

^{26}P εp decay (43.6 ms) 2004Th09,1983Ca06,2017Ja05

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia, Anagha Chakraborty		NDS 205,1 (2025)	31-May-2025

Parent: ^{26}P : $E=0.0$; $J^\pi=(3)^+$; $T_{1/2}=43.6$ ms 3; $Q(\varepsilon\text{p})=12600$ syst; $\% \varepsilon\text{p}$ decay=35.0 20

^{26}P - J^π : from 2016Ba18 and in the ENSDF database.

^{26}P - $T_{1/2}$: from 2020Li06 – ^{26}P - β -p(t) analysis. Others: 43.7 ms 6 (2004Th09, time correlations of ^{26}P ions and β or β -2p decay events), 20 ms +35–15 (1984Ca29, 1983Ca06, 1983Ho23, 1984CaZV thesis), 50 ms +23–12 (2017Ja05).

^{26}P - $Q(\varepsilon\text{p})$: 12600 200(SY) (2021Wa16).

^{26}P - $\% \varepsilon\text{p}$ decay: weighted average of 36.8 22 (2004Th09) and 33.5 20 (2017Ja05). In 2004Th09, 2017Ja05: total branch for the proton-unbound levels are measured as 39% 2, 35% 2 and $\% \varepsilon 2\text{p}$ as 2.16 24, 1.5% 4, respectively. Other measurement: $\% \varepsilon\text{p}$ branch to $T=2$ analog state $\approx 1.9\%$ (1984Ca29, 1983Ca06, 1983Ho23, 1984CaZV thesis); also estimated 2p/1p ratio for the decay of IAS as ≈ 1 . Corresponding εp branch in 2004Th09 is 5.3% 4, and 2p/1p=0.69 9.

2004Th09: ^{26}P isotope produced in fragmentation of $^{36}\text{Ar}^{18+}$ ions at $E=95$ MeV/nucleon on a ^{12}C production target. Fragment separation with LISE3 spectrometer at GANIL. Measured $E\gamma$, $E(\text{proton})$, $I\gamma$, $\gamma\gamma$, $\gamma\beta$ coin, $p\beta$ coin, $p\gamma\beta$ coin, half-life with one segmented Ge clover detector and five Si detectors.

1983Ca06 (also 1983Ho23, 1984Ca29, 1984CaZV thesis): ^{26}P produced and identified in $^{28}\text{Si}(^3\text{He},p4n)$ reaction at $E=110$ -130 MeV at LBNL facility. Measured beta-delayed two-proton pp-coin, $E(p)$, half-life, $\% \varepsilon\text{p}$, $\% \varepsilon 2\text{p}$.

2017Ja05: ^{26}P obtained from ^{32}S fragmentation from $\text{Be}(^{32}\text{S},X)$, $E=51.3$ MeV/nucleon, reaction; isotopes were separated using fragment separator at JINR, Dubna, Russia facility. Fragments were identified by time-of-flight (tof) and energy-loss technique using plastic scintillator and a silicon detector, respectively. Selected fragments were analyzed by Optical Time Projection Chamber (OTPC), filled with 49.5% Ar, 49.5% He, and 1% CO_2 at atmospheric pressure. Light produced in the gas was recorded by a digital camera (CCD) and a photomultiplier (PMT) connected to an oscilloscope; the combination of data from the CCD and the PMT was used to reconstruct particle tracks in three dimensions. Setup was tuned for ^{27}S ions, but ^{26}P was also accepted. In total 2497 events of ^{26}P were identified, of which 2463 events based on depth profile were inspected to select decay events. 141 cases of βp emission is used to reconstruct the emitted proton energy.

2022Li66: ^{26}P were produced from projectile fragmentation of a 80.6-MeV/A $^{32}\text{S}^{-16+}$ primary beam on ^9Be target. The projectile fragments were separated using the Radioactive Ion Beam Line in Lanzhou, identified by energy loss and time of flight. Ions were implanted into a silicon array consisting of three DSSD detectors; measured E_p , I_p , $E\gamma$; deduced proton energies and relative intensities.

2020Li06: ^{26}P from fragmentation of ^{32}S with $E=80.6$ MeV/nucleon. Reaction products separated and purified by RIBLL1 in Lanzhou. Ions identified by time-of-flight and energy loss. Detection system consisted of three double sided-silicon strip detectors, five Clover-type HPGe detectors, and five quadrant silicon detectors.

2015Sc16: ^{26}P isotope produced in fragmentation of ^{36}Ar primary beam, $E=150$ MeV/nucleon, on a ^9Be production target. Fragments were separated with A1900 fragment separator at NSCL; implanted in a planar germanium double-sided strip detector (GeDSSD) and surrounded by SeGA array of high purity germanium detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma$ and $\gamma\beta$ coin, deduced proton feedings to ^{25}Al levels, excitation energy of proton emission level in ^{26}Si from Doppler broadening of γ -ray peaks.

 ^{25}Al Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}$	Comments
0.0	$5/2^+$	7.168 s 4	$T_{1/2}$: from Adopted Levels.
451.8 4	$1/2^+$		
945.0 4	$3/2^+$		
1613.2 6	$(7/2)^+$		
1789.6 4	$5/2^+$		E(level): authors (2015Sc16) found no evidence of multiple proton transitions feeding this state.
2720.3 6	$7/2^+$		

† From a least squares fit to the γ ray energies.

‡ From Adopted Levels.

^{26}P ε p decay (43.6 ms) [2004Th09,1983Ca06,2017Ja05](#) (continued) $\gamma(^{25}\text{Al})$

E_γ [†]	I_γ ^{†‡}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
451.9 6	2.6 3	451.8	1/2 ⁺	0.0	5/2 ⁺	E_γ : other: 452 (2004Th09 , 2022Li66).
493.1 6	2.4 3	945.0	3/2 ⁺	451.8	1/2 ⁺	E_γ : other: 493 (2004Th09,2022Li66).
843.5 6	0.8 2	1789.6	5/2 ⁺	945.0	3/2 ⁺	E_γ : other: 845 (2004Th09,2022Li66).
930.4 7	0.09 5	2720.3	7/2 ⁺	1789.6	5/2 ⁺	
944.4 5	1.2 1	945.0	3/2 ⁺	0.0	5/2 ⁺	E_γ : other: 445 (2004Th09,2022Li66).
1338.0 5	0.8 1	1789.6	5/2 ⁺	451.8	1/2 ⁺	E_γ : other: 1338 (2022Li66).
1613.1 6	2.2 2	1613.2	(7/2) ⁺	0.0	5/2 ⁺	E_γ : other: 1612 (2004Th09,2022Li66).
1775.5 6	1.2 1	2720.3	7/2 ⁺	945.0	3/2 ⁺	
1790.2 6	0.8 3	1789.6	5/2 ⁺	0.0	5/2 ⁺	E_γ : others: 1790 (2004Th09), 1789 (2022Li66).

[†] From [2015Sc16](#). For E_γ , authors mention systematic uncertainty=0.5 keV, this uncertainty added in quadrature with the statistical uncertainties given in Table I.

[‡] Absolute intensity per 100 decays.

Delayed Protons (^{25}Al)

$E(p)$ ^{†‡}	$E(^{25}\text{Al})$	$I(p)$ ^{†#@}	$E(^{26}\text{Si})$ [†]	Comments
2541 6		0.25 10		
2855 17		0.40 10		
4097 5		1.05 15		
412 2	0.0	48.9 35	5929	$E(p)$: other: 418 8 (2020Li06). $I(p)$: 17.96% 90 (2004Th09) is inconsistent with 11.1% 12 (2020Li06) and 10.4% 9 < I_p < 13.8% 10 deduced from counts larger than 140 and smaller than 186 in PMT+CCD and also 7.4% 7 was deduced in 2017Ja05 from 99 counts in CCD image (Digital camera). Total I_p feeding to this state is 2.1% 1 in 2004Th09 , in 2015Sc16 it is <0.34%. The difference is attributed to significant γ feeding from newly established level at 2720 keV.
778 3	0.0	2.10 24	6295	$E(p), I(p)$: doublet of 778 and 866 keV proton groups (weaker lines in the literature), noted in 2017Ja05 . I_p =1.1% 3 deduced in 2017Ja05 from 15 counts. 787 8 and 0.74% 17 (2020Li06).
866 2	0.0	4.6 5	6384	$E(p), I(p)$: 870 8 and 1.44% 30 (2020Li06).
1248 2	0.0	4.1 4	6765	$E(p), I(p)$: 1256 8 and 1.45% 21 (2020Li06).
1499 2	945.0	2.69 24	7962	$E(p), I(p)$: 1507 9 and 0.80% 18 (2020Li06).
1638 3	451.8	1.76 20	7606	
1798 4	945.0	0.54 15	8254	
1983 2	0.0	6.5 5	7501	
2139 4	1789.6	1.5 4	9433	
2288 3	1613.2	4.0 4	9433	
2593 & 13	451.8	0.73 15	8563	
2638 18	0.0	0.29 10	8156	
2732 4	0.0	1.27 20	8254	
2908 11	945.0	0.15 15	9370	
2968 5	945.0	0.88 15	9433	
3097 6	1789.6	0.83 20	10405	
3258 4	945.0	0.93 10	9725	
3766 9	451.8	0.98 20	9725	
3817 6	945.0	0.34 15	10299	
3920 5	0.0	3.3 4	9433	
4719 6	451.8	0.64 10	10688	
4793 3	0.0	1.47 20	10299	
4858 4	451.8	1.22 15	10827	
51.0×10 ² 12	2720.3	1.1 1	13300	$E(p)$: 5100 100 (stat) 60 (syst) (c.m.) extracted from measured ^{25}Al initial recoil kinetic energy of 195 keV +41–50 (stat) 18 (syst) by finding the minimum value of χ^2 (2015Sc16). Corresponding energy of the proton-emitting level in ^{26}Si is 13300 100 (stat) 60 (syst).

Continued on next page (footnotes at end of table)

^{26}P ε p decay (43.6 ms) 2004Th09,1983Ca06,2017Ja05 (continued)Delayed Protons (continued)

$E(\text{p})^{\dagger\ddagger}$	$E(^{25}\text{Al})$	$I(\text{p})^{\dagger\#\text{@}}$	$E(^{26}\text{Si})^{\dagger}$	Comments
5710 3	1789.6	3.8 3	13015	E(p),I(p): other: 5751 3 and %I _p =0.81 14 (2022Li66).
5893 4	1613.2	2.0 4	13015	E(p),I(p): other: 5921 4 and %I _p =0.43 9 (2022Li66).
6401 10	0.0		11912	E(p),I(p): from 2022Li66. I _p (rel) based on %I _p =0.072 57.
6401 10	451.8		11912	E(p),I(p): from 2022Li66. Relative intensity based on %I _p =0.072 57 (2022Li66).
6551 4	945.0	0.59 25	13015	E(p),I(p): other: 6587 6 and %I _p =0.12 2 (2022Li66).
7039 5	451.8	0.49 5	13015	E(p),I(p): other: 7075 16 and %I _p =0.18 3 (2022Li66).
7494 4	0.0	1.66 15	13015	E(p),I(p): other: 7543 4 and %I _p =0.29 4 (2022Li66).
7854 6	0.0		13380	E(p): 13015 (2004Th09) and 13055 (2022Li66) is T _{1/2} =2 IAS in ^{26}Si .
7854 6	451.8		13380	E(p),I(p): from 2022Li66. I _p (rel) based on %I _p =0.07 2.
				E(p),I(p): from 2022Li66. Relative intensity based on %I _p =0.07 2 (2022Li66).

[†] From 2004Th09.[‡] from 2004Th09 (center-of-mass), except where otherwise noted.# Reported relative intensities of 2004Th09 with respect to I_p(412)=100.0 71 are normalized to ΣI_p=100, except otherwise noted.

@ For absolute intensity per 100 decays, multiply by 0.350 20.

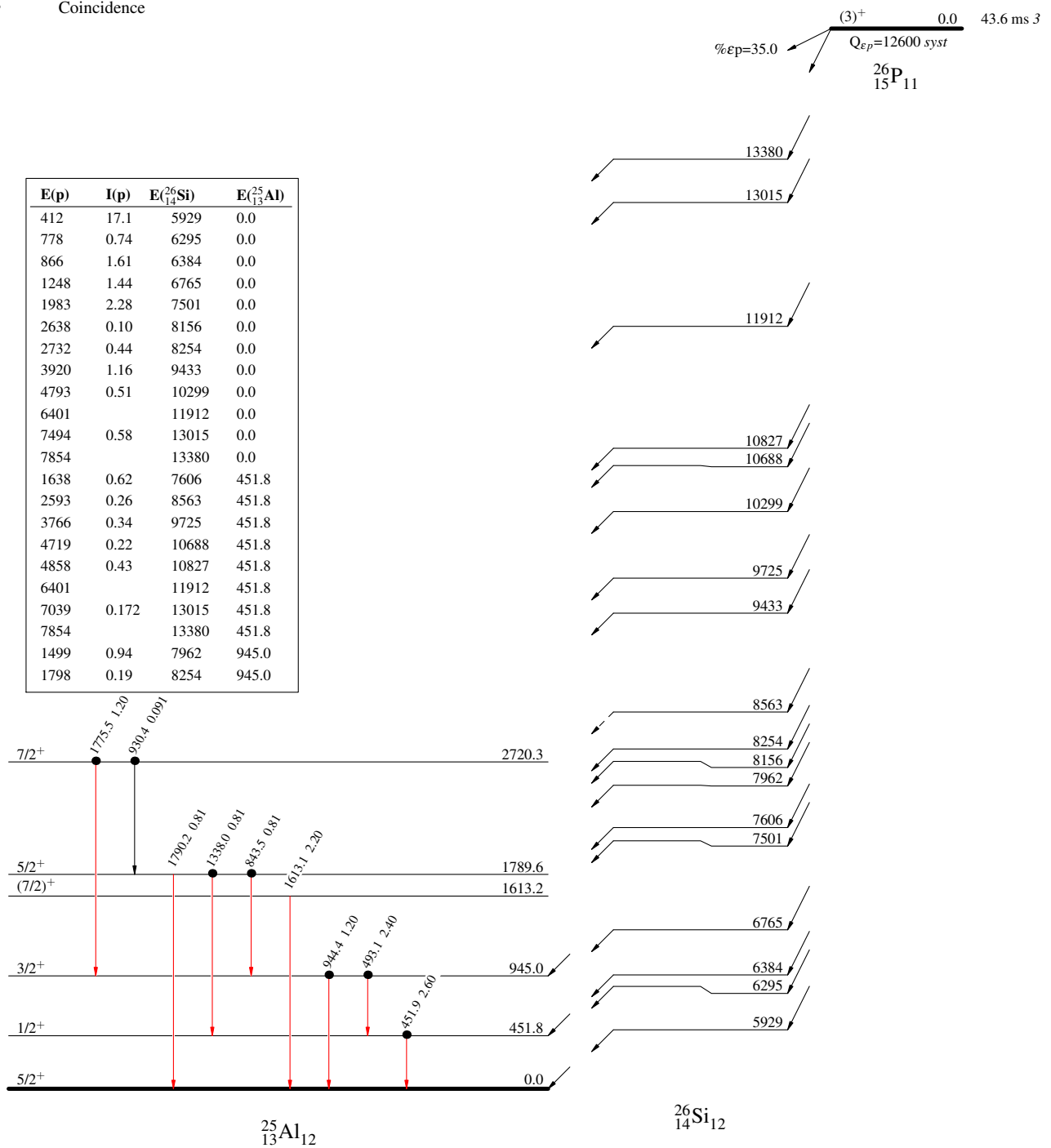
& Placement of transition in the level scheme is uncertain.

^{26}P ϵp decay (43.6 ms) 2004Th09,1983Ca06,2017Ja05**Decay Scheme**

Legend

γ Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
 $I(p)$ Intensities: $I(p)$ per 100 parent decays

- Coincidence



²⁶P εp decay (43.6 ms) 2004Th09,1983Ca06,2017Ja05

Decay Scheme (continued)

γ Intensities: I_(γ+ce) per 100 parent decays
I(p) Intensities: I(p) per 100 parent decays

