



1 Decay Scheme

Bi-213 disintegrates 97.91(3) % by beta minus emission to the levels in Po-213 and 2.09(3) % through alpha decay to Tl-209.

Le bismuth 213 se désintègre principalement par émissions bêta vers le polonium 213 et par émissions bêta (2,09 %) vers le tellure 209.

2 Nuclear Data

$T_{1/2}(^{213}\text{Bi})$:	45,59	(6)	min
$T_{1/2}(^{213}\text{Po})$:	3,70	(5)	10^{-6} s
$T_{1/2}(^{209}\text{Tl})$:	2,161	(7)	min
$Q^{\alpha}(^{213}\text{Bi})$:	5983	(6)	keV
$Q^{-}(^{213}\text{Bi})$:	1423	(5)	keV

2.1 α Transitions

	Energy keV	Probability $\times 100$	F
$\alpha_{0,1}$	5655 (10)	0,186 (5)	103
$\alpha_{0,0}$	5981 (10)	1,90 (4)	319

2.2 β^- Transitions

	Energy keV	Probability × 100	Nature	lg <i>ft</i>
$\beta_{0,9}^-$	95 (5)	0,00039 (13)		7,68
$\beta_{0,8}^-$	304 (5)	0,0608 (20)		7,07
$\beta_{0,7}^-$	323 (5)	0,595 (17)		6,16
$\beta_{0,6}^-$	377 (5)	0,020 (4)		7,85
$\beta_{0,5}^-$	419 (5)	0,0648 (23)		7,494
$\beta_{0,4}^-$	555 (5)	0,0129 (6)	1st Forbidden Unique	8,597
$\beta_{0,3}^-$	822 (5)	0,0025 (19)		9,9
$\beta_{0,2}^-$	983 (5)	30,8 (4)	1st Forbidden	6,07
$\beta_{0,1}^-$	1130 (5)	0,21 (9)	1st Forbidden	8,45
$\beta_{0,0}^-$	1423 (5)	66,2 (4)	1st Forbidden	6,316

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M (10 ⁻³)	α_T
$\gamma_{2,1}$ (Po)	147,70 (4)	0,0314 (20)	E2	0,307 (4)	0,85 (1)	0,226 (3)	1,453 (21)
$\gamma_{1,0}$ (Po)	292,80 (1)	0,55 (8)	M1+E2	0,22 (17)	0,06 (2)	0,015 (3)	0,30 (18)
$\gamma_{1,0}$ (Tl)	323,70 (2)	0,1866 (37)	M1+E2	0,134 (14)	0,0333 (13)	0,0081 (3)	0,178 (15)
$\gamma_{5,3}$ (Po)	402,8 (3)	0,00010 (4)					
$\gamma_{2,0}$ (Po)	440,44 (1)	30,77 (36)	M1	0,146 (2)	0,0250 (4)	5,94 (8)	0,179 (3)
$\gamma_{4,1}$ (Po)	574,9 (3)	0,00068 (16)					
$\gamma_{3,0}$ (Po)	600,9 (2)	0,0026 (19)					
$\gamma_{6,2}$ (Po)	604,98 (18)	0,0014 (5)					
$\gamma_{7,2}$ (Po)	659,759 (20)	0,043 (6)					
$\gamma_{5,1}$ (Po)	710,82 (3)	0,0112 (6)					
$\gamma_{7,1}$ (Po)	807,372 (11)	0,287 (14)					
$\gamma_{8,1}$ (Po)	826,564 (41)	0,0065 (4)					
$\gamma_{4,0}$ (Po)	867,961 (20)	0,0122 (6)					
$\gamma_{9,2}$ (Po)	887,76 (30)	0,00102 (19)					
$\gamma_{5,0}$ (Po)	1003,593 (17)	0,0535 (22)					
$\gamma_{6,0}$ (Po)	1045,68 (8)	0,019 (4)					
$\gamma_{7,0}$ (Po)	1100,17 (1)	0,265 (6)					
$\gamma_{8,0}$ (Po)	1119,422 (8)	0,0543 (20)					
$\gamma_{9,0}$ (Po)	1328,2 (3)	0,00039 (13)					

3 Atomic Data

3.1 Po

ω_K	:	0,965	(4)
$\bar{\omega}_L$:	0,403	(16)
n_{KL}	:	0,807	(5)

3.1.1 X Radiations

	Energy keV	Relative probability
X _K		
K α_2	76,864	60,05
K α_1	79,293	100
K β_3	89,256	}
K β_1	89,807	}
K β_5''	90,363	}
		34,43
K β_2	92,263	}
K β_4	92,618	}
KO _{2,3}	92,983	}
		10,71
X _L		
L ℓ	9,6576	
L α	11,0161 – 11,1303	
L η	12,0847	
L β	12,8239 – 14,2476	
L γ	15,251 – 16,2129	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	58,978 – 65,205	100
KLX	71,902 – 79,289	56,4
KXY	84,8 – 93,1	7,95
Auger L	5,43 – 16,86	

3.2 Tl

ω_K	:	0,963	(4)
$\bar{\omega}_L$:	0,367	(15)
n_{KL}	:	0,812	(5)

3.2.1 X Radiations

	Energy keV	Relative probability		
X _K	K α_2	70,8325	59,24	
	K α_1	72,8725	100	
	K β_3	82,118	}	
	K β_1	82,577	}	
	K β_5''	83,115	}	34
	K β_2	84,838	}	
	K β_4	85,134	}	10,1
	KO _{2,3}	85,444	}	
	X _L	L ℓ	8,9531	
		L α	10,1718 – 10,2679	
L η		10,9942		
L β		11,8117 – 12,9566		
L γ		13,8528 – 14,7362		

3.2.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	54,587 – 59,954	100
KLX	66,37 – 72,86	55,4
KXY	78,12 – 85,50	7,67
Auger L	5,18 – 10,13	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,1}$	5549 (10)	0,186 (5)
$\alpha_{0,0}$	5869 (10)	1,90 (4)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e _{AL}	(Po)	5,43 - 16,86	1,7 (3)
e _{AK}	(Po)		0,121 (19)
	KLL	58,978 - 65,205	}
	KLX	71,902 - 79,289	}
	KXY	84,8 - 93,1	}
e _{AL}	(Tl)	5,18 - 10,13	0,0107 (13)
e _{AK}	(Tl)		0,00076 (9)
	KLL	54,587 - 59,954	}
	KLX	66,37 - 72,86	}
	KXY	78,12 - 85,50	}
ec _{2,1} L	(Po)	130,8 - 133,9	0,0109 (7)
ec _{1,0} K	(Po)	199,70 (1)	0,09 (7)
ec _{1,0} K	(Tl)	238,17 (2)	0,0212 (22)
ec _{1,0} L	(Po)	275,9 - 279,0	0,025 (8)
ec _{2,0} T	(Po)	347,30 - 440,41	4,67 (9)
ec _{2,0} K	(Po)	347,34 (1)	3,81 (7)
ec _{2,0} L	(Po)	423,51 - 426,63	0,653 (13)
ec _{2,0} M	(Po)	436,29 - 437,76	0,1550 (27)
ec _{2,0} N	(Po)	439,45 - 440,26	0,0392 (7)
$\beta_{0,9}^-$	max:	95 (5)	0,00039 (13)
$\beta_{0,9}^-$	avg:	24,6 (14)	
$\beta_{0,8}^-$	max:	304 (5)	0,0608 (20)
$\beta_{0,8}^-$	avg:	84,9 (16)	
$\beta_{0,7}^-$	max:	323 (5)	0,595 (17)
$\beta_{0,7}^-$	avg:	90,8 (16)	
$\beta_{0,6}^-$	max:	377 (5)	0,020 (4)
$\beta_{0,6}^-$	avg:	107,9 (16)	

		Energy keV		Electrons per 100 disint.
$\beta_{0,5}^-$	max:	419	(5)	0,0648 (23)
$\beta_{0,5}^-$	avg:	121,4	(17)	
$\beta_{0,4}^-$	max:	555	(5)	0,0129 (6)
$\beta_{0,4}^-$	avg:	166,4	(17)	
$\beta_{0,3}^-$	max:	822	(5)	0,0025 (19)
$\beta_{0,3}^-$	avg:	260,8	(19)	
$\beta_{0,2}^-$	max:	983	(5)	30,8 (4)
$\beta_{0,2}^-$	avg:	320,4	(19)	
$\beta_{0,1}^-$	max:	1130	(5)	0,21 (9)
$\beta_{0,1}^-$	avg:	376,8	(20)	
$\beta_{0,0}^-$	max:	1423	(5)	66,2 (4)
$\beta_{0,0}^-$	avg:	492,2	(20)	

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Po)	9,6576 — 16,2129		1,14 (18)	
XK α_2	(Po)	76,864		0,99 (15)	} K α
XK α_1	(Po)	79,293		1,6 (3)	
XK β_3	(Po)	89,256	}		
XK β_1	(Po)	89,807	}	0,56 (9)	K' β_1
XK β_5''	(Po)	90,363	}		
XK β_2	(Po)	92,263	}		
XK β_4	(Po)	92,618	}	0,18 (3)	K' β_2
XKO $_{2,3}$	(Po)	92,983	}		
XL	(Tl)	8,9531 — 14,7362		0,0062 (8)	
XK α_2	(Tl)	70,8325		0,0058 (7)	} K α
XK α_1	(Tl)	72,8725		0,0098 (12)	
XK β_3	(Tl)	82,118	}		
XK β_1	(Tl)	82,577	}	0,0033 (5)	K' β_1
XK β_5''	(Tl)	83,115	}		
XK β_2	(Tl)	84,838	}		
XK β_4	(Tl)	85,134	}	0,00098 (14)	K' β_2
XKO $_{2,3}$	(Tl)	85,444	}		

6.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{2,1}(\text{Po})$	147,70 (4)	0,0128 (8)
$\gamma_{1,0}(\text{Po})$	292,80 (1)	0,421 (7)
$\gamma_{1,0}(\text{Tl})$	323,70 (2)	0,1584 (24)
$\gamma_{5,3}(\text{Po})$	402,8 (3)	0,00010 (4)
$\gamma_{2,0}(\text{Po})$	440,44 (1)	26,1 (3)
$\gamma_{4,1}(\text{Po})$	574,9 (3)	0,00068 (16)
$\gamma_{3,0}(\text{Po})$	600,9 (2)	0,0026 (19)
$\gamma_{6,2}(\text{Po})$	604,93 (17)	0,0014 (5)
$\gamma_{7,2}(\text{Po})$	659,75 (2)	0,043 (6)
$\gamma_{5,1}(\text{Po})$	710,82 (3)	0,0112 (6)
$\gamma_{7,1}(\text{Po})$	807,37 (1)	0,287 (14)
$\gamma_{8,1}(\text{Po})$	826,55 (4)	0,0065 (4)
$\gamma_{4,0}(\text{Po})$	867,96 (2)	0,0122 (6)
$\gamma_{9,2}(\text{Po})$	886,66 (14)	0,00102 (19)
$\gamma_{5,0}(\text{Po})$	1003,58 (2)	0,0535 (22)
$\gamma_{6,0}(\text{Po})$	1045,67 (8)	0,019 (4)
$\gamma_{7,0}(\text{Po})$	1100,16 (1)	0,265 (6)
$\gamma_{8,0}(\text{Po})$	1119,42 (8)	0,0543 (20)
$\gamma_{9,0}(\text{Po})$	1328,2 (3)	0,00039 (13)

7 Main Production Modes

Th – 229 decay chain

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