

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

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

$^{36}\text{Ca}-J^\pi$: From the Adopted Levels of ^{36}Ca (2012Ni01).

$^{36}\text{Ca}-T_{1/2}$: 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).

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

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

1997Tr05,1995Tr02: A 300 AMeV ^{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 ρ 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 natNi 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 ^{40}Ca impinging on a ^9Be target and was selected using ΔE -tof-B ρ 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 natNi target and was selected using ΔE -tof-B ρ 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).

1981Ay01,1980AYZZ: ^{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.

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

 ^{35}Ar Levels

E(level)	J^π^\dagger	Comments
0	$3/2^+$	
1184.3 4	$1/2^+$	E(level): from E_γ data in 1997Tr05 and 2001Lo11.

† From the Adopted Levels.

^{36}Ca ε p decay (100.9 ms) [1997Tr05](#), [2001Lo11](#), [2015Su01](#) (continued) $\gamma(^{35}\text{Ar})$

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)

$E(p)^\dagger$	$E(^{35}\text{Ar})$	$I(p)^\#$	$E(^{36}\text{K})^\ddagger$	Comments
1.37×10^3	1184.3	1.2 4	4281.7	$E(p), I(p)$: from 1997Tr05 . $E(^{36}\text{K})$: $J^\pi=0$, T=2 isobaric analog state in ^{36}K .
1648 18	0	8.4 12	3354	$E(p)$: 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	$E(^{36}\text{K})$: $J^\pi=0$, 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).

[†] $E(p)(\text{lab})$. [2007Do17](#) and [2015Su01](#) only reported $E_{c.m.}$. [1997Tr05](#) and [2001Lo11](#) only reported the $E(\text{level})$ of ^{36}K proton-emitting levels. Evaluators deduced proton center-of-mass energies $E_{c.m.}=E(\text{level})(^{36}\text{K})-S(p)(^{36}\text{K})-E(\text{level})(^{35}\text{Ar})$ using their original $S(p)=1666$ 8. Evaluators then deduced each $E(p)(\text{lab})=E_{c.m.} \times m(^{35}\text{Ar})/[m(p)+m(^{35}\text{Ar})]$.

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

[#] Absolute intensity per 100 decays.

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Decay Scheme

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

