^{30}Al β^- decay 1974Al09,1974Kl07

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia, A. Chakraborty	NDS 197,1 (2024)	31-May-2024

Parent: ^{30}Al: E=0; $J^\pi=3^+$; $T_{1/2}$=3.62 s *6*; Q(β^-)=8568.8 *19*; %β^- decay=100

^{30}Al-J^π,$T_{1/2}$: from ^{30}Al Adopted Levels.

^{30}Al-Q(β^-): from 2021Wa16.

1974Al09: ^{30}Al was produced in the ^{18}O(^{18}O,αpn), E=42 MeV, reaction at one of the Brookhaven MP tandem Van de Graaff accelerators. Ge(Li) detector; measured Eγ, Iγ.

1974Kl07: ^{30}Al was produced in the ^{30}Si(n,p), E=14.5 MeV, reaction; Ge(Li) detector; Measured Eγ, Iγ.

1961Ro12: ^{30}Al was produced in the ^{30}Si(n,p), E≈24 MeV neutron from ^{7}Li(d,n) reaction with 9.7-MeV external deuteron beam from the Purdue University 37-in. cyclotron. Detectors: NaI(Tl) and plastic phosphor coupled with photomultiplier tube. Measured Eγ, E_{β_end}=5.05 MeV *25*, deduced β feeding to the 1st and 2nd excited states.

^{30}Si Levels

E(level)[†]	J^π[#]	$T_{1/2}$
0	0^+	stable
2235.326 *19*	2^+	236 fs *12*
3498.49 *3*	2^+	61 fs *6*
3769.49 *4*	1^+	42 fs *9*
4810.22 *12*	2^+	131 fs *14*
4830.85 *5*	3^+	87 fs *14*
5231.1 *3*	3^+	
5278.73 *10*	4^+	96 fs *10*
5614.03[‡] *14*	2^+	<14 fs
5950.6[‡] *5*	4^+	16 fs *8*

[†] From a least squares fit to the γ-ray energies, assuming ΔE=0.5 keV for missing uncertainty.

[‡] Level considered for reported beta feeding in 1974Kl07.

[#] From the Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ^-[†#]	Log *ft*	Comments
(2618.2 *22*)	5950.6	0.16[‡] *5*	5.92 *14*	av Eβ=1120.3 *67* Iβ^-: from 1974Kl07.
(2954.8 *22*)	5614.03	0.30[‡] *6*	5.87 *9*	av Eβ=1282.7 *68* Iβ^-: from 1974Kl07.
(3337.7 *22*)	5231.1	2.58 *21*	5.17 *4*	av Eβ=1466.5 *68* Iβ^-: weighted average of 3.0 *3* (1974Kl07) and 2.47 *15* (1974Al09). γ-transition intensity balance yields I_β=2.27 *13*, statistically in agreement with the adopted I_β=2.58 *21*.
(3738.0 *22*)	4830.85	6.65 *16*	4.985 *17*	av Eβ=1660.6 *68* Iβ^-: weighted average of 6.3 *6* (1974Kl07) and 6.67 *16* (1974Al09). γ-transition intensity balance yields I_β=6.6 *3*, statistically in agreement with the adopted I_β=6.65 *16*.
(3758.6 *22*)	4810.22	5.77 *22*	5.060 *19*	av Eβ=1670.9 *68* Iβ^-: weighted average of 5.5 *6* (1974Kl07) and 5.81 *23* (1974Al09). γ-transition intensity balance yields I_β=5.1 *5*, statistically in agreement with the adopted I_β=5.77 *22*.
(5070.3 *22*)	3498.49	67.9 *11*	4.578 *12*	av Eβ=2311.1 *69* Iβ^-: weighted average of 68.2 *15* (1974Kl07) and 67.5 *16* (1974Al09). From the measured β spectra and available data, 1961Ro12 estimated a β feeding branch to

Continued on next page (footnotes at end of table)

^{30}Al β^- decay 1974Al09,1974Kl07 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†][#]	Log *ft*	Comments
				this level to be 83%. γ-transition intensity balance yields I$_\beta$=70 *2*, statistically in agreement with the adopted I$_\beta$=67.9 *11*.
(6333.5 *22*)	2235.326	17.2 *9*	5.619 *25*	av Eβ=2931.8 *69* Iβ^-: weighted average of 16.6 *14* (1974Kl07) and 17.6 *12* (1974Al09). From the measured β spectra and available data, 1961Ro12 estimated a β feeding branch to this level to be 16%. γ-transition intensity balance yields I$_\beta$=38.9, indicates missing γ feeding to this level from higher lying levels.

[†] Based on the measured β spectra and deduced values from Eγ, Iγ in 1961Ro12, 1974Kl07, and 1974Al09. Intensity balance of γ transition at the 1st excited level indicates that feeding from higher lying levels is missing.

[‡] From 1974Kl07. For missing and weaker γ transitions, authors estimated β feeding considering Eγ and Iγ from the literature.

[#] Absolute intensity per 100 decays.

^{30}Al β^- decay 1974Al09,1974Kl07 (continued)

$\gamma(^{30}Si)$

Iγ normalization: from Σ Iγ(1+α) to g.s.=100, assuming no beta feeding to the g.s.

E_γ[†]	I_γ[#d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ[b]	α[c]	Comments
400.2 *4*	0.11 *1*	5231.1	3^+	4830.85	3^+	[M1]		1.43×10^{-4} *2*	%Iγ=0.07 *1* α(K)=0.0001331 *19*; α(L)=9.53×10^{-6} *14*; α(M)=6.27×10^{-7} *9* I_γ: deduced by evaluators with respect to Iγ(1732.3)=2.87 *18* and the branching ratio in the adopted dataset.
421.0 *5*	0.15 *5*	5231.1	3^+	4810.22	2^+	[M1]		1.28×10^{-4} *2*	%Iγ=0.10 *3* α(K)=0.0001192 *17*; α(L)=8.54×10^{-6} *12*; α(M)=5.62×10^{-7} *8* E_γ: γ not listed in 1974Al09. I_γ: deduced by evaluators with respect to Iγ(1732.3)=2.87 *18* and the branching ratio in the adopted dataset.
671[&]	0.0011[&] *6*	5950.6	4^+	5278.73	4^+				%Iγ=0.0007 *4*
719[&]	0.0007[&] *3*	5950.6	4^+	5231.1	3^+				%Iγ=0.0005 *2*
783[&]	0.015[&] *6*	5614.03	2^+	4830.85	3^+	M1+E2	+0.20 *11*		%Iγ=0.010 *4*
804[&]	0.005[&] *3*	5614.03	2^+	4810.22	2^+				%Iγ=0.003 *2*
1039[@]	0.3 *1*	4810.22	2^+	3769.49	1^+				%Iγ=0.2 *1* I_γ: deduced by evaluators with respect to Iγ(4810)=3.27 *26* and the branching ratio in the adopted dataset.
1120[&]	0.0038[&] *15*	5950.6	4^+	4830.85	3^+				%Iγ=0.0025 *10*
1263.13 *3*	62.4 *19*	3498.49	2^+	2235.326	2^+	M1+E2	+0.18 *6*	2.90×10^{-5} *5*	%Iγ=40.6 *14* α(K)=1.359×10^{-5} *21*; α(L)=9.70×10^{-7} *15*; α(M)=6.39×10^{-8} *10* α(IPF)=1.438×10^{-5} *26* E_γ: from 1974Al09. I_γ: weighted average of 53 *2* (1974Kl07) and 62.4 *19* (1974Al09).
1311.80 *14*	2.9 *4*	4810.22	2^+	3498.49	2^+	M1+E2	−0.17 *6*	3.58×10^{-5} *6*	%Iγ=1.9 *3* α(K)=1.268×10^{-5} *19*; α(L)=9.06×10^{-7} *14*; α(M)=5.97×10^{-8} *9* α(IPF)=2.22×10^{-5} *4* E_γ: other: 1311.5 *6* (1974Al09). I_γ: deduced by evaluators with respect to Iγ(4810)=3.27 *26* and the branching ratio in the adopted dataset. Other: 3.94 *19* – deduced value in 1974Al09 (see Tables III and I) based on adopted data in 1973EnVA.
1332.48 *16*	1.43 *14*	4830.85	3^+	3498.49	2^+	M1+E2	+0.7 *+6−4*	4.4×10^{-5} *5*	%Iγ=0.93 *9* α(K)=1.33×10^{-5} *10*; α(L)=9.5×10^{-7} *7*; α(M)=6.3×10^{-8} *5* α(IPF)=2.93×10^{-5} *35* E_γ: other: 1331.9 *10* (1974Al09).

$^{30}_{14}Si_{16}$-3

^{30}Al β^- decay 1974Al09,1974Kl07 (continued)

$\gamma(^{30}Si)$ (continued)

E_γ †	I_γ #d	E_i(level)	J_i^π	E_f	J_f^π	Mult.b	δb	αc	Comments
1534.12 *4*	<0.25	3769.49	1^+	2235.326	2^+	M1+E2	−0.09 *4*	8.40×10^{-5} *12*	%Iγ<0.16 α(K)=9.60×10^{-6} *14*; α(L)=6.85×10^{-7} *10*; α(M)=4.52×10^{-8} *6* α(IPF)=7.37×10^{-5} *11*
1732.3 *8*	2.87 *18*	5231.1	3^+	3498.49	2^+	M1+E2	+0.12 *6*	1.49×10^{-4} *2*	%Iγ=1.87 *12* α(IPF)=0.0001410 *22* α(K)=7.82×10^{-6} *11*; α(L)=5.58×10^{-7} *8*; α(M)=3.68×10^{-8} *5* E_γ: other: 1733.0 *5* (1974Al09). I_γ: In Table III – %branching ≥23 (1974Al09).
1844.40& *16*	0.24& *6*	5614.03	2^+	3769.49	1^+	M1+E2	+0.11 *5*	1.91×10^{-4} *3*	%Iγ=0.16 *4* α(K)=7.04×10^{-6} *10*; α(L)=5.03×10^{-7} *7*; α(M)=3.31×10^{-8} *5* α(IPF)=0.0001831 *27*
2235.23 *2*	100	2235.326	2^+	0	0^+	E2		4.36×10^{-4} *6*	%Iγ=65 *1* α(K)=5.65×10^{-6} *8*; α(L)=4.03×10^{-7} *6*; α(M)=2.66×10^{-8} *4* α(IPF)=0.000429 *6* E_γ: others: 2235.25 *30* (1974Al09), (2.26 *3*) × 10^3 (1961Ro12).
2452.6& *13*	0.011& *5*	5950.6	4^+	3498.49	2^+	(E2)		5.40×10^{-4} *8*	%Iγ=0.007 *3* α(K)=4.82×10^{-6} *7*; α(L)=3.44×10^{-7} *5*; α(M)=2.268×10^{-8} *32* α(IPF)=0.000535 *8*
2574.8 *5*	1.48 *11*	4810.22	2^+	2235.326	2^+	M1+E2	−0.52 *11*	5.13×10^{-4} *10*	%Iγ=0.96 *7* α(K)=4.21×10^{-6} *6*; α(L)=3.00×10^{-7} *4*; α(M)=1.979×10^{-8} *30* α(IPF)=0.000509 *10* E_γ: other: 2574.0 *9* (1974Al09).
2595.39 *4*	8.91 *21*	4830.85	3^+	2235.326	2^+	M1+E2	+0.72 *+11−9*	5.36×10^{-4} *10*	%Iγ=5.79 *15* α(K)=4.19×10^{-6} *6*; α(L)=2.99×10^{-7} *4*; α(M)=1.973×10^{-8} *29* α(IPF)=0.000531 *10* E_γ: other: 2595.1 *5* (1974Al09).
2995.0 *8*	0.36 *4*	5231.1	3^+	2235.326	2^+				%Iγ=0.23 *3* I_γ: deduced by evaluators with respect to Iγ(1732.3)=2.87 *18* and the branching ratio in the adopted dataset. In Table III (1974Kl07) – %branching ≤73 and Iγ<0.9 with respect to Iγ(2235)=100.
3043.2 *1*	<0.24	5278.73	4^+	2235.326	2^+	(E2)		8.07×10^{-4} *11*	%Iγ<0.16

^{30}Al β^- decay 1974Al09,1974Kl07 (continued)

$\gamma(^{30}Si)$ (continued)

E_γ †	I_γ #d	E_i(level)	J_i^π	E_f	J_f^π	Mult.b	δb	αc	Comments
3378.68& *25*	0.20& *6*	5614.03	2^+	2235.326	2^+	(M1+E2)	−0.29 *4*	8.19×10^{-4} *12*	%Iγ=0.12 *4* α(K)=2.78×10^{-6} *4*; α(L)=1.983×10^{-7} *28*; α(M)=1.307×10^{-8} *18* α(IPF)=0.000816 *12*
3498.33 *5*	50.4 *15*	3498.49	2^+	0	0^+	E2		9.94×10^{-4} *14*	%Iγ=33 *1* α(K)=2.75×10^{-6} *4*; α(L)=1.960×10^{-7} *27*; α(M)=1.292×10^{-8} *18* α(IPF)=0.000991 *14* E_γ: other: (3.52 *3*) × 10^3 (1961Ro12). I_γ: weighted average of 47 *2* (1974Kl07) and 50.4 *15* (1974Al09). Other: 64 *6* (1961Ro12).
3716@	0.23a *7*	5950.6	4^+	2235.326	2^+	(E2)		1.07×10^{-3} *2*	%Iγ=0.14 *5* α(K)=2.512×10^{-6} *35*; α(L)=1.792×10^{-7} *25*; α(M)=1.181×10^{-8} *17* α(IPF)=0.001071 *15*
3769.22‡ *5*	<0.21	3769.49	1^+	0	0^+	M1		9.49×10^{-4} *13*	%Iγ<0.14 α(K)=2.371×10^{-6} *33*; α(L)=1.691×10^{-7} *24*; α(M)=1.115×10^{-8} *16* α(IPF)=0.000947 *13* I_γ: deduced by the evaluators with respect to Iγ(1534.12)=0.25 and the branching ratio in the adopted dataset.
4810.0 *3*	3.27 *26*	4810.22	2^+	0	0^+	E2		1.43×10^{-3} *2*	%Iγ=2.13 *17* α(K)=1.741×10^{-6} *24*; α(L)=1.242×10^{-7} *17*; α(M)=8.18×10^{-9} *11* α(IPF)=0.001432 *20*

† From the Adopted Gammas, except where otherwise noted.
‡ Not reported in 1974Al09. 1972Kl07 list from literature. Placement based on the adopted dataset by the evaluators.
# From 1974Al09, except where otherwise noted.
@ From 1974Kl07.
& Not reported in 1974Kl07, only beta feeding to the level is reported. γ from the adopted dataset and the Iγ scaled to the adopted γ branching and adjusted for the beta feeding.
a Not reported in 1974Kl07, Iγ scaled to the adopted γ branching and adjusted for the beta feeding to the level.
b From Adopted Gammas.
c Additional information 1.
d For absolute intensity per 100 decays, multiply by 0.65 *1*.

$^{30}_{14}Si_{16}$-5

^{30}Al β^- decay 1974Al09,1974Kl07

Decay Scheme

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