm thick lithium-drifted Si detector was used as a veto for implantation events and to detect β particles. Measured E_p , I_p , and implant-decay time correlations. Deduced levels, decay branching ratios, and parent ^{36}Ca $T_{1/2}$.

[1995Ga16](#): 60-keV ^{36}Ca was produced by the ISOLDE general-purpose on-line isotope separator at the CERN PS/Booster and implanted into the entrance window of a gas-Si-Si ΔE -E-veto detector telescope. Measured E_p . Deduced coefficients of the isobaric multiplet mass equation for $A=36$, $T=2$ quintets. A by-product of ^{37}Ca decay study ([1995Ga03](#)).

[1981Ay01](#): ^{36}Ca was produced via the $^{40}\text{Ca}(^3\text{He},\alpha 3\text{n})$ reaction using a 95-MeV ^3He beam from the 88-inch Cyclotron at Lawrence Berkeley Laboratory. β -delayed protons were detected using a Si surface barrier detector telescope with FWHM=55 keV and a minimum threshold of ≈ 1.5 MeV. Measured E_p . Deduced ^{36}Ca $T_{1/2}$ and coefficients of the isobaric multiplet mass equation for $A=36$, $T=2$ quintets.

Additional information 1.

Theoretical studies involving ^{36}Ca decay: shell model ([1984Mu25](#),[1990Br26](#)), covariant density functional theory ([2013Ni09](#)).

^{36}Ca εp decay (100.9 ms) 1997Tr05,2001Lo11,2015Su01 (continued) ^{35}Ar Levels

E(level)	J^π^\dagger	$T_{1/2}^\dagger$	Comments
0	$3/2^+$	1.7755 s 14	
1184.3 4	$1/2^+$		E(level): From E_γ data.

† From the Adopted Levels.

 $\gamma(^{35}\text{Ar})$

I_γ normalization: From $100/\% \varepsilon + \beta^+ \text{p}$.

E_γ	I_γ^\dagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1184.3 4	1.2 4	1184.3	$1/2^+$	0	$3/2^+$	E_γ : weighted average of 1184.2 4 (1997Tr05) and 1185 1 (2001Lo11). I_γ : From 1997Tr05.

† Absolute intensity per 100 decays.

Delayed Protons (^{35}Ar)

E(p) †	E(^{35}Ar)	I(p) $^\#$	E(^{36}K) ‡	Comments
1.37×10^3	1184.3	1.2 4	4281.7	E(p),I(p): From 1997Tr05.
1648 18	0	8.4 12	3354	E(^{36}K): $J^\pi=0$, T=2 isobaric analog state in ^{36}K . E(p): weighted average of 1676 39 (1997Tr05), 1645 21 (2001Lo11), 1660 18 (2007Do17), and 1624 22 (2015Su01). I(p): unweighted average of 11.3 6 (1997Tr05), 9.3 8 (2001Lo11), 7.3 8 (2007Do17), and 5.7 16 (2015Su01).
2549.9 22	0	37.4 10	4281.7	E(p): weighted average of 2519 21 (1981Ay01), 2550.2 22 (1995Ga16), 2548 37 (1997Tr05), 2551 21 (2001Lo11), 2538 18 (2007Do17), and 2594 30 (2015Su01). I(p): weighted average of 37.8 10 (1997Tr05), 32.1 42 (2007Do17), and 34.0 58 (2015Su01). Other: 37 1 (2001Lo11) without separating the weaker proton branch from the same level to ^{35}Ar first excited state.
2713 21	0	2.6 9	4449	E(^{36}K): $J^\pi=0$, T=2 isobaric analog state in ^{36}K . E(p): weighted average of 2713 31 (1997Tr05) and 2713 21 (2001Lo11). I(p): unweighted average of 1.7 2 (1997Tr05) and 3.5 5 (2001Lo11).
2921 35	0	1.3 2	4663	E(p): weighted average of 2937 35 (1997Tr05) and 2895 44 (2001Lo11). I(p): weighted average of 1.4 2 (1997Tr05) and 1.0 3 (2001Lo11).
3484 21	0	0.6 2	5242	E(p),I(p): From 2001Lo11.
3.98×10^3 7	0	0.9 2	5753	E(p),I(p): From 2001Lo11.
4.15×10^3 5	0	2.2 5	5927	E(p): weighted average of 4162 45 (1997Tr05) and 4135 44 (2001Lo11). I(p): unweighted average of 2.7 4 (1997Tr05) and 1.7 3 (2001Lo11).
4.99×10^3 7	0	0.4 2	6791	E(p): weighted average of 4989 69 (1997Tr05) and 4983 67 (2001Lo11). I(p): weighted average of 0.7 2 (1997Tr05) and 0.3 1 (2001Lo11).

† In lab frame. Evaluators take a weighted average when multiple measurements of a E(p) are available. 2007Do17 and 2015Su01 reported $E_{\text{c.m.}}$. 1997Tr05 and 2001Lo11 reported the E(level) of ^{36}K proton-emitting levels. Evaluators deduced proton center-of-mass energies $E_{\text{c.m.}}=E(\text{level})(^{36}\text{K})-S(\text{p})(^{36}\text{K})-E(\text{level})(^{35}\text{Ar})$ using their original $S(\text{p})=1666.8$. Evaluators then deduced each $E(\text{p})_{\text{lab}}=E_{\text{c.m.}} \times m(^{35}\text{Ar})/[m(\text{p})+m(^{35}\text{Ar})]$.

‡ $E(\text{level})(^{36}\text{K})=E(\text{p})_{\text{lab}} \times [m(\text{p})+m(^{35}\text{Ar})]/m(^{35}\text{Ar})+S(\text{p})(^{36}\text{K})+E(\text{level})(^{35}\text{Ar})$, where $S(\text{p})(^{36}\text{K})=1658.9 8$ (2021Wa16).

$^\#$ Absolute intensity per 100 decays.

^{36}Ca ϵp decay (100.9 ms) 1997Tr05,2001Lo11,2015Su01Decay Scheme

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

