^{50}Ca β^- decay (13.45 s) 2017Ga25,1984Al18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 157, 1 (2019)	15-Apr-2019

Parent: ^{50}Ca: E=0.0; $J^\pi=0^+$; $T_{1/2}$=13.45 s *5*; Q(β^-)=4958 *15*; %β^- decay=100.0

^{50}Ca-$T_{1/2}$: From Adopted Levels, where value is adopted from 2017Ga25.

^{50}Ca-Q(β^-): From 2017Wa10.

2017Ga25: ^{50}Ca was produced by spallation reaction using 500 MeV proton beam from TRIUMF cyclotron on a 22.49 g/cm^2 thick Ta target. Selected ions were ionized, accelerated to 20 keV, mass separated and delivered to the experimental station. Measured Eγ, Iγ, $\gamma\gamma$-coin using GRIFFIN array of 15 HPGe clover detectors and five 1 in x 1 in $LaBr_3$(Ce) scintillators for fast timing. The β^- particles were detected by plastic scintillator array SCEPTAR. Deduced levels, γ-ray branching ratios, level lifetimes, and transition strengths. Comparison with shell-model calculations, with special emphasis on B(M3) transition strengths.

1984Al18: measured Eγ, Iγ, $\beta\gamma$(t); pneumatic transfer system used for radioactive ^{50}Ca source.

Others: 1970Wa29, 1968Ch11.

1970Wa29: measured $T_{1/2}$, Eγ, Iγ.

1968Ch11: measured Eγ, Iγ.

1964Sh14: first identification of ^{50}Ca nuclide. Measured Eγ, Iγ. Two γ rays of 72 and 258 keV reported using scintillation detector, and placed in a $\gamma\gamma$ cascade.

^{50}Sc Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	5^+	102.5‡ s *5*	
256.895 *10*	2^+	0.35‡ s *4*	%IT=99.5 *5*; %β^-<1.0 (2017Ga25) J^π: spin=2 from (1519γ)(71γ)(θ) (2017Ga25). Upper limit of %β^- estimated in 2017Ga25 from examining γ-intensities in ^{50}Sc and ^{50}Ti.
328.447 *12*	3^+	<600 ps	J^π: spin=3 from (1519γ)(71γ)(θ) (2017Ga25). $T_{1/2}$: upper limit is based on the sensitivity of the experimental setup, as no non-prompt component was seen by $LaBr_3$ detectors (2017Ga25). Other: <10 ns from $\beta\gamma$(t) (1984Al18, authors obtained 5 ns *2*, but cited an upper limit of 10 ns as possible systematic uncertainties were not properly monitored).
1847.772 *20*	1^+	<2 ns	$T_{1/2}$: upper limit obtained using generalized centroid difference method in $\beta\gamma$-coin data (2017Ga25). Other: <10 ns from $\beta\gamma$(t) (1984Al18, authors obtained 5 ns *2*, but cited an upper limit of 10 ns as possible systematic uncertainties were not properly monitored).

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

‡ From Adopted Levels.

β^- radiations

The β feeding to 257 and 328 levels from higher levels (including those from known (1^+) states) is estimated as <0.75% (1984Al18).

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(3110 *15*)	1847.772	99 *1*	4.12 *1*	av Eβ=1349.9 *73* Iβ^-: γ feeding from higher states to this level was estimated as <1% (1984Al18).

† Absolute intensity per 100 decays.

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$\gamma(^{50}Sc)$

Iγ normalization, I(γ+ce) normalization: from ΣIγ(from 1848)=99 *1*. Lower lying states will not be directly fed (ΔJ$^\pi$≥2,no). Gamma feeding from higher states to observed states estimated to be <2% by 1984Al18.

E_γ [†]	I_γ [@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	α[&]	Comments
71.552 *5*	54.6 *50*	328.447	3$^+$	256.895	2$^+$	M1(+E2)	+0.015 *25*	0.0386 *17*	α(K)=0.0350 *15*; α(L)=0.00319 *14*; α(M)=0.000395 *17*; α(N)=2.16×10^{-5} *9* E_γ: 72.8042 *8* (1967Be65) from Kα$_2$ x ray of Pb was used as reference (1984Al18); 71.54 *20* (1970Wa29); 72 *1* (1968Ch11). I_γ: weighted average of 58.4 *60* (2017Ga25) and 52 *5* (deduced from I(γ+ce)=54 *5* and α(71γ,M1)=0.0396 in 1984Al18). δ: from (1519γ)(71γ)(θ) (2017Ga25). Other: <0.5 from α(exp)=0.13 *+13−11* deduced by evaluators from intensity balance.
256.894 *10*	99.4 *20*	256.895	2$^+$	0.0	5$^+$	(M3)		0.0356	α(K)=0.0321 *5*; α(L)=0.00306 *5*; α(M)=0.000378 *6*; α(N)=2.02×10^{-5} *3* E_γ: 264.0755 *8* (1979He19) from decay of ^{182}Ta used as reference, supplemented by lines from decays of ^{133}Ba and ^{152}Eu (1984Al18); 256.94 *10* (1970Wa29); 257 *1* (1968Ch11). I_γ: weighted average of 100 *2* (2017Ga25) and 98 *3* (deduced from I(γ+ce)=102 *3* and α(257γ,M3)=0.0366 in 1984Al18).
328	0.46 *5*	328.447	3$^+$	0.0	5$^+$				E_γ,I_γ: from 2017Ga25. In 1984Al18, only an upper limit of 0.7 for Iγ was given.
1519.300[‡] *20*	61.8 *8*	1847.772	1$^+$	328.447	3$^+$				E_γ: 1519.44 *30* (1970Wa29); 1519 *1* (1968Ch11). I_γ: weighted average of 59.6 *17* (2017Ga25) and 62.1 *6* (1984Al18).
1590.850[‡] *30*	37.5 *7*	1847.772	1$^+$	256.895	2$^+$				E_γ: 1591.00 *30* (1970Wa29); 1591 *1* (1968Ch11). I_γ: weighted average of 36.3 *10* (2017Ga25) and 37.9 *6* (1984Al18).

[†] From 1984Al18, except where noted. Authors used different reference sources whose Eγ values were known precisely, and final Eγ values were weighted averages of three runs for 71.6γ and 256.9γ, and seven runs for 1519.3 and 1519.8 γ rays.
[‡] Eγ=1562.302 *5* (1979He19) from the decay of ^{110m}Ag was used as reference (1984Al18).

Continued on next page (footnotes at end of table)

^{50}Ca β^- decay (13.45 s) 2017Ga25,1984Al18 (continued)

$\gamma(^{50}Sc)$ (continued)

From $\gamma\gamma(\theta)$ in 2017Ga25 and RUL. The same values are adopted in Adopted Levels.
@ For absolute intensity per 100 decays, multiply by 0.997 *15*.
& Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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Decay Scheme

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