$^{52m}_{25}$Mn $_{27}$

1 Decay Scheme

Mn-52m (metastable state of Mn-52) decays by positron emission and electron capture (98.295 %) populating the excited states of Cr-52, and by isomeric transition (1.705 %) to the ground state of Mn-52.

Le Mn-52m (état isomérique du Mn-52) se désintègre par capture électronique et par émission bêta plus (98,295 %) vers plusieurs états excités du Cr-52, et se désexcite par transition gamma (1,705 %) vers l'état fondamental du Mn-52.

2 Nuclear Data

$T_{1/2}(^{52m}\mathrm{Mn})$	:	21,1	(2)	min
$T_{1/2}(^{52}\mathrm{Mn})$	:	5,592	(3)	d
$Q^{+}(^{52m}\mathrm{Mn})$	:	5089,7	(19)	keV
$Q^{IT}(^{52m}\mathrm{Mn})$	:	377,749	(5)	keV

2.1 Electron Capture Transitions

	Energy (keV)	Probability (%)	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,10}$	274,1 (19)	0,0049 (9)	Allowed	5,52	0,88219 (37)	0,10088 (26)	0,01574 (9)
$\epsilon_{0,8}$	1138,5 (21)	0,00069 (30)	Allowed	7,63	0,88523 (34)	0,09832 (23)	0,01529 (9)
$\epsilon_{0,7}$	1318,1 (19)	0,0083 (11)	Allowed	6,67	0,88536 (34)	0,09821 (23)	0,01527 (9)
$\epsilon_{0,6}$	1617,6 (19)	0,023 (8)	Allowed	6,42	0,88551 (34)	0,09809 (23)	0,01525 (9)
$\epsilon_{0,5}$	1928,0 (19)	0,071 (8)	Allowed	6,082	0,88561 (34)	0,09800 (23)	0,01523 (9)
$\epsilon_{0,4}$	2125,0 (19)	0,0085 (12)	Allowed	7,088	0,88566 (34)	0,09796 (23)	0,01522 (9)
$\epsilon_{0,2}$	2720,1 (21)	0,0030 (47)	2nd Forbidden	9,21	0,88532 (34)	0,09825 (23)	0,01527 (9)
$\epsilon_{0,1}$	3655,7 (19)	1,466 (11)	Allowed	5,3288	0,88586 (33)	0,09779 (23)	0,01519 (9)

2.2 β^+ Transitions

	Energy (keV)	Probability (%)	Nature	lg ft
$\beta^+_{0,8}$	116,6 (21)	0,00000083 (37)	Allowed	7,63
$\beta^+_{0,7}$	296,1 (19)	0,00039 (5)	Allowed	6,67
$\beta^+_{0,6}$	595,7 (19)	0,0132 (33)	Allowed	6,42
$\beta^+_{0,5}$	906,0 (19)	0,167 (8)	Allowed	6,082
$\beta^+_{0,4}$	1103,0 (19)	0,0381 (17)	Allowed	7,088
$\beta^+_{0,2}$	1698,2 (21)	0,017 (8)	2nd Forbidden	9,21
$\beta^+_{0,1}$	2633,7 (19)	96,474 (45)	Allowed	5,3288

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K (10^{-4})	α_L (10^{-5})	α_M (10^{-6})	α_T (10^{-4})	α_π (10^{-4})
$\gamma_{1,0}$(Mn)	377,749 (5)	1,705 (42)	E4	356 (5)	382 (6)	515 (8)	400 (6)	
$\gamma_{6,3}$(Cr)	704,6 (2)	0,029 (9)	M1+E2	2,25 (4)	2,09 (4)	2,75 (5)	2,49 (5)	
$\gamma_{2,1}$(Cr)	935,52 (10)	0,02 (1)	E2	1,657 (24)	1,536 (22)	2,02 (3)	1,83 (3)	
$\gamma_{3,1}$(Cr)	1333,42 (30)	0,029 (10)	E2	0,730 (11)	0,674 (10)	0,887 (13)	1,174 (17)	0,367 (6)
$\gamma_{1,0}$(Cr)	1434,083 (10)	98,288 (42)	E2	0,626 (9)	0,578 (8)	0,760 (11)	1,339 (19)	0,647 (9)
$\gamma_{4,1}$(Cr)	1530,694 (18)	0,0462 (21)	M1+E2	0,546 (8)	0,504 (7)	0,663 (10)	1,593 (23)	0,989 (14)
$\gamma_{5,1}$(Cr)	1727,65 (6)	0,216 (10)	M1+E2	0,396 (6)	0,364 (6)	0,480 (7)	1,88 (3)	1,441 (24)
$\gamma_{6,1}$(Cr)	2038,02 (20)	0,0079 (14)	M1+E2	0,307 (11)	0,282 (11)	0,371 (14)	3,3 (4)	3,0 (4)
$\gamma_{7,1}$(Cr)	2337,61 (15)	0,0069 (10)	M1+E2	0,236 (4)	0,217 (3)	0,286 (4)	4,25 (7)	3,99 (7)
$\gamma_{4,0}$(Cr)	2964,777 (15)	0,00039 (30)	E2	0,1671 (24)	0,1534 (22)	0,202 (3)	7,86 (11)	7,68 (11)
$\gamma_{5,0}$(Cr)	3161,73 (6)	0,0216 (30)	E2	0,1508 (22)	0,1385 (20)	0,182 (3)	8,68 (13)	8,51 (12)
$\gamma_{10,1}$(Cr)	3381,61 (9)	0,0025 (5)	M1+E2	0,133 (3)	0,122 (3)	0,161 (4)	9,0 (6)	8,8 (6)
$\gamma_{7,0}$(Cr)	3771,69 (15)	0,00177 (39)	E2	0,1149 (16)	0,1054 (15)	0,1387 (20)	11,03 (16)	10,91 (16)
$\gamma_{8,0}$(Cr)	3951,2 (10)	0,00069 (30)	M1+E2	0,1055 (22)	0,0968 (20)	0,127 (3)	11,1 (7)	10,9 (7)
$\gamma_{10,0}$(Cr)	4815,69 (9)	0,00247 (40)	E2+M3	0,0809 (13)	0,0742 (12)	0,0977 (16)	14,39 (21)	14,30 (21)

3 Atomic Data

3.1 Cr

ω_K	:	0,289	(5)
$\bar{\omega}_L$	:	0,0045	(9)
n_{KL}	:	1,508	(5)

3.1.1 X Radiations

		Energy (keV)	Relative probability
X_K			
	$K\alpha_2$	5,40557	50,91
	$K\alpha_1$	5,41479	100
	$K\beta_1$	5,94677	} 20,31249
	$K\beta_5''$	5,987	}

		Energy (keV)	Relative probability
X_L			
	$L\ell$	0,5003	
	$L\alpha$	0,5729 - 0,57695	
	$L\eta$	0,5102	
	$L\beta$	0,57515 - 0,69748	
	$L\gamma$	0,58496 - 0,58496	

3.1.2 Auger Electrons

	Energy (keV)	Relative probability
Auger K		
KLL	4,554 - 4,794	100
KLX	5,206 - 5,412	26,9
KXY	5,841 - 5,985	1,81
Auger L	0,4263 - 0,6920	

3.2 Mn

ω_K	:	0,321	(5)
$\bar{\omega}_L$	:	0,0047	(7)
n_{KL}	:	1,478	(4)

3.2.1 X Radiations

		Energy (keV)	Relative probability
X_K			
	$K\alpha_2$	5,88772	50,99
	$K\alpha_1$	5,89881	100
	$K\beta_1$	6,49051	} 20,51954
	$K\beta_5''$	6,5354	}
X_L			
	$L\ell$	0,5576	
	$L\alpha$	0,6394 - 0,6404	
	$L\eta$	0,5695	
	$L\beta$	0,64636 - 0,7694	
	$L\gamma$	0,65826 - 0,65826	

3.2.2 Auger Electrons

	Energy (keV)	Relative probability
Auger K		
KLL	4,953 - 5,210	100
KLX	5,671 - 5,895	27,2
KXY	6,370 - 6,532	1,85
Auger L	0,4725 - 0,7653	

4 Electron Emissions

		Energy (keV)		Electrons (per 100 disint.)
e_{AL}	(Cr)	0,4263 - 0,6920		0,1549 (17)
e_{AK}	(Cr)			
	KLL	4,554 - 4,794		1,003 (13)
	KLX	5,206 - 5,412		
	KXY	5,841 - 5,985		
e_{AL}	(Mn)	0,4725 - 0,7653		0,0922 (11)
e_{AK}	(Mn)			
	KLL	4,953 - 5,210		0,0396 (12)
	KLX	5,671 - 5,895		
	KXY	6,370 - 6,532		
$ec_{1,0\ T}$	(Mn)	371,210 - 377,749		0,0656 (19)
$ec_{1,0\ T}$	(Cr)	1428,094 - 1434,083		0,01316 (19)
$\beta^+_{0,8}$	max:	116,6	(21)	0,00000083 (37)
	avg:	52,0	(9)	
$\beta^+_{0,7}$	max:	296,1	(19)	0,00039 (5)
	avg:	125,6	(8)	
$\beta^+_{0,6}$	max:	595,7	(19)	0,0132 (33)
	avg:	249,9	(8)	
$\beta^+_{0,5}$	max:	906,0	(19)	0,167 (8)
	avg:	382,7	(8)	
$\beta^+_{0,4}$	max:	1103,0	(19)	0,0381 (17)
	avg:	468,9	(8)	
$\beta^+_{0,1}$	max:	2633,7	(19)	96,474 (45)
	avg:	1170,0	(9)	
$\beta^+_{0,2}$	max:	1698,2	(21)	0,017 (8)
	avg:	764,4	(10)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy (keV)	Photons (per 100 disint.)	
XL	(Cr)	0,5003 - 0,69748	0,00070 (14)	
XKα_2	(Cr)	5,40557	0,1212 (26)	Kα
XKα_1	(Cr)	5,41479	0,238 (5)	
XKβ_1	(Cr)	5,94677	0,0484 (11)	K$'\beta_1$
XKβ_5''	(Cr)	5,987		K$'\beta_2$
XL	(Mn)	0,5576 - 0,7694	0,000344 (15)	
XKα_2	(Mn)	5,88772	0,00557 (19)	Kα
XKα_1	(Mn)	5,89881	0,0109 (4)	
XKβ_1	(Mn)	6,49051	0,00224 (8)	K$'\beta_1$
XKβ_5''	(Mn)	6,5354		K$'\beta_2$

5.2 Gamma Emissions

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{1,0}$(Mn)	377,749 (5)	1,639 (40)
$\gamma^{\pm}$	511	193,42 (9)
$\gamma_{6,3}$(Cr)	704,6 (2)	0,029 (9)
$\gamma_{2,1}$(Cr)	935,52 (10)	0,02 (1)
$\gamma_{3,1}$(Cr)	1332,62 (1)	0,029 (10)
$\gamma_{1,0}$(Cr)	1434,06 (1)	98,268 (42)
$\gamma_{4,1}$(Cr)	1530,67 (1)	0,0462 (21)
$\gamma_{5,1}$(Cr)	1727,53 (7)	0,216 (10)
$\gamma_{6,1}$(Cr)	2038,0 (2)	0,0079 (14)
$\gamma_{7,1}$(Cr)	2337,4 (2)	0,0069 (10)
$\gamma_{4,0}$(Cr)	2965 (1)	0,00039 (30)
$\gamma_{5,0}$(Cr)	3161,8 (1)	0,0216 (30)
$\gamma_{10,1}$(Cr)	3381,5 (1)	0,0025 (5)
$\gamma_{7,0}$(Cr)	3771,7 (2)	0,00177 (39)
$\gamma_{8,0}$(Cr)	3951 (1)	0,00069 (30)
$\gamma_{10,0}$(Cr)	4815,4 (2)	0,00246 (40)

6 Main Production Modes

From Fe-52 decay.

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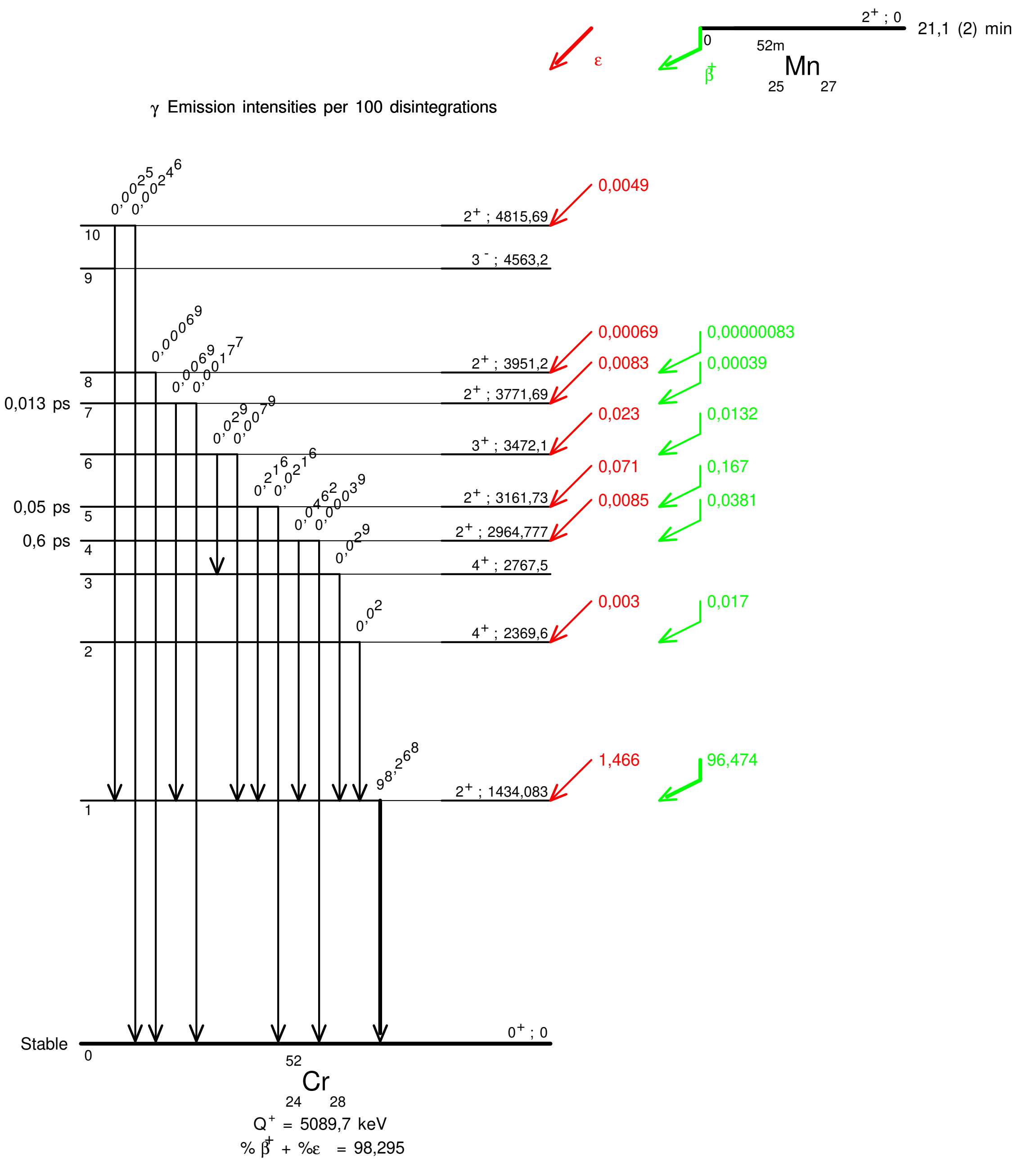
2+ ; 0
21,1 (2) min
ε
β+
52m Mn 25 27
γ Emission intensities per 100 disintegrations
0,0025
0,00246
2+ ; 4815,69
0,0049
3- ; 4563,2
0,00069
0,0069
0,0017
2+ ; 3951,2
0,00069
0,00000083
0,013 ps
2+ ; 3771,69
0,0083
0,00039
0,029
0,0079
3+ ; 3472,1
0,023
0,0132
0,216
0,0216
0,05 ps
2+ ; 3161,73
0,071
0,167
0,462
0,0039
0,6 ps
2+ ; 2964,777
0,0085
0,0381
0,029
4+ ; 2767,5
0,02
4+ ; 2369,6
0,003
0,017
98,268
2+ ; 1434,083
1,466
96,474
Stable
0+ ; 0
52 Cr 24 28
Q+ = 5089,7 keV
% β+ + %ε = 98,295


γ Emission intensities
per 100 disintegrations
1,639
1
2+ ; 377,749
21,1 min
6+ ; 0
5,592 (3) d
0
52
Mn
25 27
Q^IT = 377,749 keV
% IT = 1,705