

¹³⁵Pm ε decay (49 s) 1989Vi04,1989Ko07

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Alexander A. Rodionov And Yuri L. Khazov		NDS 109, 517 (2008)	22-Jan-2008

Parent: ¹³⁵Pm: E=0.0+x; J^π=(3/2⁺,5/2⁺); T_{1/2}=49 s 3; Q(ε)=6240 60; %ε+%β⁺ decay=100.0

¹³⁵Pm-E: This level May Be the ground state of ¹³⁵Pm.

1989Vi04: ¹³⁵Pm produced by ⁹²Mo(⁴⁶Ti,3p) E=192 MeV followed by on-line mass separation and from decay of ¹³⁵Sm.

Measured T_{1/2}, E_γ, I_γ, γγ, Xγ coin, β+γ coin.

1989Ko07: ¹³⁵Pm produced by ⁹²Mo(⁴⁶Ti,3p) E=250, 240 MeV and ¹¹²Sn(²⁸Si,3p2n) E=190 MeV followed by on-line mass separation. Measured T_{1/2}, γ rays, ce, γγ, γce.

1995Ve08: measured β⁺ end-point energies, deduced Q value.

Others: 1982AIZO, 1977Bo02, 1975Va14. 1977Bo02 reported five γ rays from ¹³⁵Pm decay and 1982AIZO reported 33 γ rays.

The ε+β⁺ feedings and associated log ft values are given by 1989Vi04 as limits based on their proposed level scheme, but in the absence of clear separation between the level schemes for the two activities (45 s and 49 s), the evaluators consider the available data to be insufficient to determine such values reliably.

The separation of the decay schemes from the two activities is not considered as well established by the evaluators due to the two half-lives being close in value. In the work of 1989Vi04 this separation was based mainly on the decay pattern to high- and low-spin states in the daughter nucleus from the parent activities with spins (1/2⁻) and (3/3⁺,5/2⁺). 1989Vi04 state that low-spin isomer in their work is mainly populated from the decay of ¹³⁵Sm whereas the high-spin isomer is populated in heavy-ion reaction.

The growth and decay properties of certain γ rays for example that of 128.8γ clearly show the presence of two activities.

Total decay energy of 1232 keV 105 calculated (by RADLIST code) from level scheme is much lower than the expected value of 6240 keV 60.

The decay scheme has not been normalized for I_γ/100 decays of the parent since the populated levels are known only up to about 745; whereas, the Q value is≈5940. Also no data exist for transition multiplicities and for ε,β⁺ feeding to g.s. The decay scheme as given by 1989Vi04 implies I_γ normalization=0.3, based on Iβ(ε+β⁺)(to g.s.)<14%.

¹³⁵Nd Levels

E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]
65.0 2	(1/2 ⁺)	328.10 18	(1/2 ⁺)	463.70 15	(5/2 ⁺)	671.75 19
193.72 14	(3/2 ⁺)	347.13 17	(1/2,3/2,5/2)	588.11 23	(3/2 ⁺ ,5/2 ⁺)	744.3 4
273.08 14	(3/2,5/2)	371.18 15	(5/2 ⁺)	602.92 24	(3/2 ⁺ ,5/2 ⁺)	

[†] From least-squares fit to E_γ's.

[‡] From 'Adopted Levels'.

γ(¹³⁵Nd)

About 12 γ rays reported by 1982AIZO were not confirmed by 1989Ko07 and 1989Vi04, these are listed in ¹³⁵Nd ε decay (45 s). Measurements of E_γ and I_γ are from a composite source of two isomers.

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
98.1 2	8 2	371.18	(5/2 ⁺)	273.08	(3/2,5/2)	I _γ : I _γ ≈2 may be from decay of 45-s isomer.
128.8 2	66 15	193.72	(3/2 ⁺)	65.0	(1/2 ⁺)	I _γ : I _γ ≈4 may be associated with the decay of 45-s isomer.
135.5 @ 5	≈2 @	328.10	(1/2 ⁺)	193.72	(3/2 ⁺)	I _γ (doublet)=4 I.
135.5 @ 5	≈2 @	463.70	(5/2 ⁺)	328.10	(1/2 ⁺)	
177.4 3	6 1	371.18	(5/2 ⁺)	193.72	(3/2 ⁺)	I _γ : I _γ ≈2 may be from decay of 45-s isomer. I _γ : 14 2 for E _γ =177.3 2 (1982AIZO).
190.6 5	≈2	463.70	(5/2 ⁺)	273.08	(3/2,5/2)	
208.1 2	50 15	273.08	(3/2,5/2)	65.0	(1/2 ⁺)	I _γ : I _γ ≈11 may be associated with the decay of 45-s isomer.

Continued on next page (footnotes at end of table)

^{135}Pm ε decay (49 s) **1989Vi04,1989Ko07** (continued) $\gamma(^{135}\text{Nd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
262.9 2	50 15	328.10	(1/2 ⁺)	65.0	(1/2 ⁺)	I_γ : 16 2 for $E_\gamma=262.2$ 2 (1982AIZO).
270.0 2	43 15	463.70	(5/2 ⁺)	193.72	(3/2 ⁺)	I_γ : $I_\gamma \approx 5$ may be from decay of 45-s isomer.
282.1 2	30 5	347.13	(1/2,3/2,5/2)	65.0	(1/2 ⁺)	I_γ : 14 2 for $E_\gamma=282.1$ (1982AIZO). 282 γ shown to deexcite a 746.0 level by 1989Ko07.
306.2 2	35 5	371.18	(5/2 ⁺)	65.0	(1/2 ⁺)	I_γ : $I_\gamma \approx 10$ may be from decay of 45-s isomer. I_γ : 16 2 for $E_\gamma=306.1$ 2 (1982AIZO).
324.6 2	10 3	671.75		347.13	(1/2,3/2,5/2)	
^x 357.0 [#] 4	6 2					
394.2 3	10 5	588.11	(3/2 ⁺ ,5/2 ⁺)	193.72	(3/2 ⁺)	
398.7 [@] 2	38 [@] 10	463.70	(5/2 ⁺)	65.0	(1/2 ⁺)	I_γ : $I_\gamma \approx 5$ may be from decay of 45-s isomer. $I_\gamma(\text{doublet})=40$ 10.
398.7 [@] 2	≈ 2 [@]	671.75		273.08	(3/2,5/2)	
409.2 2	15 5	602.92	(3/2 ⁺ ,5/2 ⁺)	193.72	(3/2 ⁺)	
471.2 3	9 2	744.3		273.08	(3/2,5/2)	
523.3 3	9 3	588.11	(3/2 ⁺ ,5/2 ⁺)	65.0	(1/2 ⁺)	
^x 582.8 [#] 3	11 3					
^x 1078.0 [#] 5	10 5					

† From 1989Vi04, unless otherwise stated.

‡ From 1989Vi04. No I_γ 's were given by 1989Ko07. Other I_γ : 1982AIZO.

From 1989Vi04 only, it belongs to the decay of either of the two isomers.

@ Multiply placed with intensity suitably divided.

^x γ ray not placed in level scheme.

^{135}Pm ϵ decay (49 s) 1989Vi04,1989Ko07

Decay Scheme

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- Coincidence

Intensities: Relative I_γ
 @ Multiply placed: intensity suitably divided

$$\begin{array}{l} (3/2^+, 5/2^+) 0.0+x \\ \hline \% \epsilon + \% \beta^+ = 100 \\ Q_\epsilon = 6240.60 \\ \hline ^{135}\text{Pm}_{74} \\ 61 \end{array} \quad 49 \text{ s } 3$$

