Comments on evaluation of decay data
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This evaluation was completed in February 2012 with a literature cut-off by the same date.

Decay Scheme

^{45}Ca disintegrates by beta minus emission to the ^{45}Sc ground state mainly, with a very small branch of 0,002 % to the ^{45}Sc first excited level of 12,4 keV.
Level energies, spins and parities (J^{π}) were taken from the evaluation by Burrows (2008Bu01).

Nuclear Data

Half-life

The recommended value was derived from measurements listed in Table 1.

Table 1. Measurement results and recommended value of ^{45}Ca half-life.

Reference	Value (d)	Uncertainty (d)	Remarks
1952De01	163,5	4,0	GM, Stat. uc
1957Th**	153	2	
1959Ca12	167	3	PC
1961Wy01	165,1	0,7	PC
1965An07	162,63	0,11	4πpc
1970Si24	163	2	PC
1994Lo04	162,67	0,25	LSC
χ^2 /n-1 =	0,34		
χ^2 crit. =	0,38		
UWM =	162,95		
LWM = (recommended)	162,64	0,11	Uc_{int} = 0,10 ; Uc_{ext} = 0,018

Conventional designations in the fourth column:
Measurement of counting rate decrease by Geiger-Müller counter (GM), proportional counter (PC), 4π proportional counter (4πpc), Liquid Scintillation Counting (LSC).
Stat. uc: statistical uncertainty component.

Values from Thiry (1957Th**), Caswell (1959Ca12) and Wyatt (1961Wy01) have been found outliers due to Chauvenet's criterion. The set of the remaining four values is consistent, and then the adopted value is the weighted mean with the lowest of the experimental uncertainties.

Decay Energy and Characteristics of Electron Emissions

The decay energy of ^{45}Ca has been adopted from the evaluation of Audi *et al.* (2011AuZZ),
Q_{β^-} = 258,0 (7) keV.
It should be noted that in the previous evaluation (2003Au03) Q_{β^-} = 255,8 (8) keV. This difference seems due to a change of 2,5 keV in the ^{45}Sc mass.

Several papers report measurements of the ^{45}Ca β^- spectrum (1950Ma03, 1950Ke60, 1967Ha39); by using a Kurie plot, the nature of the transition gs → gs was determined to be allowed.
With this hypothesis, a mean beta energy of 76,8 keV was calculated with the BetaShape program (2011Mo**), which is based on theoretical considerations. It can be compared with the experimental value of 74,6 (30) keV obtained by Caswell (1952Ca10).
A weak β^- transition to the 12,4 keV level was deduced from the observation of K conversion electrons by Freedman *et al.* (1965Fr12). The ratio of the K conversion electrons over the total β emissions was measured being:
$I(ce_K)/I\beta = 1{,}4 \times 10^{-5}$ (+8 -3)
The adopted value for this ratio is $I(ce_K)/I\beta = 1{,}7\ (6) \times 10^{-5}$ in application of the method described in Audi (2003Au03, page 21) to experimental data with asymmetric uncertainties.
The internal conversion coefficients for a M2 transition were calculated with the BrIcc program in the "frozen orbital approximation" (Kibédi *et al.* - 2008Ki07), that is: α_T = 423 (9) and α_K = 362 (8).
Then, the probability of the β^- transition to the 12,4 keV level is $2{,}0\ (7) \times 10^{-3}$ %.

Gamma-ray transition and emission

From the results above, the probability of the 12,4 keV gamma-ray transition is $2{,}0\ (7) \times 10^{-3}$ % and the gamma-ray emission intensity is negligible.

References

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