

$^{209}\text{Bi}(\mu^-, \nu 2n\gamma)$ 2007Me09,1971Ba10

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev, S. Lalkovski		NDS 112, 707 (2011)	1-Aug-2010

2007ME09: Facility: TRIUMF; Beam: μ^- from in-flight decay of π^- , where $E(\pi^-)=90$ MeV/c; Target: 3.5 g/cm² Bi; Detectors: superconducting solenoid, bending magnet, two HPGe placed at 90 deg. with respect to the beam axis, NaI(Tl) anti-Compton shield, plastic scintillator; Measured: X-rays, E γ , I γ .

1971BA10: Facility: CERN synchrocyclotron; Beam: μ^- ; Target: 5 g/cm²; Detectors: μ^- -telescope; two Ge(Li); Measured: X-rays, E γ , I γ , X γ (t); Deduced: level energies, lifetimes.

Muonic lifetime: 73.5 ns 4 (2007Me09), 79 ns 5 (1971Ba10).

 Muon Lyman (or K) series for Bismuth as seen in 2007Me09

μ x ray	Energy	Intensity as a percent per muon capture	
2p _{1/2} -1s _{1/2}	5841.5	30	36.1 15
2p _{3/2} -1s _{1/2}	6032.4	30	48.6 15
3p _{1/2} -1s _{1/2}	8539	10	2.3 3
3p _{3/2} -1s _{1/2}	8584	10	2.6 3
3p _{3/2} -1s _{1/2}	8628	10	0.7 4
4p-1s	9468/9521	1.0	7
5p-1s	9945/9973	0.3	6
6p-1s	10201/10218	1.2	12

 Muon Balmer (or L) series for Bismuth as seen in 2007Me09

μ x ray	Energy	Intensity as a percent per muon capture	
3d _{3/2} -2p _{3/2}	2504	2	1.5 8
3d _{3/2} -2p _{3/2}	2549.6	3	22.5 11
3d _{5/2} -2p _{3/2}	2558.9	3	18.4 11
3d _{3/2} -2p _{1/2}	2700.3	2	26.7 11
4d _{5/2} -2p _{3/2}	3510	1	4.0 14
4d _{3/2} -2p _{1/2}	3679	1	2.2 6
5d _{5/2} -2p _{3/2}	3951		0.3 6
5d _{3/2} -2p _{1/2}	4132		0.5 5
6d _{5/2} -2p _{3/2}	4191		<0.7
6d _{3/2} -2p _{1/2}	4376		<0.7

 Muon Paschen (or M) series for Bismuth as seen in 2007Me09

μ x ray	Energy	Intensity as a percent per muon capture	
4f _{7/2} -3d _{5/2}	961.3	2	42.7 29
4f _{5/2} -3d _{3/2}	996.8	2	34.5 24
5f _{7/2} -3d _{5/2}	1400.4	5	3.9 6
5f _{5/2} -3d _{3/2}	1440.2	5	2.9 8
6f _{7/2} -3d _{5/2}	1640.1	5	2.2 6
6f _{5/2} -3d _{3/2}	1681.0	a)	1.2 10
7f _{7/2} -3d _{5/2}	1783	2	0.4 2
7f _{5/2} -3d _{3/2}	1826	2	0.8 6
8f _{7/2} -3d _{5/2}	1876	2	1.0 6
8f _{5/2} -3d _{3/2}	1920	2	0.7 7

a): at the same energy as, and dominated by,
 the double escape peak of the Bi x ray 3d_{3/2}-2p_{1/2}

 Muon Brackett (or N) series for Bismuth as seen in 2007Me09

μ x ray	Energy	Intensity as a percent per muon capture	
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5g _{7/2} -4f _{5/2}	442.0 1	39.8 19
5g _{9/2} -4f _{7/2}	448.7 1	32.0 19
6g _{7/2} -4f _{5/2}	679.7 1	4.8 10
6g _{9/2} -4f _{7/2}	687.6 2	3.7 10
7g _{7/2} -4f _{5/2}	823.4 5	1.4 5
7g _{9/2} -4f _{7/2}	832.0 5	1.2 6
8g _{7/2} -4f _{5/2}	916.3	0.7 6
8g _{9/2} -4f _{7/2}	924.4	0.5 3
9g _{7/2} -4f _{5/2}	980.2	<0.5
9g _{9/2} -4f _{7/2}	988.5	<0.4
10g _{7/2} -4f _{5/2}	1025.9	0.4 4
10g _{9/2} -4f _{7/2}	1034.3	0.2 2

 ^{207}Pb Levels

E(level) [†]	J ^π [‡]	T _{1/2} [‡]	Yield per muon capture, % [#]
0	1/2 ⁻		
569.70 5	5/2 ⁻		8.8 23
897.78 5	3/2 ⁻		5.9 13
1633.36 7	13/2 ⁺	0.806 s 5	5.8 10
2339.95 7	7/2 ⁻		1.8 6
2623.5 5	5/2 ⁺		1.3 6
2662.4 5	7/2 ⁺		1.7 6
2728.7 7	9/2 ⁺		3.5 5

[†] From a least-squares fit to E γ .[‡] From the Adopted Levels.[#] From [2007Me09](#). $\gamma(^{207}\text{Pb})$

E γ [†]	I γ [†]	E _i (level)	J ^π _i	E _f	J ^π _f	Comments
389 1	2.0 8	2728.7	9/2 ⁺	2339.95	7/2 ⁻	
569.70 5	22.4 19	569.70	5/2 ⁻	0	1/2 ⁻	I γ : 13.3 20 in 1971Ba10 .
897.78 5	7.2 11	897.78	3/2 ⁻	0	1/2 ⁻	I γ : 6 3 in 1971Ba10 .
1063.66 5	9.5 9	1633.36	13/2 ⁺	569.70	5/2 ⁻	I γ : Lower limit, due to T _{1/2} =0.81 s for the 1633 level.
1095 1	2.8 4	2728.7	9/2 ⁺	1633.36	13/2 ⁺	
1725.7 5	1.3 6	2623.5	5/2 ⁺	897.78	3/2 ⁻	
1770.24 5	2.4 6	2339.95	7/2 ⁻	569.70	5/2 ⁻	
2092.7 5	1.7 6	2662.4	7/2 ⁺	569.70	5/2 ⁻	

[†] From [2007Me09](#), but $\Delta E\gamma$ were estimated by the evaluators.

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Level Scheme

Intensities: Percent γ -ray yield/muon capture

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
- $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
- $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$

