^{85}Kr – Comments on evaluation of decay data by V. Chisté and M. M. Bé

This evaluation was completed in July 2003 and the half life value has been updated in May 2004.

1) Decay Scheme

^{85}Kr disintegrates by β^- emission to the ^{85}Rb ground state (99.562 (10) %) and to the second excited level at 513.998 (5) keV (0.438 (10) %). The decay scheme is based mainly on the measurements of the 514 keV γ-emission intensity (see § **4. Radiation Emission, 4.2 Gamma Ray Emissions**).

2) Nuclear Data

The Q value is from Audi and Wapstra (1995Au04)

Level energies, spins and parities are from R. A. Meyer (1980Me06).

The measured ^{85}Kr half-life values are, in years:

	$T_{1/2}$	
Reference	Value (a)	Comments
Thode (1948Thode)	9.4 (4)	See also 1947Th06.
Turner (1953Tu22)	10.57 (14)	
Wanless (1953Wa17)	10.27 (18)	
Lerner (1963Le07)	10.76 (2)	
Anspach (1965An07)	10.75 (3)	
Johnston (1974Johnston)	10.714 (57)	
Walz (1983Wa26)	10.702 (8)	Superseded by 2004Sc04.
Unterweger (1992Un01)	10.7720 (38)	Superseded by 2002Un02.
Eberszkorn (1996Er06)	10.757 (49)	
Unterweger (2002Un02)	10.7756 (33)	
Schrader (2004Sc04)	10.724 (7)	

Evaluators calculated the weighted average of these 9 values using the Lweight program (version 3) as 10.750 years with an external uncertainty of 0.011 years and a reduced-χ^2 of 6.34. Evaluators rejected the Thode (1948Thode), Turner (1953Tu22) and Wanless (1953Wa17) values based on the Chauvenet's criterion. For the remaining 6 values, the largest contribution to the weighted average comes from the value of Unterweger (2002Un02), amounting to 79 %. The program Lweight 3 increased the uncertainty for the 2002Un02 value from 0.0033 to 0.0064 in order to reduce its relative weight from 79 % to 50 %.

The adopted value is the weighted mean: *10.752 a*, with an uncertainty of *0.023 a* (expanded so range includes the most precise value of Unterweger (2002Un02)) and a reduced-χ^2 of 6.

2.1) β^- Transitions

The β^- probabilities and the associated uncertainties have been deduced from γ transition probability balance at each level of the decay scheme, i. e., $P_\beta(0,0)$ = 99.562 (10) % and $P_\beta(0,2)$ = 0.438 (10) % . The values of log ft have been calculated with the program LOGFT for the Allowed and 1st Unique Forbidden transitions.

2.2) Gamma Transitions

Probabilities

The transition probabilities have been calculated from the gamma emission intensities and the internal conversion coefficients (see § **4.2) Gamma Ray Emissions**).

Mixing ratios and internal conversion coefficients

The adopted δ (= 0.072 (4)) for the 151 keV γ-transition and the gamma transition multipolarities of the 362 keV ((E3)) and of the 513 keV (M2, from ^{85}Sr ground state decay) were adopted from Sievers (1991Si01).

The theoretical internal conversion coefficients (table 1) have been interpolated from values in 1978Ro22 using the ICC Computer Code (program Icc99v3a – GETICC dialog).

Table 1:

E_γ (keV)	**Multipolarity**	**Value of α_K**	**Value of α_L**	**Value of α_T**
151.18 (3)	M1 + 0.52 (4) % E2	0.0430 (13)	0.00485 (14)	0.0488 (14)
362.81 (3)	(E3)	0.0292 (9)	0.0040 (1)	0.0340 (10)
513.998 (5)	M2	0.00635 (19)	0.00072 (2)	0.00721 (21)

For the 151 keV γ-transition, the α_T is calculated as follows:

α_T(M1) * %(M1) + α_T(E2) * %(E2) = (0.00479 (14) * 0.9948 (4)) + (0.213 (6) * 0.0052 (4)) = 0.0488 (14)

Calculations of ICC uncertainties for transitions:

∗ For the all transitions, uncertainties in α_T, α_K and α_L calculated values with ICC Computer Code (program Icc99v3a) are taken to be 3 %.

3) Atomic Data

Atomic values (ω_K, ϖ_L and n_{KL}) are from Schönfeld (1996Sc06).

The X-ray and Auger probabilities are calculated by Emission program.

4) Radiation emissions

4.2) Gamma ray emissions

Gamma ray energies (in keV) are from R. A. Meyer (1980Me06).
Emission probability values are deduced from measured values of the 514 keV absolute γ-emission intensity in Table 2 and using values relative to 514-keV transition for the other gamma-rays (1980Me06) shown in Table 3.

Table 2:

Reference	514 keV γ-emission intensity (%)	Comments
Geiger (1961Ge02)	0.46 (4)	
Eastwood (1964Ea01)	0.431 (17)	
Denecke (1967De05)	0.435 (13)	
Weighted Average (Lweight 3)	0.435 (10)	Reduced-χ^2 = 0.22

Table 3:

Energy (keV)	Relative γ-emission intensity measured by R. A. Meyer (1980Me06) (%)	Absolute γ-emission intensity (%)
151	0.0005 (3)	0.000 002 2 (13)
362	0.0005 (1)	0.000 002 18 (44)
514	100	0.435 (10)

With theses values shown in table 3, and the values of α_T calculated using the ICC Computer Code (table 1, section 2.2), evaluators deduced the γ-transition probability (table 4).

Table 4:

Energy (keV)	Transition probability (%)
151	0.000 002 3 (14)
362	0.000 002 25 (45)
514	0.438 (10)

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