^{225}Ra - Comments on evaluation of decay data by Huang Xiaolong and Wang Baosong

This evaluation was completed in 2007. Literature available by May 2007 was included.

1 Decay Scheme

^{225}Ra disintegrates 100 % by β^- emission to levels in ^{225}Ac. ^{225}Ra ground state has $J^\pi = 1/2^+$ (1990Ak03).

The recommended Q(β^-) value of 356 (5) keV in Audi (2003Au03) agrees with the Q(β^-) value of 353 (8) keV, calculated by the evaluator (using program RADLST) from average radiation energies. This agreement supports the completeness and correctness of the decay scheme.

2 Nuclear Data

The Q(β-) value is from the mass adjustment in 2003Au03.
Level energies, spin and parities are from 1990Ak03.
The measured and recommended ^{225}Ra half-life values are listed in Table 1.

Table 1: Measured half-life values of ^{225}Ra and recommended value.

$T_{1/2}$ (d)	References	Measurement method
14	1947En03	
14.8 (2)	1950Ha52	Alpha pulse analyser, 10 $T_{1/2}$
15.02 (56)	1987Mi10	Solid-state detector, linear least squares fit
14.91 (11)		Unweighted mean
14.82 (19)		Weighted mean,χ^2=0.14
14.82 (19)	Recommended value	From weighted mean

The half-life weighted average has been calculated using the LWM computer program. The recommended half-life is from LWM result. Further measurements are needed to determine this value with greater precision.

2.1 β^- Transitions

The maximum energies of the β^- transitions in the decay of ^{225}Ra have been deduced from the Q(β-) value (2003Au03) and the level energies.

The adopted β^- transition probabilities and their associated uncertainties to the 40-keV level and to the ground state were deduced from P(γ) = 30.0 (7) % and α_T = 1.293 (19) for the 40-keV γ-ray. No β^- transitions to the 120.8- and 155.6- keV levels were observed. Based on Ac KX-ray intensities an upper limit of < 0.01 % for the respective β^- transitions to these levels was reported in 1984Ah01.

The *logft* values and average β^- energies have been calculated with the program LOGFT.

2.2 γ Transitions

The transition probability of the 40-keV γ-ray was calculated using its γ-ray emission intensity and the relevant total internal conversion coefficient.

The multipolarity of this γ-ray transition is from 1990Ak03.

The internal conversion coefficient (ICC) (and its associated uncertainty) for the 40-keV γ-ray transition has been interpolated from theoretical values based on the "Frozen Orbital" approximation (2002Ba85) using the BrIcc computer program (2008Ki07).

3 Atomic Data

Atomic fluorescence yields (ω_K,ϖ_L, ϖ_M, η_{KL} and η_{LM}) are from Schönfeld (1996Sc06).

The X-ray and Auger electron emission probabilities have been deduced from γ-ray and conversion electron data by using the computer code RADLST.

4 Electron emissions

The conversion electron emission probabilities have been deduced from γ-ray transition data using theoretical internal conversion coefficients.

5 Photon emissions

5.1 γ-ray energy

Measurements of the 40-keV γ-ray energy from ^{225}Ra are listed in Table 2 together with their weighted mean value. The recommended value is from the weighted mean value.

Table 2: Measured and recommended γ-ray energy from ^{225}Ra β^- decay.

1955Ma61	1955St04	1981Di14	1987Ah05	LWM	Evaluation
41 (2)	40 (1)	40.12 (5)	40.09 (5)	40.11 (4)	40.11 (4)

5.2 Absolute values of the γ-ray emission probability

The measurements of the absolute γ-ray emission probabilities from ^{225}Ra decay are listed in Table 3. The present recommended value is taken from a precise measurement in equilibrium with ^{229}Th (1986He06).

Table 3: Measured and recommended absolute γ-ray emission probability of 40.09keV for ^{225}Ra.

P_γ (40.09 keV) (%)	References	Measurement method
33	1955Ma61	Scintillation spectrometry
29	1955St04	
39.3 (12)	1981Di14	Ge(Li)
30.0 (7)	1986He06	Ge(Li) and Au-Si surface barrier, in equilibrium with ^{229}Th
30.0 (7)		Recommended value from 1986He06

6 References

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