^{167}W ε decay (19.9 s) 1989Me02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Parent: ^{167}W: E=0.0; J^π=(5/2$^-$); $T_{1/2}$=19.9 s *5*; Q(ε)=6260 *30*; %ε+%β^+ decay=99.96 *1*

^{167}W-J^π,$T_{1/2}$: From ^{167}W Adopted Levels.

^{167}W-Q(ε): From 2021Wa16.

^{167}W-Measured εK/β^+=0.57 *11* (1989Me02) from I(K x ray, Ta) and I($\gamma^\pm$) in coincidence with 497γ. This implies Q=5590 *+300−240* (1989Me02) for ^{167}W ε decay, as compared to 6260 *30* from 2021Wa16.

^{167}W-%ε+%β^+ decay: Measured %α=0.04 *1* for ^{167}W decay (1989Me02).

1989Me02: ^{167}W produced by irradiating 93% enriched $^{136}BaF_2$ with 191 MeV ^{36}Ar beam at the VICKSI accelerator facility of HMI-Berlin, and identified from coincidences with Ta x rays and excitation function measurements. Measured Eγ, Iγ, Eα, $\gamma\gamma$-coin, γ(Ta K-x rays)-coin, γ(511-annihilation radiation)-coin, half-life of the decay of ^{167}W. Deduced total and K-conversion coefficients for 84-, 94- and 110-keV transitions from γ ray, K-x ray and $\gamma\gamma$-coin data.

Others: 1989Br19 (also 1987Es08), 1992HeZV: measured half-life of ^{167}W and ^{167}Ta decays.

The decay scheme is from 1989Me02. In view of the unknown ε+β^+ feeding to the g.s., and due to a large difference between the highest populated level at 663 keV and Q-value of 6260 *30*, the decay scheme is considered incomplete by the evaluators, and has not been normalized to obtain γ-ray intensities per 100 decays.

^{167}Ta Levels

E(level)	J^π[†]	Comments
0.0	(3/2$^+$)	
94.4 *2*	(5/2$^+$)	
204.6 *3*	(7/2$^+$)	
232.83 *25*	(7/2$^+$)	
254.1 *5*	(7/2$^+$)	
289.0 *3*	(5/2$^+$,7/2$^+$,9/2$^+$)	
392.0 *4*	(≤7/2)	E(level): 175.4 *3* also possible; order of 175γ and 392γ uncertain.
496.57 *25*	(5/2$^-$)	
503.0 *5*	(9/2$^+$)	
567.4 *5*		
611.2 *5*	(9/2$^-$)	
663.0 *4*		

[†] From the Adopted Levels.

γ(^{167}Ta)

The ε+β$^+$ feedings and log *ft* values given in Fig. 3 of 1989Me02: 20% (log *ft*=4.8) for 94.4 level; 24% (log *ft*=4.7) for 204.6 level; 5% (log *ft*=5.3) for 254.1 level; 36% (log *ft*=4.5) for 289.0 level; and 15% for levels above 289 keV. As the evaluators consider the decay scheme to be incomplete, these values are not adopted. The apparent large feedings to low-lying levels in 1989Me02 could be due to the missing γ transitions from unobserved higher levels.
All the gamma rays reported by 1989Me02 are in coincidence with Ta K-x rays and 511-keV annihilation radiation.

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[‡]	δ[‡]	α[#]	Comments
84.4 *2*	29 *2*	289.0	(5/2$^+$,7/2$^+$,9/2$^+$)	204.6	(7/2$^+$)	M1(+E2)	<1.25	7.25 *15*	α(K)=3.0 *29*; α(L)=3.2 *15*; α(M)=0.8 *4* α(N)=0.19 *9*; α(O)=0.025 *11*; α(P)=0.00028 *27* α(K)exp=6 *3* (1989Me02)
94.4 *2*	100	94.4	(5/2$^+$)	0.0	(3/2$^+$)	M1+E2		4.9 *3*	α(K)=2.6 *17*; α(L)=1.7 *11*; α(M)=0.4 *3* α(N)=0.10 *7*; α(O)=0.014 *8*; α(P)=0.00024 *17* α(exp)=4.5 *5* (1989Me02) α(total) from simultaneous observation of 110γ in singles and the number of 94 keV γ rays in coincidence with 110γ (1989Me02).
110.2 *2*	94 *4*	204.6	(7/2$^+$)	94.4	(5/2$^+$)	M1+E2		2.9 *4*	α(K)=1.8 *10*; α(L)=0.9 *5*; α(M)=0.22 *12* α(N)=0.05 *3*; α(O)=0.007 *4*; α(P)=0.00015 *11* α(K)exp=2 *1* (1989Me02)
[x]141.6 *4*									Reported by 1987Es08 (and 1989Br19). Probably does not belong to ^{167}Ta. 1989Me02 report 141.6γ in coincidence with Hf K x ray and 139.5γ in ^{167}Hf, so they assign it to ^{167}Ta ε decay.
159.7 *4*	21 *2*	254.1	(7/2$^+$)	94.4	(5/2$^+$)				I$_\gamma$: corrected for contribution from 158.7γ emitted in ^{166}Ta decay.
175.4 *3*		567.4		392.0	(≤7/2)				I$_\gamma$: not determined; contaminant present. Iγ<17 expected based on intensity balance at the 392 level.
194.6 *3*	16 *2*	289.0	(5/2$^+$,7/2$^+$,9/2$^+$)	94.4	(5/2$^+$)				
232.8 *3*	46 *2*	232.83	(7/2$^+$)	0.0	(3/2$^+$)	[E2]		0.181	α(K)=0.1110 *16*; α(L)=0.0531 *8*; α(M)=0.01303 *20* α(N)=0.00306 *5*; α(O)=0.000422 *7*; α(P)=8.33×10^{-6} *12*
263.7 *3*	4 *1*	496.57	(5/2$^-$)	232.83	(7/2$^+$)				
270.2 *4*	13 *4*	503.0	(9/2$^+$)	232.83	(7/2$^+$)				
[x]275.6 *3*	22 *1*								
378.4 *4*	18 *5*	611.2	(9/2$^-$)	232.83	(7/2$^+$)				
392.0 *4*	17 *2*	392.0	(≤7/2)	0.0	(3/2$^+$)				
430.2 *3*	17 *2*	663.0		232.83	(7/2$^+$)				
496.6 *3*	34 *3*	496.57	(5/2$^-$)	0.0	(3/2$^+$)				
[x]533.7 *4*	21 *2*								

[†] From 1989Me02.

$\gamma(^{167}$Ta) (continued)

‡ From α(total) and or α(K)exp (1989Me02).

\# Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^{x} γ ray not placed in level scheme.

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Decay Scheme

Intensities: Relative $I_{(\gamma+ce)}$

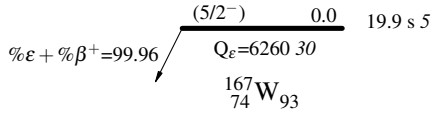
Legend

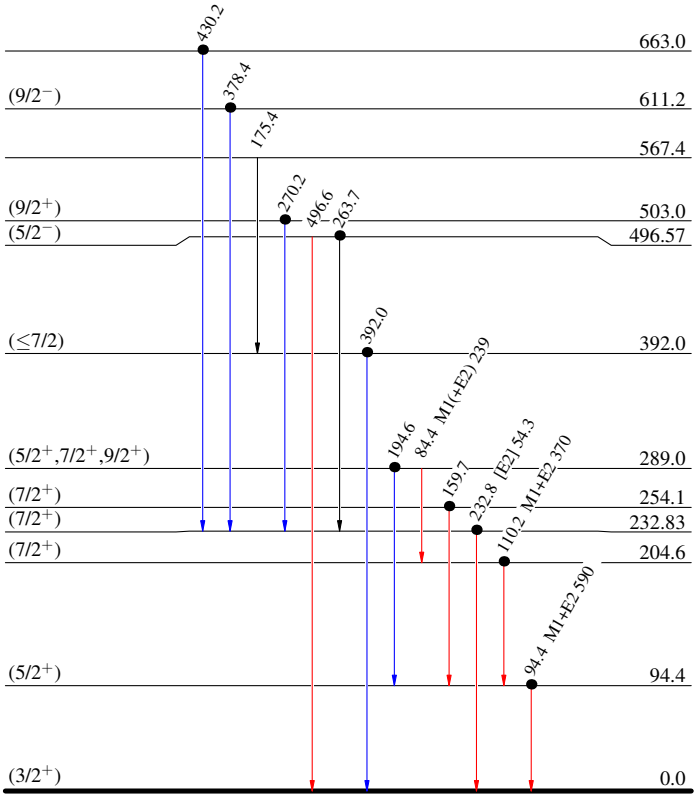
$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

Coincidence





$^{167}_{73}Ta_{94}$