^{102}Pd(^{58}Ni,pnγ) 2016Ca15

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

2016Ca15, 2014Ca03: compiled for the XUNDL database by B. Singh (McMaster). See also 2015Ca04 from the same group (see short description of 2014Ca03 in ^{158}Ta IT decay dataset).

2016Ca15, 2015Ca04: E(^{58}Ni)=255 MeV from JYFL accelerator facility. Target ≈1 mg/cm^2 thick 90% enriched in ^{102}Pd. ^{158}Ta recoils were identified using recoil-decay tagging method and correlated with γ rays. Measured prompt and delayed γ-ray spectra, Eγ, Iγ, $\gamma\gamma$-coin, Eα, (^{158}Ta ions)$\gamma\alpha$ correlations using JUROGAM array of 43 Compton-suppressed Ge detectors for γ rays. Deduced high-spin levels, and J^π. Discussed (unobserved) proton emission from the (19$^-$) high-spin isomer. 2016Ca15 state that statistics were too weak to identify gamma rays feeding the (2$^-$) ground state of ^{158}Ta.

^{158}Ta Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
141 *9*	(9$^+$)	36.7 ms *15*	%α=95 *5*; %ε+%β^+=5 *5* Additional information 1. Half-life and decay modes from Adopted Levels. Proton decay mode is possible since S(p)(^{158}Ta g.s.)=−450 *50* (2012Wa38). Measured Eα=6048 *5* (1997Da07). Possible configuration=$\pi h_{11/2}\otimes\nu f_{7/2}$ based on that for 9$^+$ isomers in neighboring nuclei (1997Da07).
207.10[#] *20*	(10$^+$)		
919.50 *10*	(11$^+$)		J$^\pi$: interpreted by 2016Ca15 as $\pi h^3_{11/2}\otimes\nu f^3_{7/2}$ in analogy with 11$^+$ and 13$^+$ states in ^{152}Ho and ^{154}Tm (13$^+$ not found).
923.2? *10*			
953.40[#] *23*	(12$^+$)		
1358.5? *10*			
1391.88 *25*			
1551.53[#] *25*	(14$^+$)		
1804.2[#] *3*	(16$^+$)		
1824.9 *3*			
2025.5 *3*			
2098.2 *3*	(16$^+$)		
2387.2 *3*	(17$^+$)		
2601.6 *3*			
2805.5[@] *4*	(19$^-$)	6.1 μs *1*	%α=1.4 *2* (2014Ca03); %IT=98.6 *2* Possible configuration=$\pi h^{-3}_{11/2}\otimes\nu(f_{7/2},h_{9/2},i_{13/2})$. 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).
2853.8 *4*			
2877.9 *4*			E(level): level from text in 2016Ca15, not shown in authors′ level-scheme (Fig. 3).
2938.3? *3*			
2959.7 *3*			
3021.4 *3*			
3063.2[@] *4*			
3330.0 *4*			
3387.5[@] *4*			
3626.6 *4*			
3676.2[&] *3*			
3776.0[@] *4*			
3794.1 *4*			

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^{102}Pd(^{58}Ni,pnγ) 2016Ca15 (continued)

^{158}Ta Levels (continued)

E(level)†	E(level)†	E(level)†	E(level)†
3851.4 *4*	4652.2 *4*	5142.2& *4*	6166.0 *4*
4088.3& *3*	4779.1 *5*	5229.2 *4*	6259.3 *4*
4349.4 *4*	4955.9 *4*	5362.1 *4*	6619.2? *4*
4613.5& *4*	4996.2& *4*	5415.3 *4*	6781.7 *5*
4645.0 *4*	5064.8 *5*	5628.9 *4*	

† Deduced from least-squares fit to Eγ data. Reduced χ^2=3.9 is lager than critical χ^2=1.8 at 95% confidence level, probably due to underestimated uncertainty of 0.1 keV for many γ rays, especially for some unresolved structures. Five Eγ values deviate by 2-3 σ from the fitted values (by evaluator).

‡ Based on (9$^+$) lowest level and measured multipolarities that are assumed stretched based on the heavy-ion reaction type by which the level scheme was populated.

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

@ Band(B): γ cascade based on 19$^-$ isomer.

& Band(C): γ cascade based on 3676.5 level.

γ(^{158}Ta)

Eγ	Iγ@	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.&	αb	Comments
(33.4†)		1391.88		1358.5?				Eγ: possible transition discussed in text (2016Ca15), not shown in authors' level scheme (Fig. 3).
(33.9†)		953.40	(12$^+$)	919.50	(11$^+$)	(M1)	17.52	
66.1‡ *2*		207.10	(10$^+$)	141	(9$^+$)	(M1)	2.46	
(72.7†)		2098.2	(16$^+$)	2025.5				
146.0 *1*	14.1 *3*	5142.2		4996.2				
185.9 *1*	6.0 *3*	5415.3		5229.2				
200.2 *2*	3.6 *2*	2025.5		1824.9				
236.9 *1*	8.5 *3*	4088.3		3851.4				
252.9 *1*	58.9 *5*	1804.2	(16$^+$)	1551.53	(14$^+$)	(E2)a	0.1387	Eγ: level-energy difference=252.7.
257.7 *1*	49.7 *5*	3063.2		2805.5	(19$^-$)			
261.0 *1*	6.6 *3*	4349.4		4088.3				
266.8c *1*	5.5c *3*	3330.0		3063.2				Eγ: unresolved doublet, placed from 3330 and 5629 levels.
266.8c *1*	5.5c *3*	5628.9		5362.1				
x269.8 *2*	4.9 *3*							
273.1c *1*	29.4c *4*	1824.9		1551.53	(14$^+$)			Eγ: unresolved triplet, placed from 1825, 2099 and 5415 levels. Eγ: level-energy difference=273.4.
273.1c *1*	29.4c *4*	2098.2	(16$^+$)	1824.9				
273.1c *1*	29.4c *4*	5415.3		5142.2				
x285.7 *2*	2.6 *4*							
296.6 *1*	4.9 *3*	3626.6		3330.0				
324.3 *1*	32.5 *4*	3387.5		3063.2				
336.6 *1*	20.6 *4*	2938.3?		2601.6				
350d		5415.3		5064.8				
357.9c *2*	47.7c *8*	2959.7		2601.6				
x359.2c *1*	47.7c *8*							359.2γ in coincidence with 357.9γ.
366.3 *2*	6.4 *4*	5362.1		4996.2				
382.8 *1*	29.0 *6*	4996.2		4613.5				

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^{102}Pd(^{58}Ni,pnγ) 2016Ca15 (continued)

γ(^{158}Ta) (continued)

E_γ	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[b]	Comments
388.5 *1*	18.0 *5*	3776.0		3387.5				
406.1[#] *1*	9.8 *11*	5362.1		4955.9				
406.6[#] *1*	7.6 *10*	3794.1		3387.5				
412.1 *1*	71.4 *6*	4088.3		3676.2				
(418.5[‡] *7*)		2805.5	(19$^-$)	2387.2	(17$^+$)			
434[d]		1824.9		1391.88				
435.3 *1*	47.2 *7*	1358.5?		923.2?				
438.5 *1*	17.3 *5*	1391.88		953.40	(12$^+$)			
466.6 *2*	6.1 *4*	2853.8		2387.2	(17$^+$)			
474.0 *1*	14.3 *4*	2025.5		1551.53	(14$^+$)			
503.3 *1*	47.6 *6*	2601.6		2098.2	(16$^+$)			
525.2 *1*	39.7 *7*	4613.5		4088.3				
[x]537.2 *2*	8.2 *16*							
572.6 *3*	2.5 *6*	2959.7		2387.2	(17$^+$)			
576.5 *3*	3.7 *8*	5229.2		4652.2				
583.0[#] *2*	18.5 *25*	2387.2	(17$^+$)	1804.2	(16$^+$)	(M1)	0.0350	
583.7[#] *2*	10.6 *20*	5229.2		4645.0				E_γ: level-energy difference=584.2.
598.1 *1*	100.0	1551.53	(14$^+$)	953.40	(12$^+$)	(E2)[a]	0.01306	
606.3 *1*	22.3 *6*	4955.9		4349.4				
615.7 *2*	8.8 *5*	6781.7		6166.0				
633.7 *2*	35.9 *28*	2025.5		1391.88				
636.7 *7*	5.7 *27*	5415.3		4779.1				
655.2 *2*	6.4 *5*	3676.2		3021.4				
[x]685.8 *2*	10.4 *5*							685.8γ in coincidence with 435.3γ and 474.0γ.
(708.1[‡] *9*)		2805.5	(19$^-$)	2098.2	(16$^+$)			
716.5 *1*	64.0 *7*	3676.2		2959.7				
[x]727.5 *2*	9.4 *5*							727.5γ in coincidence with 412.1γ, 825.1γ and 857γ.
737.7 *2*	13.0 *5*	3676.2		2938.3?				
746.3 *1*	62.0 *7*	953.40	(12$^+$)	207.10	(10$^+$)	(E2)[a]	0.00792	
763.5 *2*	5.6 *4*	5415.3		4652.2				
770.7 *2*	11.9 *4*	5415.3		4645.0				E_γ: level-energy difference=770.3.
778.5 *1*	83.0 *7*	919.50	(11$^+$)	141	(9$^+$)	(E2)[a]	0.00723	
782.2[‡] *10*		923.2?		141	(9$^+$)			
797.6 *2*	15.0 *7*	2601.6		1804.2	(16$^+$)			
[x]804.6 *2*	8.2 *7*							804.6γ in coincidence with 435.3γ and 583.0γ.
[x]825.1 *2*	13.2 *5*							825.1γ in coincidence with 412.1γ.
830.0 *12*	2.0 *7*	3851.4		3021.4				
844.0 *2*	13.5 *7*	6259.3		5415.3				
[x]857								857γ in coincidence with 412.1γ.
861.4 *2*	18.7 *6*	2959.7		2098.2	(16$^+$)			
868.9 *2*	19.8 *5*	4645.0		3776.0				
876.3 *2*	14.1 *5*	4652.2		3776.0				
893[d]		3851.4		2959.7				
(1001.6[‡] *11*)		2805.5	(19$^-$)	1804.2	(16$^+$)	[E3]		
1003.1 *2*	9.3 *5*	4779.1		3776.0				
1013.4 *3*	7.0 *5*	5362.1		4349.4				E_γ: level-energy difference=1012.7.
1023.8 *2*	7.9 *5*	6166.0		5142.2				
1052.5 *3*	5.0 *4*	2877.9		1824.9				
1074.1 *3*	4.2 *4*	2877.9		1804.2	(16$^+$)			
1203.9[d] *2*	14.7 *10*	6619.2?		5415.3				
1217.5 *2*	13.2 *10*	3021.4		1804.2	(16$^+$)			

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^{102}Pd(^{58}Ni,pnγ) 2016Ca15 (continued)

γ(^{158}Ta) (continued)

E_γ	I_γ[@]	E_i(level)	E_f
[x]1260.2 *2*	5.8 *4*		
[x]1274.7 *6*	2.0 *4*		
1288.8 *3*	3.6 *4*	5064.8	3776.0

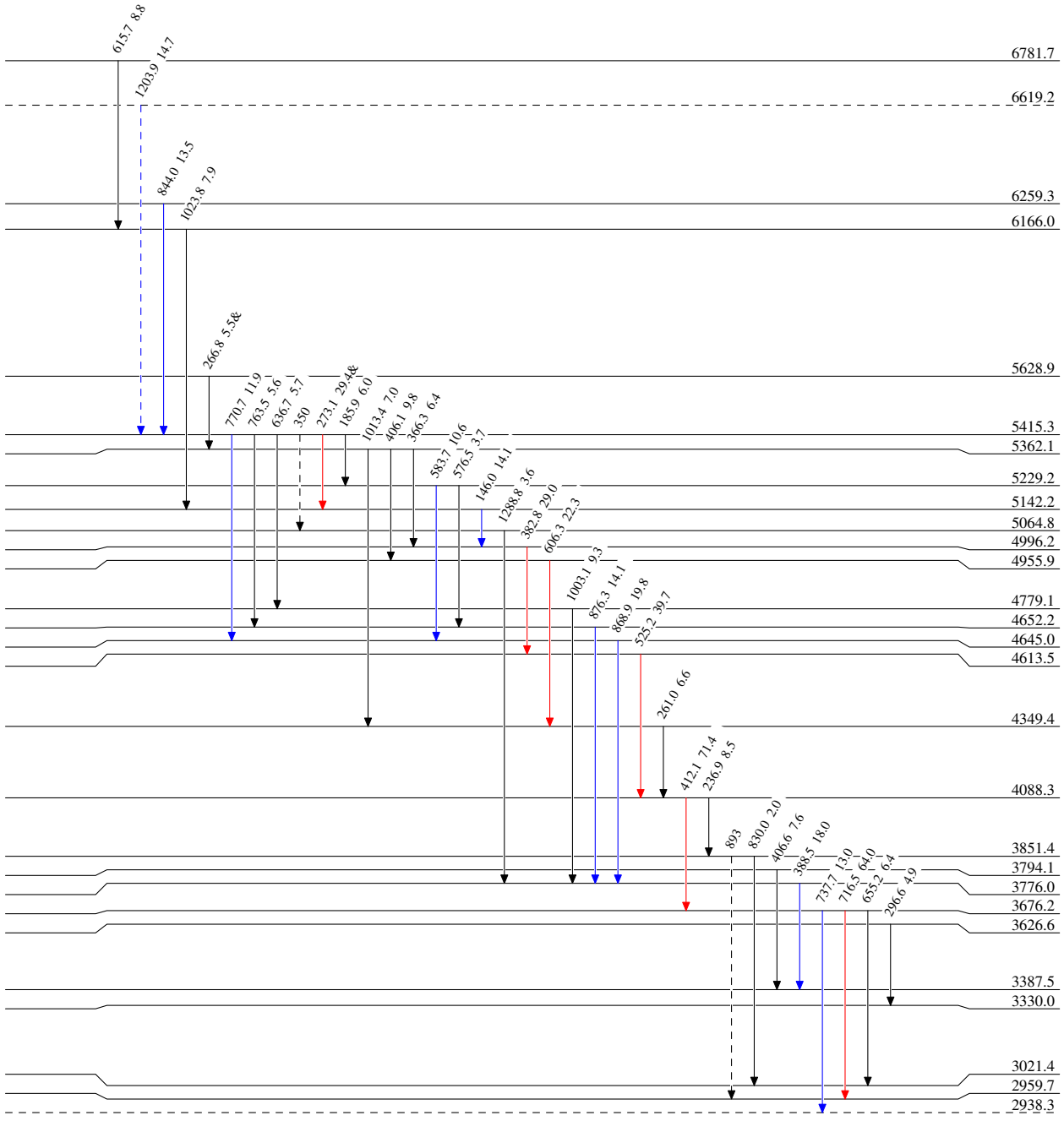
[†] γ not observed, its existence required by $\gamma\gamma$-coin data. Energy was deduced (by evaluator) from difference of connecting levels.
[‡] From 2016Ca15 (Table II) for delayed γ rays from the 6.1−μs isomer.
[#] 583.0+583.7 and 406.1+406.6 form unresolved doublets; however, based on $\gamma\gamma$-coin data, separated intensities are assigned.
[@] Values from 2016Ca15 (Table I) divided by a factor of 10.
[&] From 2016Ca15 (Table II), based on intensity balance arguments, and transition rates for expected level lifetime, except where noted. Only pure multipolarities were assumed.
[a] From consistency with angular correlation data in 2016Ca15, although, no data are provided, reason for which the assignments are still to be checked by futher study.
[b] Additional information 2.
[c] Multiply placed with undivided intensity.
[d] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{102}Pd(^{58}Ni,pnγ) 2016Ca15

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)



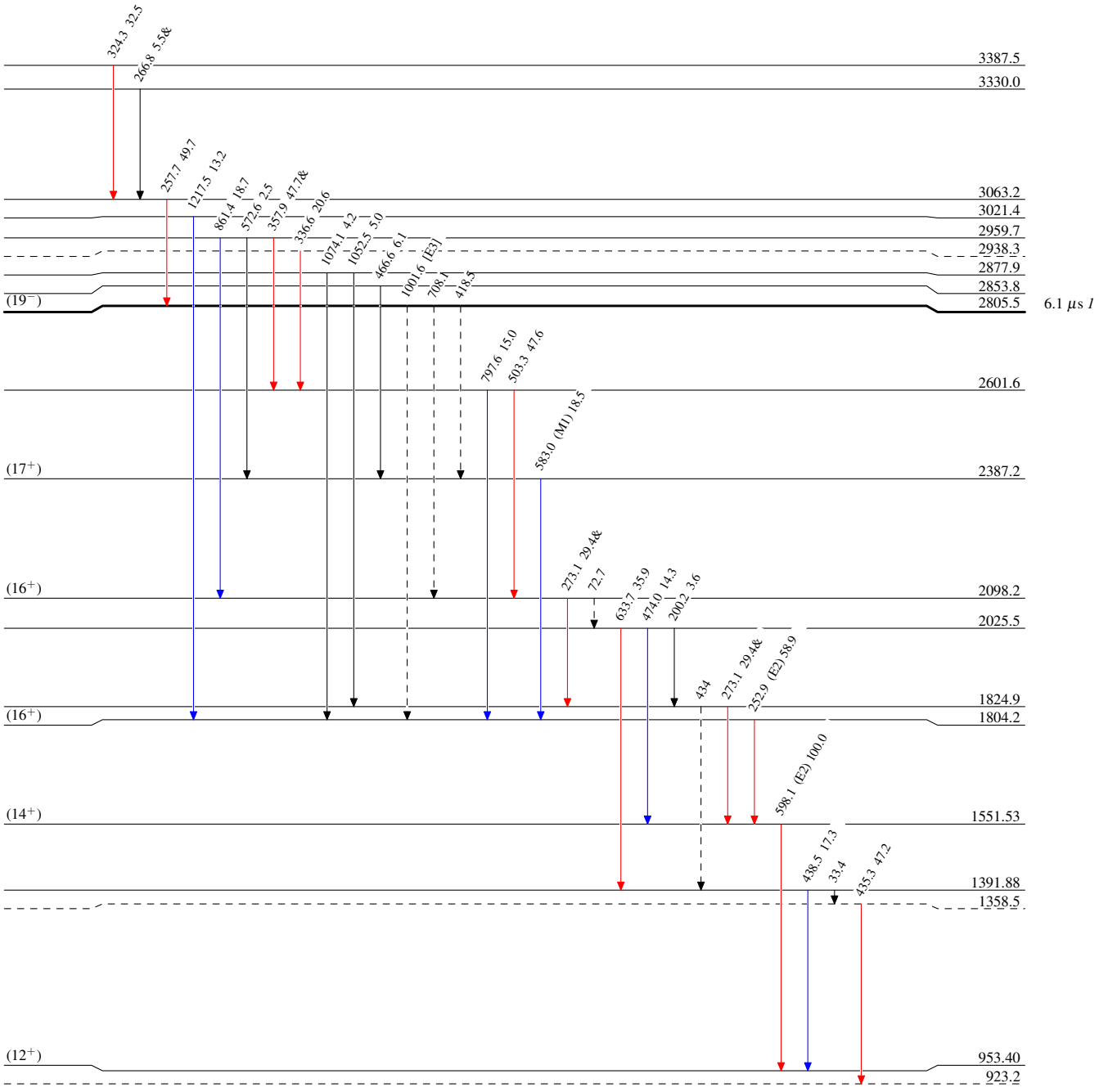
$^{158}_{73}Ta_{85}$

^{102}Pd(^{58}Ni,pnγ) 2016Ca15

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)

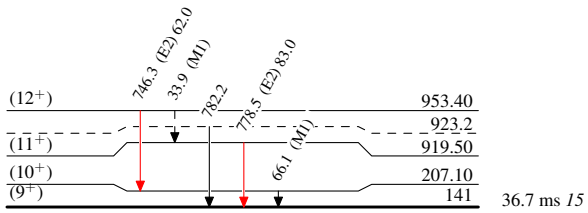


$^{158}_{73}Ta_{85}$

^{102}Pd(^{58}Ni,pnγ) 2016Ca15

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

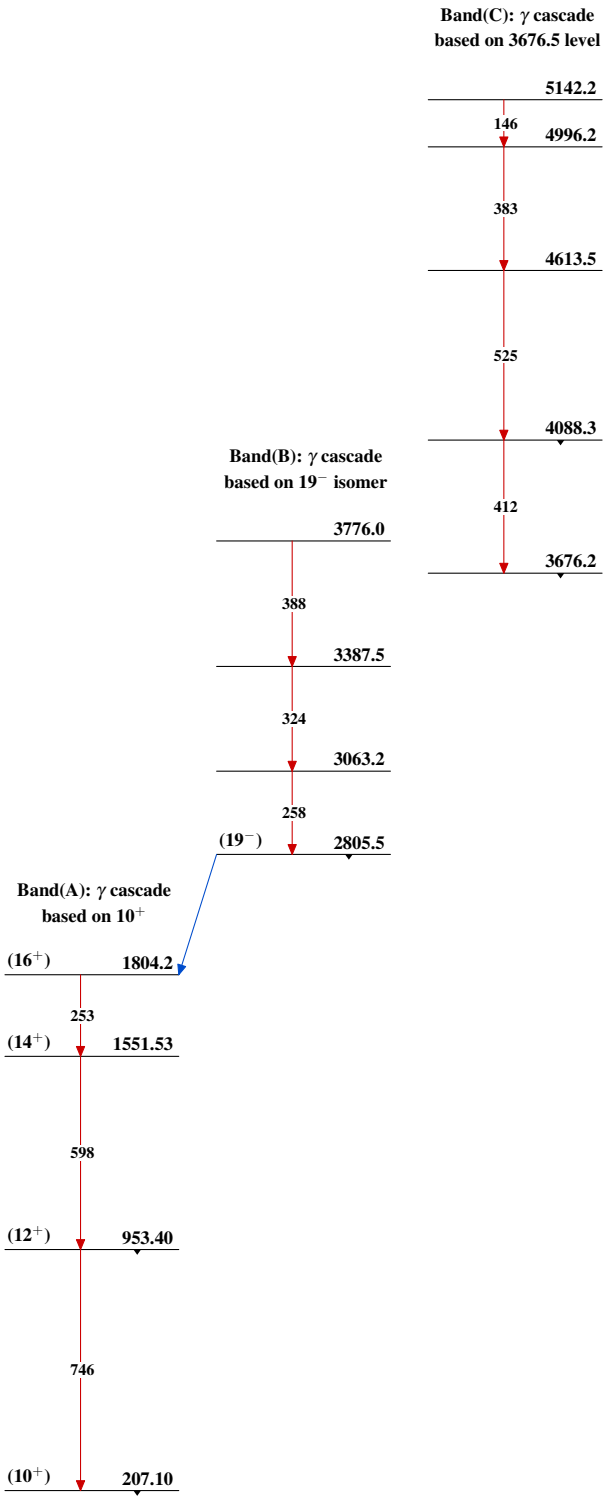


$^{158}_{73}Ta_{85}$

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)

^{102}Pd(^{58}Ni,pnγ) 2016Ca15



$^{158}_{73}Ta_{85}$