

**¹³³Xe^m - Comments on evaluation of decay data
by M. Galán**

1) Decay Scheme

¹³³Xe^m disintegrates by a strong converted γ -transition to the ground state of ¹³³Xe.

2) Nuclear Data

The 233-keV isomeric state has $J^\pi = 11/2^-$ (1989RA17).

The measured ¹³³Xe^m half-life values, are:

Reference	Value (days)
1975HO18	2,19 (5)
1974FOZY	2,188 (8)
1968AL16	2,191 (29)
1961ER04	2,26 (2)
1951BE11	2,30 (8)
Number of input values	5
Reduced χ^2	3,22
Weighted Mean	2,198
Internal uncertainty	0,007
External uncertainty	0,013
NRM	2,200 (11)
RT	2,191 (8)
Adopted value	2,198 (13)

The AveTool program has been used with these five input values. This program calculates averages using three statistical methods: LWM (Limitation of Relative Statistical Weight), NRM (Normalised Residual Method) and RT (Rajeval Technique).

The recommended value for the ¹³³Xe^m half-life is the LWM mean of 2,198 d with an external uncertainty of 0,013 d.

2.1) Gamma-ray Transitions

The evaluated γ -ray transition energy is the photon energy plus the nuclear recoil energy.

The 233-keV γ -ray has an M4 multipolarity. The various theoretical conversion coefficients for this transition (Band *et al.* Häger and Seltzer, Rösel *et al.*) differ about 2 % from each other. The ICCs (α_T , α_K , α_L) have been interpolated from the new Band *et al.* tables (2002BA85) using the BrIcc Computer Code. The uncertainties on these conversion coefficients are estimated to be 1,4 %.

Some experimental values together with the theoretical values are shown in the table:

Reference	α_K	K/L+M
Experimental		
1954BE55	4,4 (14)	2,32 (15)
1968AL16	7,68 (25)	2,04 (12)
1972AC02	7,4 (14)	2,54 (20)
Theoretical		
1968HA52	6,37 (9)	2,51 (5)
1978RO22	6,35 (9)	2,44 (4)
2002BA85	6,25 (9)	2,41 (3)

3) Atomic Data

Atomic values (ω_K , $\bar{\omega}_L$ and η_{KL}) are from 1996SC06.

ω_K	$0,888 \pm 0,005$
$\bar{\omega}_L$	$0,097 \pm 0,005$
η_{KL}	$0,902 \pm 0,004$

The X-ray and Auger electron emission probabilities have been calculated from γ -ray and conversion electron data using the programs RADLST and EMISSION. Differences between these results were $< 0,6 \%$.

4) Radiation emissions

4.1 Conversion electrons

The conversion electron emission probabilities have been deduced from the ICC values and from the γ -ray emission probability.

The total conversion electron emission probability has been deduced from:

$$P_{ce} = 100 - P_\gamma = 100 - 10,16 (13) = 89,84 (13)$$

4.2 g-Ray Emissions

Various measurements of the γ -ray energy have been found in the bibliography:

Reference	Value (keV)
1976ME16	233,221 (15)
1972AC02	233,2 (4)
1952BE55	232,8 (3)
1951BE11	232,8 (4)
Number of input values	4

Reduced χ^2	1,02
Weighted Mean	233,219
Internal uncertainty	0,015
External uncertainty	0,015
NRM	233,219 (15)
RT	233,11 (12)
Adopted value	233,219 (15)

The recommended value is the LWM mean of 233,219 keV with an external uncertainty of 0,015.

The γ -ray emission intensity is given by:

$$P\gamma = 100 / (1 + \alpha) = 100 / [1 + 8,84 (13)] = 10,16 (13) \%$$

Additional reference:

F. Lagoutine, Table des Radionucléides, CEA-LMRI (1984)

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