

**$^{104}\text{Sn} \beta^+$  decay**    **2006Ka16,1985De08,1985Ra19**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jean Blachot	NDS 108,2035 (2007)	30-Mar-2007

Parent:  $^{104}\text{Sn}$ :  $E=0$ ;  $J^\pi=0^+$ ;  $T_{1/2}=20.8$  s 5;  $Q(\beta^+)=4510$  60;  $\% \beta^+$  decay=100.0

$^{104}\text{Sn}$ - $T_{1/2}, Q(\beta^+)$ : From 2003Au02 and 2003Au03.

2006Ka16:  $^{104}\text{Sn}$  isotope produced in  $^{50}\text{Cr}(^{58}\text{Ni}, \alpha)$ .

reaction at  $E=284$ -302 MeV, ion-beam facility at GSI, recoil mass separator. Measured  $E\gamma$ ,  $I\gamma$ ,  $\gamma\gamma$ ,  $\beta\gamma$ ,  $\beta\gamma\gamma$  using an array of one Cluster, two Clovers and two smaller Ge detectors surrounding the Silicon detectors for  $\beta$  detection. Total absorption  $\beta$  spectrum (TAS).

1985De08  $^{92}\text{Mo}(^{20}\text{Ne}, \text{ypxn}) E(^{20}\text{Ne})=210$  MeV.

1985Ra19  $^{50}\text{Cr}(^{58}\text{Ni}, 2\text{p}2\text{n}) E(^{58}\text{Ni})=4.68$  MeV/U.

Measured:  $\gamma$ ,  $X\gamma$ ,  $\gamma(t)$ ,  $ce$ ,  $\beta^+$  -endpoint (1991Ke11).

1991Ke11 has measured  $Q+=4515$  keV 60.

On-line mass separator (1985De08).

GSI on-line mass separator + chemical separation in the mass separator ion source with bunched-beam release (1989SzZY, 1985Ra19).

$^{104}\text{In}$  Levels

E(level)	$J^\pi^\dagger$	$T_{1/2}$	Comments
0.0	(6 <sup>+</sup> )	1.80 min 3	
93.2 1	(5 <sup>+</sup> )		
93.5 1	(3 <sup>+</sup> )	15.7 s 5	$T_{1/2}$ : from Adopted Levels for $^{104}\text{In}$ .
226.16 13	(2 <sup>+</sup> )		
241.4 1	(4 <sup>+</sup> )		
396.3 1	(3 <sup>+</sup> )		
738.1 2	(2 <sup>+</sup> )		
1138.8 2	1 <sup>+</sup>		
1382.4 5	1 <sup>+</sup>		
1441.5 3	1 <sup>+</sup>		
1499.7?	1 <sup>+</sup>		
1633.5 4	1 <sup>+</sup>		
1651.0 4	1 <sup>+</sup>		
2072.0	(1 <sup>+</sup> )		

<sup>†</sup> From Adopted Levels.

$\epsilon, \beta^+$  radiations

E(decay)	E(level)	$I\beta^{\ddagger}$	$I\epsilon^{\ddagger}$	Log $ft$	$I(\epsilon+\beta^+)^{\dagger\ddagger}$	Comments
( $2.44 \times 10^3$ # 6)	2072.0	0.2	0.3	5.0	0.5	av $E\beta=634$ 27; $\epsilon K=0.58$ 3; $\epsilon L=0.075$ 4; $\epsilon M+=0.0190$ 9
( $2.88 \times 10^3$ 6)	1633.5	14	12	3.6	26	av $E\beta=832$ 28; $\epsilon K=0.403$ 23; $\epsilon L=0.052$ 3; $\epsilon M+=0.0131$ 8
( $3.07 \times 10^3$ 6)	1441.5	11	7.1	3.9	18	av $E\beta=919$ 28; $\epsilon K=0.339$ 20; $\epsilon L=0.0434$ 25; $\epsilon M+=0.0110$ 7
( $3.13 \times 10^3$ 6)	1382.4	2	1	4.7	3	av $E\beta=946$ 28; $\epsilon K=0.321$ 19; $\epsilon L=0.0411$ 24; $\epsilon M+=0.0104$ 6
( $3.37 \times 10^3$ 6)	1138.8	37	15	3.6	52	av $E\beta=1058$ 28; $\epsilon K=0.256$ 15; $\epsilon L=0.0328$ 19; $\epsilon M+=0.0083$ 5

<sup>†</sup> From total absorption spectra (2006Ka16).

<sup>‡</sup> Absolute intensity per 100 decays.

# Existence of this branch is questionable.

$^{104}\text{Sn } \beta^+$  decay **2006Ka16,1985De08,1985Ra19** (continued)

$E_\gamma^\dagger$	$I_\gamma^\&$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult. <sup>‡</sup>	$\gamma(^{104}\text{In})$		Comments
							$\alpha^a$		
$^{x70}\text{@}$									
$^{x76}\text{@}$									
93.2 1	13	93.2	(5 <sup>+</sup> )	0.0	(6 <sup>+</sup> )	M1	0.629	$\alpha(\text{K})= 0.544$ ; $\alpha(\text{L})= 0.0688$ ; $\alpha(\text{M})=0.01329$ ; $\alpha(\text{N+..})=0.00290$	
93.5 1		93.5	(3 <sup>+</sup> )	0.0	(6 <sup>+</sup> )	M3	63.7	$\alpha(\text{K})\text{exp}=45.5$ (1989Va05) $\alpha(\text{K})= 43.7$ ; $\alpha(\text{L})= 15.84$ ; $\alpha(\text{M})= 3.35$ ; $\alpha(\text{N+..})= 0.766$ B(M3)(W.u.)=2.15 10	
132.7 1	100	226.16	(2 <sup>+</sup> )	93.5	(3 <sup>+</sup> )	M1	0.2329	$\alpha(\text{K})= 0.2017$ ; $\alpha(\text{L})= 0.0253$ ; $\alpha(\text{M})=0.00489$ ; $\alpha(\text{N+..})=0.00107$	
148.1 1	13	241.4	(4 <sup>+</sup> )	93.5	(3 <sup>+</sup> )	M1	0.1718	$\alpha(\text{K})= 0.1487$ ; $\alpha(\text{L})=0.01865$ ; $\alpha(\text{M})=0.00361$ ; $\alpha(\text{N+..})=0.00079$	
154.7 1	9	396.3	(3 <sup>+</sup> )	241.4	(4 <sup>+</sup> )				
169.9 2	1	396.3	(3 <sup>+</sup> )	226.16	(2 <sup>+</sup> )				
302.8 2	7	396.3	(3 <sup>+</sup> )	93.5	(3 <sup>+</sup> )				
342.3 2	18	738.1	(2 <sup>+</sup> )	396.3	(3 <sup>+</sup> )				
401.2 2	24	1138.8	1 <sup>+</sup>	738.1	(2 <sup>+</sup> )				
512 1	$\approx 10$	738.1	(2 <sup>+</sup> )	226.16	(2 <sup>+</sup> )				
644.6 3	15	738.1	(2 <sup>+</sup> )	93.5	(3 <sup>+</sup> )				
703.5 3	12	1441.5	1 <sup>+</sup>	738.1	(2 <sup>+</sup> )				
894.9 4	12	1633.5	1 <sup>+</sup>	738.1	(2 <sup>+</sup> )				
912.6 4	60	1138.8	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
912.6 <sup>#</sup>	$\approx 6.7$	1651.0	1 <sup>+</sup>	738.1	(2 <sup>+</sup> )				
1045 1	$<1.5$	1138.8	1 <sup>+</sup>	93.5	(3 <sup>+</sup> )				
1156.3 <sup>b</sup> 1	$\approx 4$	1382.4	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
1215.3 5	12	1441.5	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
1273.5 <sup>#b</sup>	4.2	1499.7?	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
1407.3 5	22	1633.5	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
1425.4 <sup>#</sup>	2.2	1651.0	1 <sup>+</sup>	226.16	(2 <sup>+</sup> )				
1845.8 <sup>#</sup>	2.0	2072.0	(1 <sup>+</sup> )	226.16	(2 <sup>+</sup> )				

<sup>†</sup> From 1985De08 and 1985Ra19, unless otherwise stated.

<sup>‡</sup> From  $\alpha(\text{K})\text{exp}$ .

<sup>#</sup> New  $\gamma$  ray from 2006Ka16.

<sup>@</sup>  $\gamma$  seen in coin (2006Ka16), but not assigned in the level scheme.

<sup>&</sup> For absolute intensity per 100 decays, multiply by  $\approx 0.75$ .

<sup>a</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

<sup>b</sup> Placement of transition in the level scheme is uncertain.

<sup>x</sup>  $\gamma$  ray not placed in level scheme.

$^{104}\text{Sn } \beta^+ \text{ decay } \quad 2006\text{Ka16,1985De08,1985Ra19}$

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - - -  $\gamma$  Decay (Uncertain)
- Coincidence

Decay Scheme

Intensities:  $I_{(\gamma+ce)}$  per 100 parent decays

