^{176}Yb(^{31}P,Xγ) 2005Po03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 174, 1 (2021)	15-Apr-2021

Also includes ^{238}U(^{12}C,Xγ) for measuring $T_{1/2}$ of isomers in 2005Po03.

2005Po03: E=152 MeV ^{31}P beam was produced from the Vivitron accelerator of IReS at Strasbourg. Target was 1.5 mg/cm^2 ^{176}Yb on a 15 mg/cm^2 Au backing. γ rays were detected with the EUROBALL IV spectrometer consisting of an inner ball of 210 BGO crystals, 15 Cluster Ge detectors in the backward hemisphere, 26 Clover Ge detectors around 90°, and 30 tapered single-crystal Ge detectors at forward angles, with each Cluster detector consisting of seven closely packed large-volume Ge crystals and each Clover detector consisting of four smaller Ge crystals. Measured Eγ, Iγ, γγ-coin. Deduced levels, J, π, band structures, configurations. Systematics of neighboring Sb isotopes.

The isomeric state in the fission fragment ^{123}Sb was identified using a fission fragment detector to trigger the EUROBALL III array and isolate the delayed γ-ray cascades in the ^{238}U(^{12}C,Xγ) reaction at 90 MeV. Fragments escaping from the target were stopped in the heavy-ion detector, SAPhIR, consisting of 32 photovoltaic modules laying in four rings around the target. The EUROBALL III time window was 1 μs, allowing detection of delayed γ-rays emitted during the de-excitation of the isomeric state.

^{123}Sb Levels

E(level)[†]	J$^{\pi}$[#]	$T_{1/2}$	Comments
0.0[&]	7/2$^+$		
160.16 *18*	5/2$^+$		
1030.07 *24*	9/2$^+$		
1088.52[&] *24*	11/2$^+$		
1260.49 *22*	9/2$^+$		
1655.74 *23*	(11/2$^-$)		Configuration=($\pi d_{5/2}\otimes 3^-$)⊗($\pi h_{11/2}$).
2036.7 *3*	(15/2$^-$)		
2043.9[&] *4*	(15/2$^+$)		Configuration=$\pi g_{7/2}\otimes 4^+$.
2237.1[@] *4*	(19/2$^-$)	110 ns *10*	$T_{1/2}$: from γ(t) (2005Po03).
2485.6[&] *6*	(19/2$^+$)		
2612.6[&] *8*	(21/2$^+$)		J$^{\pi}$: (23/2$^+$) from Adopted Levels.
2734.4[@] *5*	(21/2$^-$)		
2967.6[&] *8*	(23/2$^+$)		
3347.9[@] *5*	(23/2$^-$)		
3786.0?[‡@] *6*	(25/2$^-$)		
4024.5[@] *6*	(27/2$^-$)		
4391.9?[‡@] *7*			
4772.2[@] *8*			

† From a least-squares fit to γ-ray energies.

‡ Since the ordering of the 380-367 and 238-438 cascades is not well established, energies of 4392 and 3786 levels can be different.

\# As proposed by 2005Po03 based on band assignments, analogy with the level structures of the lighter Sb isotopes, and known assignments of low-lying states.

@ Band(A): Band based on (19/2$^-$). Possible configuration=$\pi g_{7/2}\nu h_{11/2}\nu d_{3/2}$ coupled to quadrupole vibration. Higher spins (J>29/2) the configuration may become $\pi g_{7/2}\nu h^3_{11/2}\nu d_{3/2}$ (2005Po03).

& Band(B): γ-cascade based on g.s. high-spin members (19/2 to 23/2) may be from $\pi g_{9/2}\otimes\nu h^2_{11/2}$ configuration in analogy with odd-A In isotopes (2005Po03).

^{176}Yb(^{31}P,Xγ) 2005Po03 (continued)

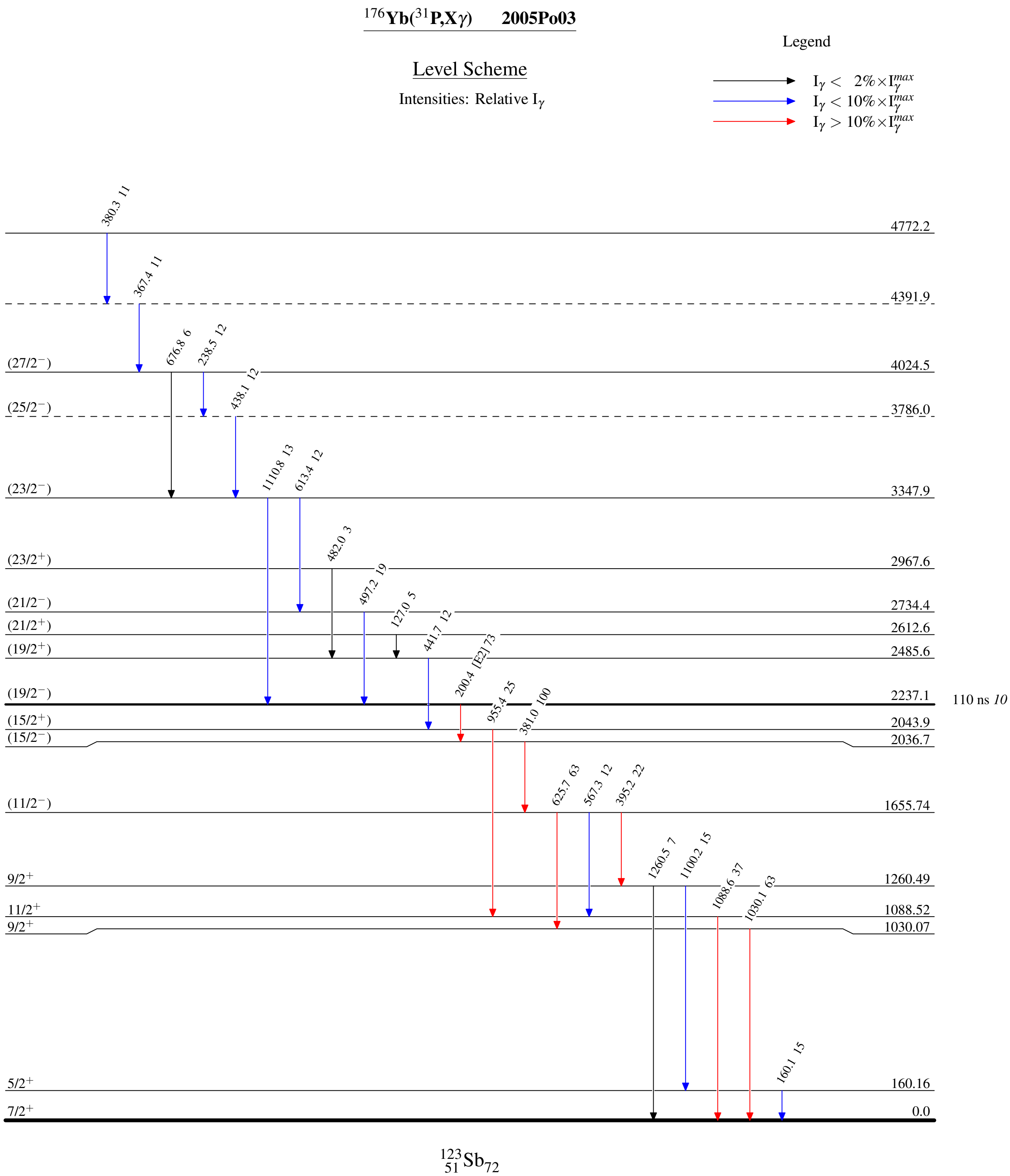
γ(^{123}Sb)

Eγ†	Iγ†	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.
127.0 *5*	5 *2*	2612.6	(21/2⁺)	2485.6	(19/2⁺)	
160.1	15 *4*	160.16	5/2⁺	0.0	7/2⁺	
200.4 *2*	73 *15*	2237.1	(19/2⁻)	2036.7	(15/2⁻)	[E2]#
238.5‡ *3*	12 *4*	4024.5	(27/2⁻)	3786.0?	(25/2⁻)	
367.4‡ *4*	11 *4*	4391.9?		4024.5	(27/2⁻)	
380.3‡ *4*	11 *4*	4772.2		4391.9?		
381.0 *2*	100 *15*	2036.7	(15/2⁻)	1655.74	(11/2⁻)	
395.2 *2*	22 *5*	1655.74	(11/2⁻)	1260.49	9/2⁺	
438.1‡ *3*	12 *4*	3786.0?	(25/2⁻)	3347.9	(23/2⁻)	
441.7 *4*	12 *4*	2485.6	(19/2⁺)	2043.9	(15/2⁺)	
482.0 *5*	3 *1*	2967.6	(23/2⁺)	2485.6	(19/2⁺)	
497.2 *3*	19 *5*	2734.4	(21/2⁻)	2237.1	(19/2⁻)	
567.3 *3*	12 *3*	1655.74	(11/2⁻)	1088.52	11/2⁺	
613.4 *3*	12 *3*	3347.9	(23/2⁻)	2734.4	(21/2⁻)	
625.7 *3*	63 *12*	1655.74	(11/2⁻)	1030.07	9/2⁺	
676.8 *5*	6 *3*	4024.5	(27/2⁻)	3347.9	(23/2⁻)	
955.4 *3*	25 *6*	2043.9	(15/2⁺)	1088.52	11/2⁺	
1030.1 *3*	63 *9*	1030.07	9/2⁺	0.0	7/2⁺	
1088.6 *3*	37 *5*	1088.52	11/2⁺	0.0	7/2⁺	
1100.2 *3*	15 *4*	1260.49	9/2⁺	160.16	5/2⁺	
1110.8 *4*	13 *4*	3347.9	(23/2⁻)	2237.1	(19/2⁻)	
1260.5 *4*	7 *2*	1260.49	9/2⁺	0.0	7/2⁺	

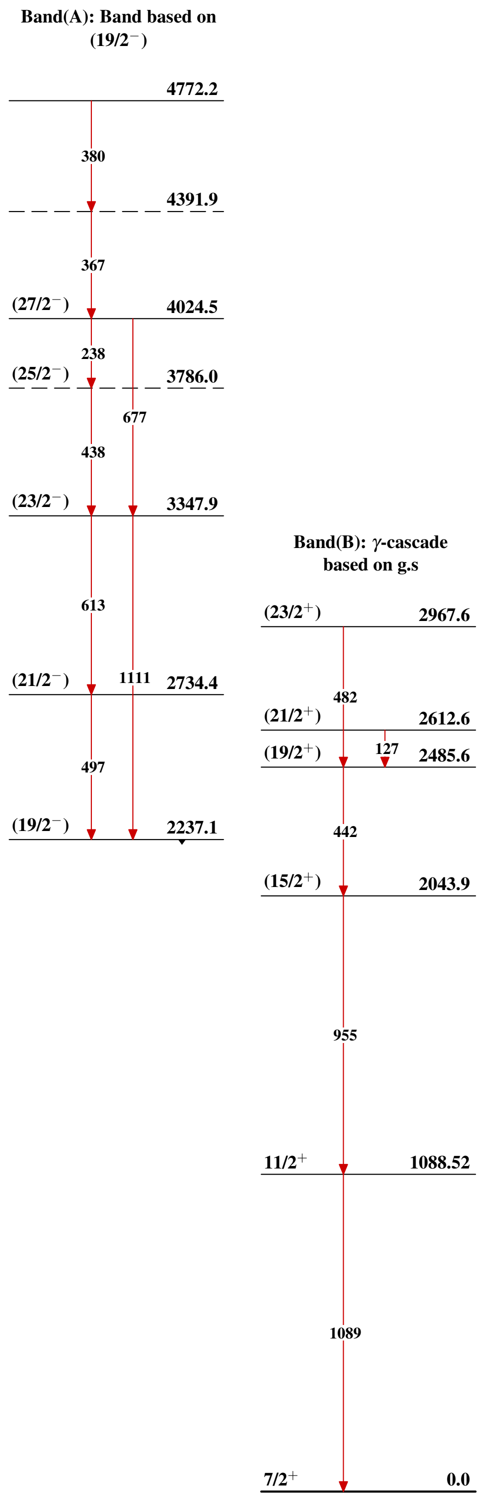
† From 2005Po03.

‡ The ordering of the γ cascades 380-367 and 238-438 is not precisely determined due to the similarity in the relative γ-ray intensities of the respective transitions in the two cascades.

Isomer half-life is consistent with mult(200.4γ)=E2. The transition is assigned as (19/2⁻)–>(15/2⁻) in analogy with similar transitions in ^{119}Sb and ^{121}Sb.


^{176}Yb(^{31}P,Xγ) 2005Po03
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
4772.2
4391.9
(27/2−) 4024.5
(25/2−) 3786.0
(23/2−) 3347.9
(23/2+) 2967.6
(21/2−) 2734.4
(21/2+) 2612.6
(19/2+) 2485.6
(19/2−) 2237.1 110 ns 10
(15/2+) 2043.9
(15/2−) 2036.7
(11/2−) 1655.74
9/2+ 1260.49
11/2+ 1088.52
9/2+ 1030.07
5/2+ 160.16
7/2+ 0.0
380.3 11
367.4 11
676.8 6
238.5 12
438.1 12
1110.8 13
613.4 12
482.0 3
497.2 19
127.0 5
441.7 12
200.4 [E2] 73
955.4 25
381.0 100
625.7 63
567.3 12
395.2 22
1260.5 7
1100.2 15
1088.6 37
1030.1 63
160.1 15
$^{123}_{51}Sb_{72}$

$^{176}Yb(^{31}P,X\gamma)$ 2005Po03



$^{123}_{51}Sb_{72}$