^{209}Bi(^{7}Li,p2nγ),^{209}Bi(^{8}He,4nγ) 2003LaZZ,2005Ga46

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 181, 475 (2022)	1-Jan-2022

Other: 2004Da23 – ^{209}Bi(^{7}Li,p2nγ) – measured fusion cross section.

2003LaZZ: ^{209}Bi(^{7}Li,p2nγ) E=48 MeV; Detector: CAESAR array, consisting of six Compton-suppressed HPGe detector and two LEPS detectors, an ADC clock; measured: Eγ, γ-γ coin, $T_{1/2}$.

2005Ga46: ^{209}Bi(^{8}He,4nγ) E=28 MeV; Detector: EXOGAM array, composed of four Compton suppressed Ge Clover detectors; Measured: Eγ. Level scheme not given.

^{213}At Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0.0	9/2$^-$	125 ns *6*	$T_{1/2}$: From Adopted Levels.
725	(13/2$^-$)		
1112	(15/2$^-$)		
1130	(17/2$^-$)		
1319	(19/2$^-$)		
1319+y	(27/2$^-$)[#]	85[@] ns	Additional information 1. E(level): In 2003LaZZ, this level energy is presented as (1554) keV, can be obtained combining γ-rays, presented as unplaced in this dataset, and 1319 keV level as 1319+92+105+(38)=1554 or 1319+92+55+51=1556. $T_{1/2}$: From τ=122 ns (2003LaZZ).
1682+y	(29/2$^+$)[#]		E(level): (1917) keV in 2003LaZZ.
1839+y	(33/2$^+$)[#]	82[@] ns	E(level): (2073) keV in 2003LaZZ. $T_{1/2}$: From τ=118 ns (2003LaZZ).
2195+y	(35/2$^-$)[#]		E(level): (2429) keV in 2003LaZZ.
2571+y	(37/2$^-$)[#]		E(level): (2805) keV in 2003LaZZ.
2621+y	(43/2$^-$)[#]	34.7[@] ns	E(level): (2855) keV in 2003LaZZ. $T_{1/2}$: From τ=50 ns (2003LaZZ). Possible configuration: π ($[h^{+2}_{9/2},f^{+1}_{7/2}]_{23/2^-}$) ν ($[g^{+1}_{9/2},i^{+1}_{11/2}]_{10^+}$) (2003LaZZ). $T_{1/2}$: A low-energy (50-keV) unobserved transition was postulated to explain the observed isomer (2003LaZZ).
2927+y	(49/2$^+$)[#]	45 μs *4*	E(level): Other: 2998 *27* (2021Ko07 – NUBASE). (3161) keV in 2003LaZZ. Possible configuration: π ($[h^{+2}_{9/2},i^{+1}_{13/2}]_{29/2^+}$) ν ($[g^{+1}_{9/2},i^{+1}_{11/2}]_{10^+}$) (2003LaZZ). $T_{1/2}$: From τ=65 μs *6*, 306γ(t) (2003LaZZ – preliminary result). %Isomeric production ratio=4.7 *5* (2013Bo18) from ^{238}U fragmentation.

[†] Deduced by evaluator from a least square fit to the γ-ray energies, assuming ΔE=1 keV for all Eγ. Levels above 19/2$^-$ state, 1319 keV, are labeled adding '+x' by the evaluator due to premature placements of highly converted low energy γ-lines between (27/2$^-$) and 19/2$^-$ states. Those low energy γ-lines are presented as unplaced here in the dataset.

[‡] From Adopted Levels, except where otherwise noted.

[#] From 2003LaZZ, detailed arguments are not available. It appears that the assignment was based on the placement of gamma transitions in the level scheme following the decay of 2626+y isomer (J$^{\pi}$=(49/2$^+$)), shell model calculations, and comparison with a comparable isomer at 4771.4 (J$^{\pi}$=(25$^-$)), $T_{1/2}$=152 μs *5*, in ^{212}At.

[@] From intermediate time spectra between different parts of γ-ray transitions in 2003LaZZ.

^{209}Bi(^{7}Li,p2nγ),^{209}Bi(^{8}He,4nγ) 2003LaZZ,2005Ga46 (continued)

$\gamma(^{213}At)$

E_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [@]	Comments
(17)	1130	(17/2$^-$)	1112	(15/2$^-$)			
(^{x}38[‡])							
(50)	2621+y	(43/2$^-$)	2571+y	(37/2$^-$)			E_γ: A low-energy (50-keV) unobserved γ transition was postulated to explain the observed isomer (2003LaZZ).
^{x}51[‡]							
^{x}55[‡]							
^{x}88[‡]							
^{x}92[‡]							
^{x}105[‡]							
156	1839+y	(33/2$^+$)	1682+y	(29/2$^+$)			
189[#]	1319	(19/2$^-$)	1130	(17/2$^-$)			
306	2927+y	(49/2$^+$)	2621+y	(43/2$^-$)	[E3]	0.707	α(K)=0.1715 *24*; α(L)=0.393 *6*; α(M)=0.1075 *15*; α(N+..)=0.0342 *5* α(N)=0.0280 *4*; α(O)=0.00558 *8*; α(P)=0.000600 *9* Mult.: Proposed in 2003LaZZ based on predicted E3 strength of 23 W.u. *2* compared to 26 W.u. *1* in ^{212}At (27 W.u. *1* in the ENSDF).
356	2195+y	(35/2$^-$)	1839+y	(33/2$^+$)			
363[#]	1682+y	(29/2$^+$)	1319+y	(27/2$^-$)			
376[#]	2571+y	(37/2$^-$)	2195+y	(35/2$^-$)			
387[#]	1112	(15/2$^-$)	725	(13/2$^-$)			
405[#]	1130	(17/2$^-$)	725	(13/2$^-$)			
520	1839+y	(33/2$^+$)	1319+y	(27/2$^-$)			
725[#]	725	(13/2$^-$)	0.0	9/2$^-$			

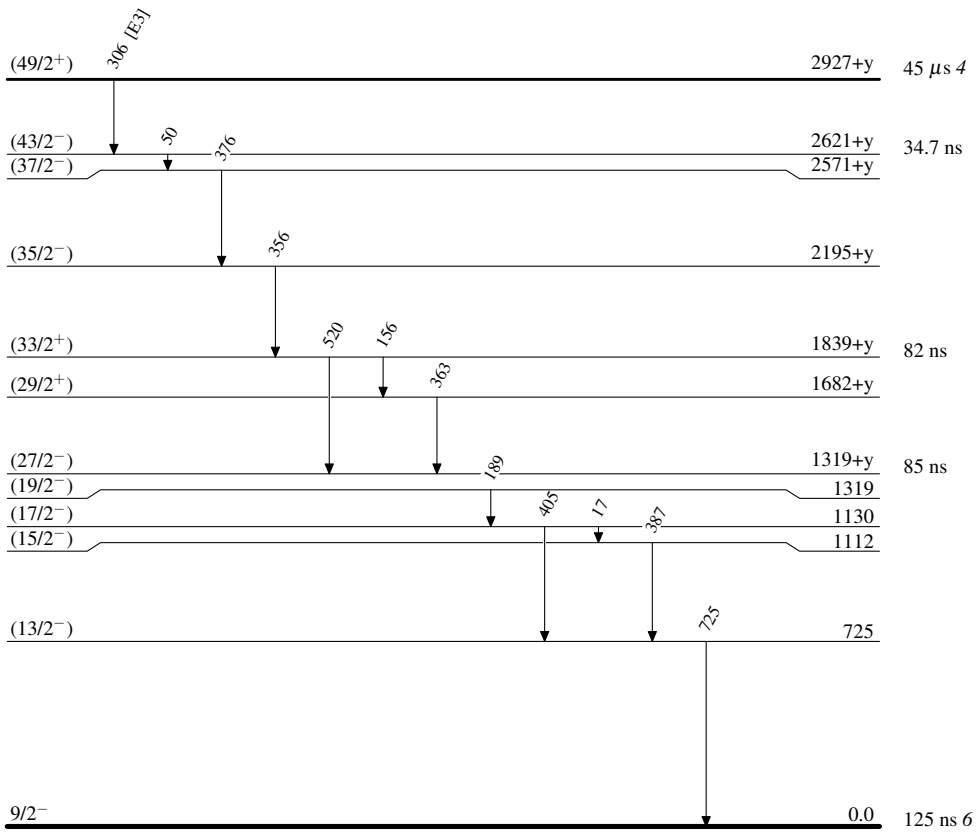
[†] From 2003LaZZ, except where otherwise noted.
[‡] Placement in 2003LaZZ between the (27/2$^-$) and 19/2$^-$ states, in coincidence with 725 keV within a timeframe of 30-850 ns. The evaluator presents these γ-rays as unplaced due to unclear level scheme between (27/2$^-$) and 19/2$^-$ states.
[#] This γ-ray is also present in figure of the γ-ray spectrum in 2005Ga46.
[@] Additional information 2.
[x] γ ray not placed in level scheme.

Legend

^{209}Bi(^{7}Li,p2nγ),^{209}Bi(^{8}He,4nγ) 2003LaZZ,2005Ga46

Level Scheme

γ Decay (Uncertain)



$^{213}_{85}At_{128}$