^{166}Ta ε decay 2005Mc01,1977Le08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 109, 1103 (2008)	1-Mar-2008

Parent: ^{166}Ta: E=0; $J^\pi=(2)^+$; $T_{1/2}$=34.4 s *5*; Q(ε)=7760 *40*; %ε+%$β^+$ decay=100.0

^{166}Ta produced using ^{159}Tb(^{16}O,9n) reaction At E=147 *5* MeV (1977Le08) or E=155 MeV (2005Mc01).

1977Le08: measured Eγ, Iγ, γγ coin, parent $T_{1/2}$.

2005Mc01: aluminized Kapton tape transport of reaction recoils to low background area; three Compton-suppressed Clover HPGE detectors and one low-energy photon spectrometer; measured Eγ (E<2400), Iγ, γγ coin, γγ(θ) (two cascades).

^{166}Hf Levels

The decay scheme is adopted from 2005Mc01; it differs significantly from that proposed In 1977Le08 on the basis of limited coincidence information. the authors of 2005Mc01 introduce new levels At 897, 1405, 1551 and 1603; they also reject those At 695, 852, 909, 1023, 1213 and 1447 proposed In 1977Le08. However, the deduced ε+$β^+$ feeding and the J^π of the levels fed still fail to present an entirely consistent picture, suggesting that the scheme is incomplete, As might Be expected given that Q=7760 and No Eγ>2400 transitions have been measured.

E(level)†	J^π‡	$T_{1/2}$‡	E(level)†	J^π‡	E(level)†	J^π‡
0	0^+	6.77 min *30*	1007.16 *6*	(3^+)	1404.85 *7*	
158.64 *4*	2^+		1064.99 *10*	(0^+)	1551.39 *10*	(4^-)
470.47 *6*	4^+		1162.70 *8*		1603.18 *11*	$(2^+,3,4^+)$
809.96 *6*	(2^+)		1218.76 *8*	2^+		
897.16 *12*	6^+		1332.41 *7*	$(2^+,3,4^+)$		

† From least-squares fit to Eγ, omitting the 1133γ from the 1603 level because that Eγ May contain a typographical error.

‡ From Adopted Levels.

ε,$β^+$ radiations

E(decay)	E(level)	I$β^+$ †	Iε†	Log *ft*	I(ε+$β^+$)†	Comments
(6.16×10^3 *4*)	1603.18	1.99 *15*	0.61 *5*	6.54 *4*	2.60 *19*	av Eβ=2344 *19*; εK=0.194 *4*; εL=0.0306 *6*; εM+=0.00933 *17*
(6.21×10^3 *4*)	1551.39	0.81 *9*	0.56 *7*	8.75^{1u} *6*	1.37 *16*	av Eβ=2315 *19*; εK=0.341 *5*; εL=0.0548 *8*; εM+=0.01674 *24*
(6.36×10^3 *4*)	1404.85	6.0 *5*	1.6 *1*	6.14 *4*	7.6 *6*	av Eβ=2437 *19*; εK=0.178 *3*; εL=0.0282 *5*; εM+=0.00857 *15*
(6.43×10^3 *4*)	1332.41	4.8 *3*	1.3 *1*	6.26 *4*	6.1 *4*	av Eβ=2471 *19*; εK=0.173 *3*; εL=0.0273 *5*; εM+=0.00832 *15*
(6.54×10^3 *4*)	1218.76	2.7 *3*	0.68 *8*	6.55 *6*	3.4 *4*	av Eβ=2525 *19*; εK=0.165 *3*; εL=0.0261 *5*; εM+=0.00793 *14*
(6.60×10^3 *4*)	1162.70	1.92 *15*	0.46 *4*	6.72 *4*	2.38 *18*	av Eβ=2551 *19*; εK=0.161 *3*; εL=0.0255 *5*; εM+=0.00775 *13*
(6.70×10^3 *4*)	1064.99	0.93 *14*	0.21 *3*	7.07 *7*	1.14 *17*	av Eβ=2597 *19*; εK=0.155 *3*; εL=0.0244 *4*; εM+=0.00744 *13* Log *ft*: much too low for a ΔJ=2, Δπ=No transition.
(6.75×10^3 *4*)	1007.16	4.8 *5*	1.1 *1*	6.38 *5*	5.9 *6*	av Eβ=2625 *19*; εK=0.1512 *25*; εL=0.0239 *4*; εM+=0.00727 *12*
(6.86×10^3 *4*)	897.16	0.55 *8*	0.12 *2*	7.36 *7*	0.67 *10*	av Eβ=2677 *19*; εK=0.1447 *24*; εL=0.0228 *4*; εM+=0.00695 *12* Iε,log *ft* apparent feeding inconsistent with J^π of level fed.
(6.95×10^3 *4*)	809.96	15.1 *11*	3.05 *23*	5.95 *4*	18.1 *13*	av Eβ=2718 *19*; εK=0.1397 *23*; εL=0.0220 *4*;

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^{166}Ta ε decay 2005Mc01,1977Le08 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ †	Iε†	Log *ft*	I(ε+β+)†	Comments
						εM+=0.00671 *11*
(7.29×10^3 *4*)	470.47	12.8 *7*	2.21 *12*	6.13 *3*	15.0 *8*	av Eβ=2878 *19*; εK=0.1223 *19*; εL=0.0193 *3*; εM+=0.00587 *10*
						Log *ft*: much too low for a ΔJ=2, Δπ=No transition.
(7.60×10^3 *4*)	158.64	31 *3*	4.7 *4*	5.84 *4*	36 *3*	av Eβ=3026 *19*; εK=0.1086 *17*; εL=0.0171 *3*; εM+=0.00521 *8*

† Absolute intensity per 100 decays.

γ(^{166}Hf)

Iγ normalization: The normalization assumes that there is no ε+β+ feeding to the ground state (ΔJ=(2), Δπ=No); then, Σ (I(γ+ce) to g.s.)=100%.

E_γ†	I_γ†[a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	α[b]	Comments
158.64 *4*	100.0 *30*	158.64	2+	0	0+	E2	0.636	α(K)=0.315 *5*; α(L)=0.245 *4*; α(M)=0.0606 *9*; α(N+..)=0.01593 *23* α(N)=0.01409 *20*; α(O)=0.00182 *3*; α(P)=1.97×10^{-5} *3* Iγ=100.0 *35* In 1977Le08. Iγ=54.1% 8, assuming recommended decay scheme normalization.
197.5&[c]		1007.16	(3+)	809.96	(2+)			I_γ: <0.40 (2005Mc01).
211.6&[c]		1218.76	2+	1007.16	(3+)			I_γ: <0.13 (2005Mc01).
255.0&[c]		1064.99	(0+)	809.96	(2+)			I_γ: <0.19 (2005Mc01).
311.87 *5*	44.7 *9*	470.47	4+	158.64	2+	E2	0.0706	α(K)=0.0495 *7*; α(L)=0.01616 *23*; α(M)=0.00388 *6*; α(N+..)=0.001036 *15* α(N)=0.000908 *13*; α(O)=0.0001240 *18*; α(P)=3.56×10^{-6} *5* Iγ=53.6 *21* In 1977Le08.
325.3&[c]		1332.41	(2+,3,4+)	1007.16	(3+)			I_γ: <0.33 (2005Mc01).
339.5&[c]		809.96	(2+)	470.47	4+			I_γ: <0.27 (2005Mc01).
352.8&[c]		1162.70		809.96	(2+)			I_γ: <0.51 (2005Mc01).
397.6@ *1*	2.9@ *3*	1404.85		1007.16	(3+)			
408.8&[c]		1218.76	2+	809.96	(2+)			I_γ: <0.69 (2005Mc01).
426.7@ *1*	1.21@ *17*	897.16	6+	470.47	4+	E2	0.0292	α(K)=0.0220 *3*; α(L)=0.00549 *8*; α(M)=0.001297 *19*; α(N+..)=0.000349 *5* α(N)=0.000304 *5*; α(O)=4.28×10^{-5} *6*; α(P)=1.660×10^{-6} *24*
522.5&[c]		1332.41	(2+,3,4+)	809.96	(2+)			I_γ: <0.65 (2005Mc01).
536.81 *7*	2.0 *2*	1007.16	(3+)	470.47	4+			Eγ=536.0 *4*, Iγ=7.5 *10* In 1977Le08; probably included large contribution from 537.6γ In ^{166}Yb (2005Mc01).
544.27@ *10*	0.94@ *18*	1551.39	(4−)	1007.16	(3+)			
x552.4# *4*	5.6# *18*							attributed In 2005Mc01 to 552.0γ from ^{164}Lu ε decay.
594.65 *10*	5.7 *9*	1404.85		809.96	(2+)			placement from 1065 level In 1977Le08

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^{166}Ta ε decay 2005Mc01,1977Le08 (continued)

γ(^{166}Hf) (continued)

E_γ †	I_γ †a	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α[b]	Comments
								rejected In 2005Mc01 based on γγ coin data.
651.26 *5*	18.9 *4*	809.96	(2$^+$)	158.64	2$^+$			Iγ=16.1 *11* In 1977Le08. Mult.: 651γ-159γ(θ) consistent with 2+(810)−2+(159)−0+(g.s.) sequence (W(Δθ=75°)/W(Δθ=15°)=0.99 *12*) (2005Mc01).
692.23 *6*	4.4 *3*	1162.70		470.47	4$^+$			Eγ=693.2 *5*, Iγ=1.2 *5* In 1977Le08.
x742.8# *4*	13.3# *12*							attributed to ^{164}Yb In 2005Mc01.
748.25 *7*	3.0 *2*	1218.76	2$^+$	470.47	4$^+$			an Eγ=750.0 *5*, Iγ=10.4 *18* transition was placed, instead, from a 909 level In 1977Le08.
x750.0# *5*	10.4# *18*							May include the 748.25γ from 2005Mc01 and a large contribution from the 747.8γ In ^{164}Yb.
793.2&c		1603.18	(2$^+$,3,4$^+$)	809.96	(2$^+$)			I_γ: <0.33 (2005Mc01).
810.0 *3*	20.2 *18*	809.96	(2$^+$)	0	0$^+$			Iγ=18.6 *16* In 1977Le08.
848.41 *6*	12.7 *9*	1007.16	(3$^+$)	158.64	2$^+$			Eγ=847.4 *4*, Iγ=13.6 *27* In 1977Le08.
x851.7# *6*	3.4# *14*							absent In 2005Mc01 (Iγ<0.3).
861.97 *7*	5.4 *3*	1332.41	(2$^+$,3,4$^+$)	470.47	4$^+$			Iγ=7.1 *20* In 1977Le08.
x864.1# *5*	9.2# *23*							attributed In 2005Mc01 to 863.9γ from ^{164}Lu ε decay.
906.35 *9*	2.1 *3*	1064.99	(0$^+$)	158.64	2$^+$	(E2)	0.00500	α(K)=0.00411 *6*; α(L)=0.000689 *10*; α(M)=0.0001570 *22*; α(N+..)=4.30×10^{-5} *6* α(N)=3.71×10^{-5} *6*; α(O)=5.54×10^{-6} *8*; α(P)=3.21×10^{-7} *5* I_γ: 11.5 *15* In 1977Le08. Mult.: from 906γ-159γ(θ) consistent with 0(1065)−2+(159)−0+(g.s.) sequence (W(Δθ=75°)/W(Δθ=15°)=0.50 *10*) (2005Mc01).
934.4&c		1404.85		470.47	4$^+$			I_γ: <0.17 (2005Mc01).
x977.0# *8*	4.7# *11*							absent In 2005Mc01 (Iγ<0.15).
1004.1&c		1162.70		158.64	2$^+$			I_γ: <0.15 (2005Mc01).
x1054.4# *10*	8.3# *13*							attributed to ^{166}Yb In 2005Mc01.
1060.2@ *1*	2.3@ *3*	1218.76	2$^+$	158.64	2$^+$			
1080.86@ *12*	1.6@ *2*	1551.39	(4$^-$)	470.47	4$^+$			
1132.75@ *11*	2.5@ *3*	1603.18	(2$^+$,3,4$^+$)	470.47	4$^+$			E_γ: from table I of 2005Mc01; Eγ=1133.75 *11* In table II and 1134 In fig. 3. 1132.75 fits placement well, 1133.75 does not.
1173.74 *7*	5.9 *4*	1332.41	(2$^+$,3,4$^+$)	158.64	2$^+$			
1218.8@ *3*	1.0@ *4*	1218.76	2$^+$	0	0$^+$			
1246.37@ *7*	5.4@ *3*	1404.85		158.64	2$^+$			
x1288.3# *12*	5.8# *21*							absent In 2005Mc01 (Iγ<0.12).
1444.4@ *2*	2.3@ *1*	1603.18	(2$^+$,3,4$^+$)	158.64	2$^+$			
x1447.0# *20*	6.3# *16*							2005Mc01 report No evidence In singles for this G.

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^{166}Ta ε decay 2005Mc01,1977Le08 (continued)

$\gamma(^{166}Hf)$ (continued)

† From 2005Mc01, except As noted.
‡ From Adopted Gammas, except As noted.
# From 1977Le08.
@ Not reported previously In ^{166}Ta ε decay.
& Approximate energy from level-energy difference for unobserved but spin-allowed transition; upper limit for intensity is given In comments and transition is omitted from Adopted Levels, Gammas.
[a] For absolute intensity per 100 decays, multiply by 0.541 *17*.
[b] 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.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{166}Ta ε decay 2005Mc01,1977Le08

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence