

¹⁵⁸Ta IT decay: 6.1 μs 2016Ca15, 2014Ca03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 141, 1 (2017)	1-Feb-2017

Parent: ¹⁵⁸Ta: E=2809.2 14; J^π=(19⁻); T_{1/2}=6.1 μs 1; %IT decay=98.6 2

¹⁵⁸Ta-%IT decay: %α=1.4 2 (2014Ca03).

2016Ca15, 2014Ca03: compiled for the XUNDL database by B. Singh (McMaster). References are related by common authors and setup.

2016Ca15: isomer produced in ¹⁰²Pd(⁵⁸Ni,pn), E=255 MeV from JYFL accelerator facility. Target ≈1 mg/cm² thick 90% enriched in ¹⁰²Pd. ¹⁵⁸Ta recoils were identified using recoil-decay tagging method and correlated with γ rays. Measured delayed γ-ray spectra, Eγ, Iγ, γγ-coin, Eα, (¹⁵⁸Ta ions)γα correlations using JUROGAM array of 43 Compton-suppressed Ge detectors for γ rays. Deduced high-spin levels and J^π.

2014Ca03: ¹⁰²Pd(⁵⁸Ni,pnγ), E(⁵⁸Ni)=255 MeV from JYFL accelerator facility. Target=1 mg/cm² thick enriched ¹⁰²Pd. ¹⁵⁸Ta recoils were separated by RITU separator and GREAT spectrometer. Measured prompt and delayed γ-ray spectra, Eγ, Iγ, γγ-coin, Eα, (¹⁵⁸Ta ions)γα correlations, half-life of a high-spin isomer using JUROGAM array for γ rays, and DSSDs for particles. Deduced isomer decay modes, levels and J^π in ¹⁵⁸Ta. Discussed (unobserved) proton emission from the high-spin isomer.

¹⁵⁸Ta Levels

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
0.0	(2 ⁻)	55 ms 15	from Adopted Levels, not observed in the IT decay.
141 9	(9 ⁺)	36.7 ms 15	%α=95 5; %ε+%β ⁺ =5 5 Additional information 1. Energy, half-life and decay modes from Adopted Levels dataset. Proton decay mode is also possible since S(p)(¹⁵⁸ Ta g.s.)=-450 50 (2012Wa38). Measured Eα=6048 5 (1997Da07). Possible configuration=πh _{11/2} ⊗vf _{7/2} based on that for 9 ⁺ isomers in neighboring nuclei (2016Ca15 cite 1997Da07). Half-life, J ^π , and decay modes from Adopted Levels dataset.
207.10 [#] 20	(10 ⁺)		
919.8 10	(11 ⁺)		
923.2? 10			
954.3 [#] 10	(12 ⁺)		
1359.1? 13			
1393.3 12			
1553.7 [#] 12	(14 ⁺)		
1807.2 [#] 13	(16 ⁺)		
1827.5 12			
2027.7 12			
2101.1 13	(16 ⁺)		J ^π : stretched E3 γ from (19 ⁻).
2390.9 14	(17 ⁺)		
2809.2 14	(19 ⁻)	6.1 μs 1	%α=1.4 2 (2014Ca03); %IT=98.6 2 E(level): other: 2805.5 4 from ¹⁰² Pd(⁵⁸ Ni,pnγ) dataset (2016Ca15). There appears to be a consistent difference in Eγ, with the values from IT decay 0.5 to 1 keV higher than those given in ¹⁰² Pd(⁵⁸ Ni,pnγ) dataset, although the former are reported with larger uncertainty. Proposed configuration=πh _{11/2} ⁻³ ⊗v(f _{7/2} ,h _{9/2} ,i _{13/2}) (2014Ca03, 2016Ca15). An α peak observed at 8644 keV 11 from this isomer, assignment based on correlated γ rays with this α line. No protons were observed from this isomer, even though allowed by decay Q value. T _{1/2} : from γ(t) (2014Ca03).

[†] Deduced from least-squares fit to Eγ data.

^{158}Ta IT decay: 6.1 μs **2016Ca15,2014Ca03** (continued)

^{158}Ta Levels (continued)

‡ From measured stretched multiplicities starting with (9⁺) and increasing spin values with increasing energy excitation based on rotational character of deformed nuclei.

Band(A): γ cascade based on 10⁺. Configuration= $\pi h_{11/2} \otimes \nu (f_{7/2}^2 h_{9/2})$ (2014Ca03).

$\gamma(^{158}\text{Ta})$

I γ normalization: From weighted average of 0.889 32 deduced from I(γ +ce)(778, 748 and 782)=100 and 0.853 38 from I(γ +ce)(418, 708 and 1002)=100.

E_γ	I_γ & c	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. † a	α^b	$I_{(\gamma+ce)}^c$	Comments
(34.2 ‡)		1393.3		1359.1?					E_γ : possible transition discussed in text (2016Ca15), not shown in authors' level scheme (Fig. 3).
(34.5 ‡)		954.3	(12 ⁺)	919.8	(11 ⁺)	[M1]	16.63	58 3	I $_{(\gamma+ce)}$: from transition intensity balance at 954.3 level.
66.1 2	14.9 8	207.10	(10 ⁺)	141	(9 ⁺)	(M1)	2.46		Mult.: E1 or M1 restricted by α - γ prompt coinc (higher mult would imply too long $T_{1/2}$'s); M1 from intensity balance.
(73.4 ‡)		2101.1	(16 ⁺)	2027.7					Placement by evaluator based on level-energy difference.
159.5 ^e 2	2.0 2	1553.7	(14 ⁺)	1393.3					
(200.2 [#] 2)	0.29 [#] 6	2027.7		1827.5					E_γ : unresolved doublet, placed from 1825 and 2099 levels.
253.5 6	91.1 47	1807.2	(16 ⁺)	1553.7	(14 ⁺)	(E2)	0.1376 22		
273.7 ^d 6	4.0 ^d 6	1827.5		1553.7	(14 ⁺)				
273.7 ^d 6	4.0 ^d 6	2101.1	(16 ⁺)	1827.5					E_γ : unresolved doublet, placed from 1825 and 2099 levels.
418.5 [@] 7	4.8 6	2809.2	(19 ⁻)	2390.9	(17 ⁺)	(M2)	0.278		
434 ^e		1827.5		1393.3					
435.9 7	5.8 7	1359.1?		923.2?					
439.2 8	4.2 6	1393.3		954.3	(12 ⁺)				
(474.0 [#] 1)	1.2 [#] 2	2027.7		1553.7	(14 ⁺)				
583.9 8	7.5 7	2390.9	(17 ⁺)	1807.2	(16 ⁺)	(M1)	0.0349		
599.2 8	100.0	1553.7	(14 ⁺)	954.3	(12 ⁺)	(E2)	0.01300		
634.5 8	2.9 5	2027.7		1393.3					
708.1 [@] 9	11.5 8	2809.2	(19 ⁻)	2101.1	(16 ⁺)	(E3)	0.0224		
747.2 9	48.8 26	954.3	(12 ⁺)	207.10	(10 ⁺)	(E2)	0.00790		
778.8 10	57.9 31	919.8	(11 ⁺)	141	(9 ⁺)	(E2)	0.00722		
782.2 10	5.0 7	923.2?		141	(9 ⁺)				
1001.6 11	98.4 51	2809.2	(19 ⁻)	1807.2	(16 ⁺)	(E3)	0.00949		

† 254 γ , 599 γ , 747 γ , and 778 γ , $\Delta J=2$, quadrupole, most likely E2 transitions by angular distribution measurements; 1002 γ , 708 γ , compatible with E3 multipolarity based on lifetime. all E2 assignments and the E3 for 1003 γ are compatible with measured intensities after allowing for internal conversion. 418 γ and 583 γ are assigned M2 and M1 character, respectively, (both stretched) based on lifetime and intensity balance.

Continued on next page (footnotes at end of table)

^{158}Ta IT decay: 6.1 μs **2016Ca15, 2014Ca03 (continued)**

$\gamma(^{158}\text{Ta})$ (continued)

- \ddagger γ not observed, its existence required by $\gamma\gamma$ -coin data. Energy is deduced by evaluator from difference of connecting levels.
- # Values taken by evaluator from Table I in [2016Ca15](#), based on its observation in the prompt γ spectrum.
- @ This γ ray is assigned to the decay of the 6.1- μs isomer since it is absent in the prompt γ spectrum (Fig. 6a in [2016Ca15](#)).
- & Values listed in Table II in [2016Ca15](#) divided by a factor of 10.
- ^a From Table II in [2016Ca15](#), based on intensity balance arguments, and transition rates for expected level lifetime. Pure multipolarities were assumed.
- ^b From BrIcc v2.3b (16-Dec-2014) [2008Ki07](#), “Frozen Orbitals” appr.
- ^c For absolute intensity per 100 decays, multiply by 0.86 3.
- ^d Multiply placed with undivided intensity.
- ^e Placement of transition in the level scheme is uncertain.

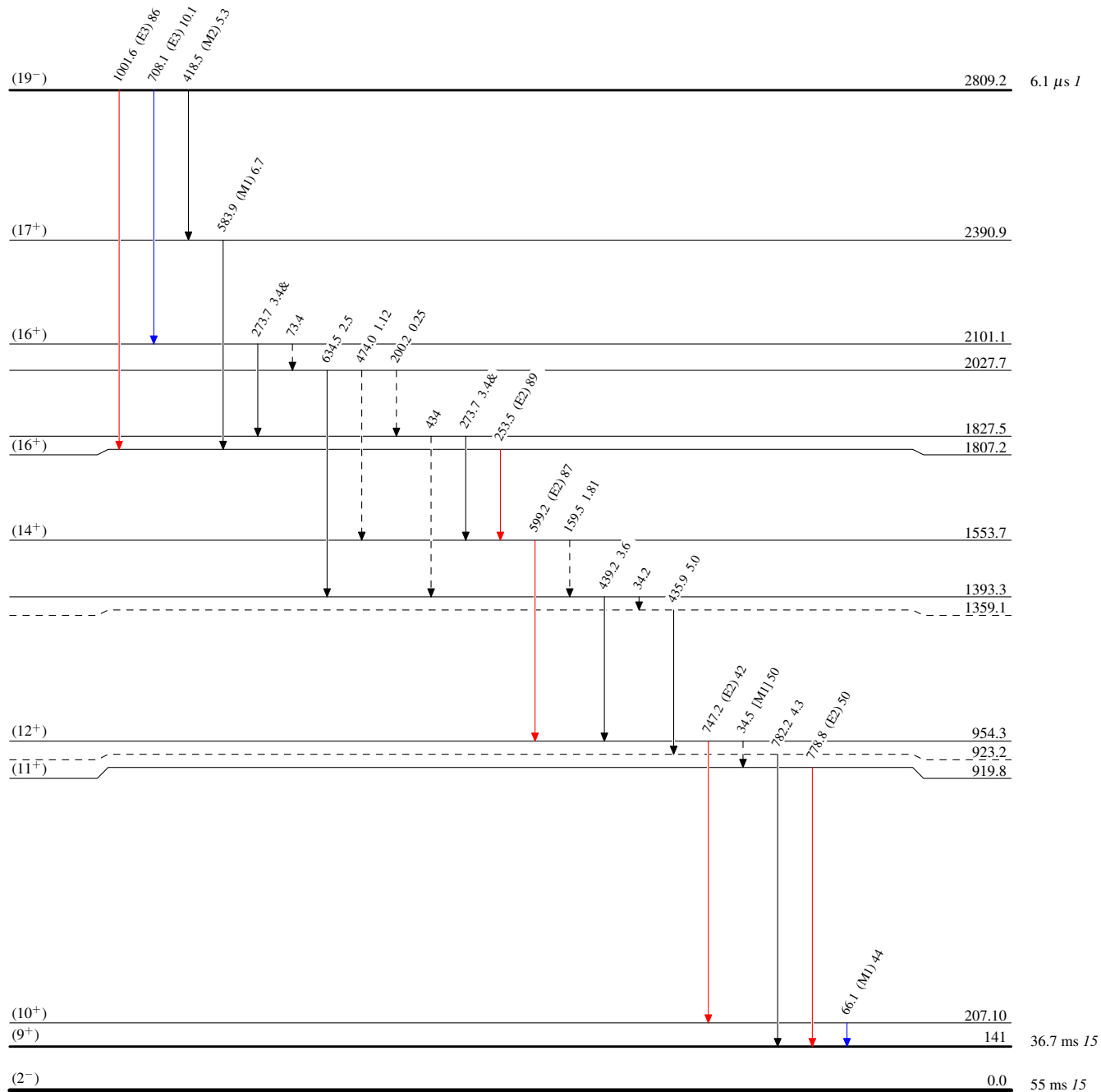
^{158}Ta IT decay: 6.1 μs 2016Ca15,2014Ca03

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
 & Multiply placed: undivided intensity given
 %IT=98.6 2

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)



$^{158}\text{Ta}_{85}$

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