

^{35}Al β^- decay (38.1 ms) 2005Ti11,2001Nu01

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

Parent: ^{35}Al : $E=0$; $J^\pi=(5/2)^+$; $T_{1/2}=38.1$ ms 4; $Q(\beta^-)=14170$ 40; $\% \beta^-$ decay=100

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

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

2005Ti11,2006AnZW: A ^{35}Al secondary beam at ≈ 2 pps was produced via the fragmentation of a 78-MeV/nucleon ^{36}S primary beam and selected by the LISE3 spectrometer at GANIL. A total of 3.46×10^5 ^{35}Al ions were continuously implanted into an NE102A plastic scintillator also for detecting β . The implantation detector was sandwiched between two silicon detectors for monitoring beam and for veto, respectively. Neutrons were detected using the TONNERRE array consisting of 19 plastic scintillator modules. γ rays were detected using two EXOGAM clover modules and a LEPS detector. Measured E_γ , I_γ , E_n , I_n , $\beta\gamma$ -coin, βn -coin, and $\beta n\gamma$ -coin. Deduced the decay scheme consisting of ^{35}Si and ^{34}Si levels, ^{35}Al $T_{1/2}$, decay branching ratios, $\log ft$, $B(\text{GT})$, and β -delayed neutron emission probability. Comparisons with shell-model calculations.

2001Nu01,2002Nu02: Exp 1: A ^{35}Al secondary beam at 8 pps was produced via the fragmentation of a UC target with 1.4 GeV protons at ISOLDE, CERN with subsequent surface-ionization and mass separation. ^{35}Al ions were collected onto a moving tape. β particles were detected using a thin cylindrical plastic scintillator, γ rays were detected using two Ge detectors, and neutrons were detected using eight low-threshold plastic scintillators. Measured E_γ , I_γ , E_n , I_n , $\beta\gamma$ -coin, $\gamma\gamma$ -coin, βn -coin. Deduced the decay scheme consisting of ^{35}Si and ^{34}Si levels, ^{35}Al $T_{1/2}$, decay branching ratios, $\log ft$, and β -delayed neutron emission probability. Comparisons with shell-model calculations. Exp 2: A lifetime measurement for the 974-keV level in ^{35}Si used a thin plastic scintillator for detecting β and a BaF_2 detector for detecting γ .

Other experimental studies on ^{35}Al $T_{1/2}$ and β -delayed neutron emission probability: 2017Ha23, 1999YoZW,

1995ReZZ/2008ReZZ, 1989MuZU, 1989Le16, 1988MuZY, 1988Mu08, 1988DuZT, 1988BaYZ, 1987DuZU, 1987BaZI.

Theoretical studies involving ^{35}Al decay: 2018Yo06, 2013Li39.

 ^{35}Si Levels

$E(n)$ under comments are deduced from $E(n)_{\text{c.m.}}=E(\text{level})(^{35}\text{Si})-S(n)(^{35}\text{Si})-E(\text{level})(^{34}\text{Si})$, with $E(\text{level})(^{35}\text{Si})$ reported in 2005Ti11 based on the neutron time-of-flight spectrum. 2005Ti11 used $E(\text{level})(^{34}\text{Si})=3326$ for $E(n1)$. 2005Ti11 used $S(n)(^{35}\text{Si})=2474$ 43, consistent with $S(n)(^{35}\text{Si})=2470$ 40 from 2021Wa16.

$E(\text{level})^{\dagger\ddagger}$	$J^\pi\#$	$T_{1/2}\#$	Comments
0	$(7/2)^-$	0.78 s 12	
909.95 23	$(3/2)^-$	55 ps 14	2001Nu01 reports a $\%I\beta^- < 0.9$ from 2001Nu01 without considering the conversion electron of the transition from 974 level to 910 level. The net feeding is deduced to be -1.9 9 from the $\gamma+ce$ intensity balance.
973.88 18	$(3/2)^+$	5.9 ns 6	$T_{1/2}$: lifetime=8.5 ns 9 from $\beta\gamma(t)$ in 2001Nu01, also adopted in the Adopted Levels.
2168.16 36	$(5/2)^+$		
3140	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=666$.
3450	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=976$.
3770	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=1296$.
5190	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=2716$.
5760	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=3286$.
6330	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n0)_{\text{c.m.}}=3856$; $E(n1)_{\text{c.m.}}=530$.
7360	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n1)_{\text{c.m.}}=1560$.
7690	$(3/2^+, 5/2^+, 7/2^+)$		Deduced $E(n1)_{\text{c.m.}}=1890$.

\dagger Additional information 1.

\ddagger From a least-squares fit to γ -ray energies for levels connected with γ transitions. For unbound levels, from 2005Ti11 based on the neutron time-of-flight spectrum.

$\#$ From the Adopted Levels of ^{35}Si .

³⁵Al β⁻ decay (38.1 ms) 2005Ti11,2001Nu01 (continued)

β⁻ radiations

av Eβ: [Additional information 2](#).

The decay scheme is incomplete due to possible unobserved levels in a large gap of about 6.5 MeV between Q-value=14.17 MeV and the highest populated level at E=7.69 MeV.

E(decay)	E(level)	Iβ ⁻ †#	Log ft‡	Comments
(6.48×10 ³ 4)	7690	2.7 2	4.5	av Eβ=2995
(6.81×10 ³ 4)	7360	2.6 2	4.6	av Eβ=3157
(7.84×10 ³ 4)	6330	6.8 3	4.5	av Eβ=3662
(8.41×10 ³ 4)	5760	4.5 2	4.8	av Eβ=3942
(8.98×10 ³ 4)	5190	8.9 3	4.6	av Eβ=4222
(1.040×10 ⁴ 4)	3770	3.2 2	5.4	av Eβ=4919
(1.072×10 ⁴ 4)	3450	6.0 3	5.2	av Eβ=5076
(1.103×10 ⁴ 4)	3140	3.3 2	5.5	av Eβ=5229
(1.200×10 ⁴ 4)	2168.16	9.5	5.2	av Eβ=5706 20 Iβ ⁻ : 9.2 19 from 2001Nu01 ; 6.7 9 from 2005Ti11 with only one branch 2168γ observed.
(1.320×10 ⁴ 4)	973.88	52	4.7	av Eβ=6293 20 Iβ ⁻ : 48 9 from 2001Nu01 ; 50 3 from 2005Ti11 .
(1.417×10 ⁴ 4)	0	3.0 10	6.1 2	av Eβ=6771 20 Iβ ⁻ : from 2001Nu01 , which states that the β branch to the ³⁵ Si ground state was evaluated by comparing the total γ intensity due to the deexcitation of excited states of ³⁵ Si with the decay of ³⁵ Si activity and assuming no direct ³⁵ Si production.

† For the two bound excited states, Iβ⁻ is from the γ+ce intensity balance at each state. Quoted Iβ⁻ values without uncertainties are considered upper limits due to the incomplete decay scheme, and the associated log ft values are considered lower limits. For unbound excited states (>2470), Iβ⁻ is from the absolute Iβ⁻ in [2005Ti11](#) based on neutron intensities.

‡ For unbound levels, [2005Ti11](#) did not report uncertainties for neutron energies or level energies. The evaluators estimate the uncertainties of log ft are <0.1, assuming a 200-keV uncertainty in level energies.

Absolute intensity per 100 decays.

γ(³⁵Si)

I_γ normalization: 0.47 4 from Σ%I(γ+ce to g.s.)=60 4, deduced from 100-%β⁻n-%Iβ⁻(g.s.), where %β⁻n=37 4 from the Adopted Levels of ³⁵Al and %Iβ⁻(g.s.)=3.0 10 from [2001Nu01](#). The deduced normalization factor should be considered an upper limit due to potential missing γ transitions from unobserved levels in the gap to the ground state. Other: 0.45 from [2001Nu01](#), based on %β⁻n=41 13.

E _γ ‡	I _γ ‡#	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	α†	Comments
64.1 3	100	973.88	(3/2 ⁺)	909.95	(3/2) ⁻	[E1]	0.0368 8	α(K)=0.0342 7; α(L)=0.00244 5; α(M)=0.0001581 33 %I _γ =47
910.11 30	99.7 19	909.95	(3/2) ⁻	0	(7/2) ⁻	[E2]	4.13×10 ⁻⁵ 6	α(K)=3.84×10 ⁻⁵ 5; α(L)=2.74×10 ⁻⁶ 4; α(M)=1.805×10 ⁻⁷ 25 %I _γ =47
973.78 20	11.8 24	973.88	(3/2 ⁺)	0	(7/2) ⁻	[M2]	5.05×10 ⁻⁵ 7	α(K)=4.69×10 ⁻⁵ 7; α(L)=3.36×10 ⁻⁶ 5; α(M)=2.211×10 ⁻⁷ 31 %I _γ =5.6
^x 1130.4 4	3.2 9							%I _γ =1.5 2014St18 suggests this γ is likely the

Continued on next page (footnotes at end of table)

$^{35}\text{Al} \beta^-$ decay (38.1 ms) 2005Ti11,2001Nu01 (continued) $\gamma(^{35}\text{Si})$ (continued)

E_γ [‡]	I_γ ^{‡#}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1194.2 4	5.3 12	2168.16	(5/2 ⁺)	973.88	(3/2 ⁺)	1134 γ from 2042 to 908 transition observed in the $^{36}\text{Si} \rightarrow n + ^{35}\text{Si}$ knockout reaction.
2168.2 6	15 3	2168.16	(5/2 ⁺)	0	(7/2 ⁻)	%I γ =2.5
^x 5629 3	2.4 12					%I γ =7.1 %I γ =1.1

[†] Additional information 3.

[‡] From 2001Nu01.

[#] For absolute intensity per 100 decays, multiply by 0.47.

^x γ ray not placed in level scheme.

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Decay Scheme

Intensities: Relative I_γ

Legend

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

