^{252}Cf SF decay   2015Wa28,2010Hw03

	Type	Author	History Citation	Literature Cutoff Date
	Full Evaluation	N. Nica	NDS 170, 1 (2020)	16-Aug-2020

Parent: ^{252}Cf: E=0.0; J^π=0$^+$; T$_{1/2}$=2.645 y 8; %SF decay=?

Data set based on the XUNDL compilations of 2015Wa28 and 2010Hw03 done by B. Singh (McMaster).

2015Wa28, 2010Hw03 (same group): high spin studies of ^{153}Pr from ^{252}Cf SF decay; 2015Wa28 includes prompt γ-ray study from ^{9}Be(^{238}U,Fγ) reaction.

2012Ma13: ^{252}Cf SF decay, γ cascades for ^{153}Pr together with identical cascades from ^{248}Cm SF decay. However because band assignments of 2012Ma13 and 2015Wa28 are disprepant, both SF decay data of 2012Ma13 are grouped together and given in ^{248}Cm SF decay dataset.

Others: 1987Gr12, 1972Ho08.

2015Wa28: combine data from two experiments:

1. ^{252}Cf SF decay: measured Eγ and $\gamma\gamma$ using GAMMASPHERE array comprised of 101 Compton-suppressed Ge detectors at LBNL facility.

2. ^{9}Be(^{238}U,Fγ),E=6.2 MeV/nucleon, measured Eγ, Iγ, Z- and A- gated $\gamma\gamma$ coincidences with isotopically identified fission fragments using VAMOS++ and EXOGAM array at GANIL facility.

Deduced high-spin levels.

2010Hw03 (including published Erratum): measured Eγ and $\gamma\gamma$ using GAMMASPHERE array comprised of 101 Compton-suppressed Ge detectors. Deduced J^π values.

Comments about the discrepancies in between 2015Wa28, 2010Hw03 and 2012Ma13:

The 206.6-279.5-351.1-417.8-477.9-528.4 γ cascade proposed by 2010Hw03 was reassigned by 2012Ma13 to ^{154}Pr. 2012Ma13 assigned instead the 141.6-221.0-291.8-358.4-420.9-479.0-533.9 γ cascade to ^{153}Pr. Both changes are based on mass correlations with γ cascades (2012Ma13, Fig. 10).

Based on mass- and Z-gated single γ-ray spectrum obtained from ^{9}Be(^{238}U,Fγ) reaction (Fig. 28), 2015Wa28 assigned the cascade 143.0-221.9-297.7 to ^{153}Pr of which the first two γ rays matched the 141.6-221.0 sequence of 2012Ma13 but the absence of 291.8γ and the presence of 297.7γ rejected the assignment of 2012Ma13 and replaced it with the cascade 143.0-221.9-297.7-368.9-435.6-496.2 (band C in the Levels section). 2015Wa28 also pointed out (Fig. 28) that the sequences 206.6-279.5-351.1-417.8-477.9-528.4 and 88.0-207.1 adopted by 2010Hw03 and rejected by 2012Ma13 pertain to ^{153}Pr (bands B and A in the Levels section). Three γ rays of 51.7, 227.8 and 277.7 keV previously assigned by 2010Hw03 to ^{153}Pr are not confirmed in the ^{252}Cf SF data of 2015Wa28.

Based on the fact that the last published study of 2015Wa28 discussed extensively the differences in between 2015Wa28, 2012Ma13 and 2010Hw03, the assignments of 2015Wa28 were adopted in the Adopted Levels, Gammas dataset. However these assignments are still rather tentative and new studies are needed to reassess the differences in between the three mentioned references.

^{153}Pr Levels

Although J^π values were adopted by 2010Hw03, none is confirmed by 2015Wa28 who consider that no J^π values can be assigned based on existing data.

E(level)[†]	Comments
0.0+x[‡]	Additional information 1.
0.0+y[@]	Additional information 2.
88.0+x[‡] _3_	
138.4+x[#] _4_	
143.0+y[@] _5_	
295.1+x[‡] _4_	
345.0+x[#] _5_	
364.9+y[@] _7_	
624.5+x[#] _6_	

Continued on next page (footnotes at end of table)

^{252}**Cf SF decay   2015Wa28,2010Hw03 (continued)**

^{153}Pr Levels (continued)

E(level)[†]	E(level)[†]	E(level)[†]
662.6+y[@] _9_	1393.4+x[#] _7_	1963.3+y[@] _13_
975.6+x[#] _6_	1467.1+y[@] _12_	2399.7+x[#] _8_
1031.5+y[@] _10_	1871.3+x[#] _8_	2507.3+y[@] _14_

[†] From least-squares fit to Eγ data.
[‡] Band(A): Band based on 0+x level.
[#] Band(B): Band based on 138.4+x level.
[@] Band(C): Band based on 0+y level.

$\gamma(^{153}$Pr$)$

E$_\gamma$[†]	I$_\gamma$[&]	E$_i$(level)	E$_f$	Mult.[‡]	Comments
49.9[#] _3_	<127[b]	345.0+x	295.1+x	E1	Mult.: see comments for 50.4γ from 138.4+x level.
50.4[#] _3_	<127[b]	138.4+x	88.0+x	E1	α(exp)=3.2 _9_ (2010Hw03)
					α(exp)=2.3 _7_ in 2010Hw03 is corrected to 3.2 _9_ in the Erratum to 2010Hw03, but reversed to 2.3 _7_ value in 2015Wa28 assuming 49.9- and 50.4-keV transitions have the same K-conversion coefficient.
88.0[#] _3_	73 _9_	88.0+x	0.0+x	M1	α(exp)=1.8 _6_ (2010Hw03)
					α(exp)=1.2 _5_ in 2010Hw03 is corrected to 1.8 _6_ in the Erratum to 2010Hw03.
143.0[@] _5_		143.0+y	0.0+y		
156.7[#] _3_	28 _2_	295.1+x	138.4+x		
206.6[#] _3_	<100[a]	345.0+x	138.4+x		
207.1[#] _3_	<100[a]	295.1+x	88.0+x		
221.9[@] _5_		364.9+y	143.0+y		
279.5[#] _3_	64 _4_	624.5+x	345.0+x		
297.7[@] _5_		662.6+y	364.9+y		
351.1[#] _3_	58 _4_	975.6+x	624.5+x		
368.9[@] _5_		1031.5+y	662.6+y		
417.8[#] _3_	27 _2_	1393.4+x	975.6+x		
435.6[@] _5_		1467.1+y	1031.5+y		
477.9[#] _3_	13 _1_	1871.3+x	1393.4+x		
496.2[@] _5_		1963.3+y	1467.1+y		
528.4[#] _3_	4.6 _7_	2399.7+x	1871.3+x		
544.0[@c] _5_		2507.3+y	1963.3+y		

[†] Uncertainty is stated as 0.5 keV for strong transitions and as much as 1 keV in prompt γ-spectra, whereas from ^{252}Cf SF decay, uncertainty is stated as 0.1 keV for strong γ rays and 0.5 for weaker lines. Evaluator assigns 0.3 keV uncertainty for I$\gamma \geq 20$ and 0.5 for I$\gamma < 20$, or when Iγ not stated.
[‡] From 2010Hw03 based on α(exp).
[#] From 2010Hw03.
[@] New γ ray from 2015Wa28.
[&] From ^{252}Cf SF decay (2015Wa28; for the Eγ's < 100 keV the relative intensities are from e-mail reply from the first author (E.H. Wang) of 2015Wa28 to the compiler (B. Singh) on Sept 17, 2015).

^{252}Cf SF decay   **2015Wa28,2010Hw03** (continued)
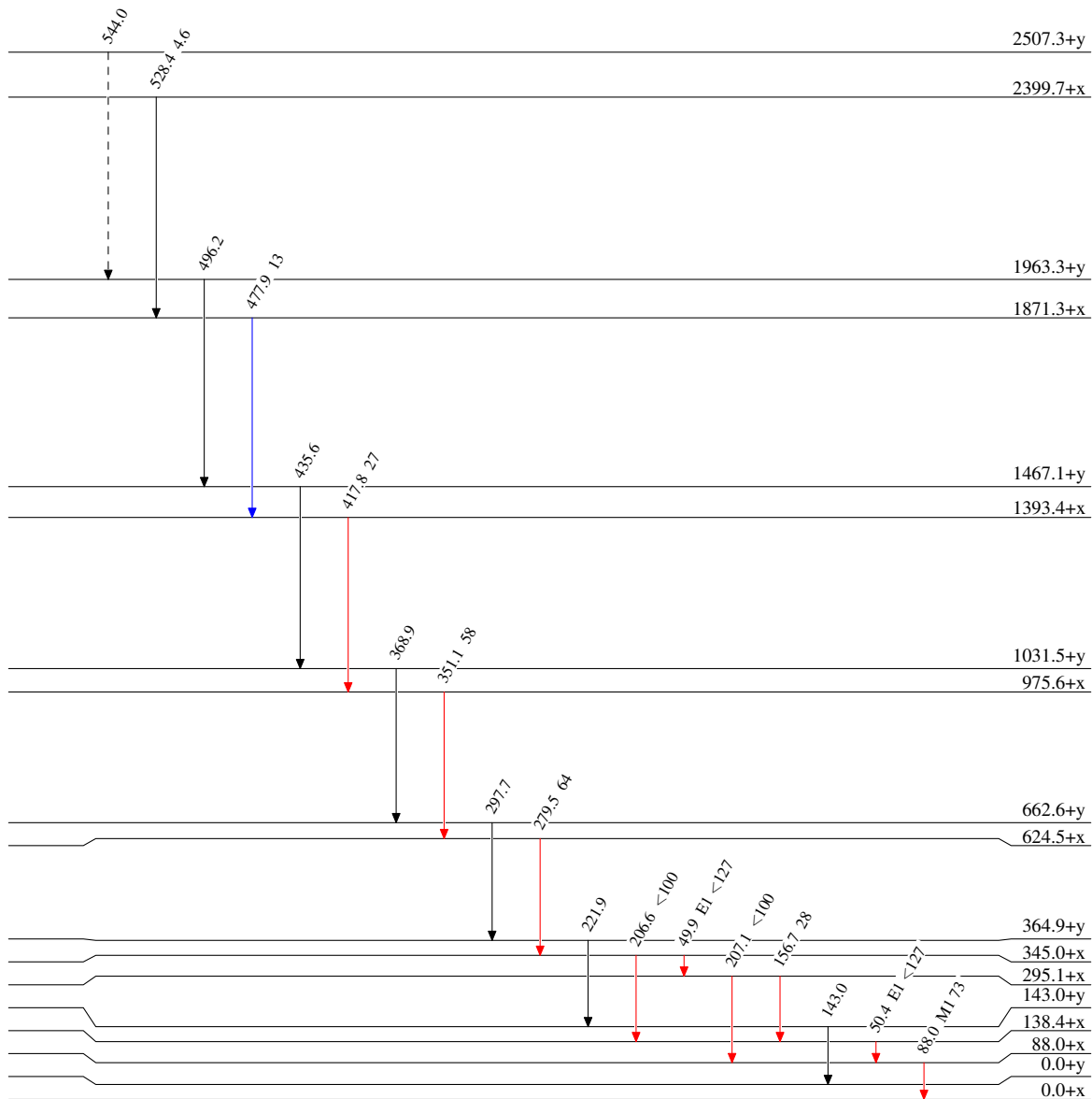
$\gamma(^{153}$Pr) (continued)

[a] Combined intensity of 100 for 206.6+207.1 γ rays.
[b] Combined intensity of <127 for 49.9+50.4 γ rays.
[c] Placement of transition in the level scheme is uncertain.
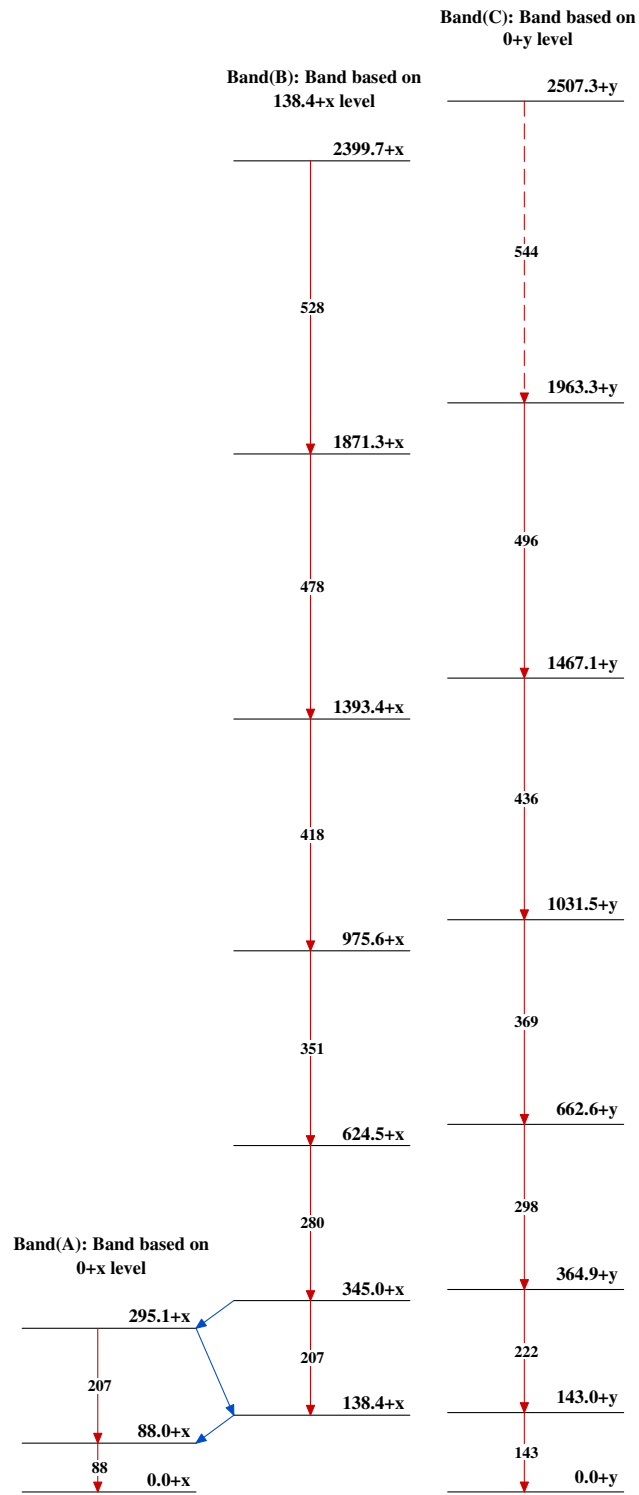
^{252}Cf SF decay   **2015Wa28,2010Hw03** (continued)

^{252}**Cf SF decay   2015Wa28,2010Hw03**

Legend

Level Scheme

Intensities: Relative I$_\gamma$

I$_\gamma$ < 2%×I$_\gamma^{max}$
I$_\gamma$ < 10%×I$_\gamma^{max}$
I$_\gamma$ > 10%×I$_\gamma^{max}$
γ Decay (Uncertain)

$^{153}_{59}$Pr$_{94}$

^{252}Cf SF decay   2015Wa28,2010Hw03

Band(C): Band based on 0+y level

Band(B): Band based on 138.4+x level

Band(A): Band based on 0+x level

2507.3+y

2399.7+x

544

528

1963.3+y

1871.3+x

496

478

1467.1+y

1393.4+x

436

418

1031.5+y

975.6+x

369

351

662.6+y

624.5+x

298

280

295.1+x

345.0+x

364.9+y

207

207

222

207

138.4+x

143.0+y

88.0+x

88

143

0.0+x

0.0+y

$^{153}_{59}Pr_{94}$