$^{56}_{27}\mathrm{Co}_{29}$

1 Decay Scheme

^{56}Co decays 20,02 (28) % by β^+ emission and 79,98 (28) % by electron capture to ^{56}Fe. ^{56}Co emits γ-rays with energies up to 3612 keV that are useful for the calibration of germanium detectors.

Le ^{56}Co se désintègre par émission β^+ à 20,02 (28) % et par capture électronique à 79,98 (28) % vers le ^{56}Fe. Le ^{56}Co émet des rayonnements γ d'énergies allant jusqu'à 3612 keV, utiles pour l'étalonnage des détecteurs germanium.

2 Nuclear Data

$T_{1/2}$(^{56}Co)	:	77,245	(20)	d
Q^+(^{56}Co)	:	4566,6	(4)	keV

2.1 Electron Capture Transitions

	Energy (keV)	Probability (%)	Nature	log ft	P_K	P_L	P_M
$\epsilon_{0,15}$	108,3 (4)	0,211 (7)	Allowed	6,92	0,87202 (38)	0,10944 (27)	0,01741 (10)
$\epsilon_{0,14}$	119,2 (6)	0,0163 (7)	Allowed	8,12	0,87327 (38)	0,10839 (27)	0,01722 (10)
$\epsilon_{0,13}$	171,78 (40)	0,2136 (23)	Allowed	7,33	0,87698 (34)	0,10527 (23)	0,01667 (10)
$\epsilon_{0,12}$	268,6 (4)	3,680 (13)	Allowed	6,5	0,87989 (32)	0,10283 (22)	0,01623 (9)
$\epsilon_{0,11}$	446,75 (40)	9,90 (3)	Allowed	6,52	0,88188 (31)	0,10115 (21)	0,01593 (9)
$\epsilon_{0,10}$	466,33 (40)	12,46 (4)	Allowed	6,46	0,88201 (31)	0,10105 (21)	0,01591 (9)
$\epsilon_{0,9}$	517,8 (4)	3,936 (20)	Allowed	7,05	0,88229 (31)	0,10081 (21)	0,01587 (9)
$\epsilon_{0,8}$	710,18 (40)	16,83 (5)	Allowed	6,69	0,88297 (30)	0,10024 (21)	0,01577 (9)
$\epsilon_{0,7}$	1121,33 (40)	21,20 (9)	Allowed	6,99	0,88364 (30)	0,09968 (21)	0,01567 (9)
$\epsilon_{0,6}$	1196,74 (41)	0,014 (6)	2nd Forbidden	10,97	0,88231 (31)	0,10081 (21)	0,01586 (9)
$\epsilon_{0,5}$	1443,7 (4)	9,02 (6)	Allowed	7,59	0,88389 (30)	0,09946 (21)	0,01563 (9)
$\epsilon_{0,4}$	1606,69 (40)	0,025 (11)	2nd Forbidden	11,22	0,8830 (3)	0,10022 (21)	0,01576 (9)
$\epsilon_{0,2}$	2481,54 (40)	2,451 (26)	Allowed	8,64	0,88426 (30)	0,09916 (21)	0,01558 (9)
$\epsilon_{0,1}$	3719,83 (40)	0,038 (10)	2nd Forbidden	12,52	0,88404 (30)	0,09934 (21)	0,01561 (9)

2.2 β^+ Transitions

	Energy (keV)	Probability (%)	Nature	log ft
$\beta^+_{0,7}$	99,33 (40)	0,00808 (19)	Allowed	6,99
$\beta^+_{0,6}$	174,74 (41)	0,0000040 (17)	2nd Forbidden	10,97
$\beta^+_{0,5}$	421,7 (4)	1,042 (10)	Allowed	7,59
$\beta^+_{0,4}$	584,7 (4)	0,0016 (7)	2nd Forbidden	11,22
$\beta^+_{0,2}$	1459,54 (40)	18,25 (19)	Allowed	8,64
$\beta^+_{0,1}$	2697,83 (40)	0,72 (20)	2nd Forbidden	12,52

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_T (10^{-4})	α_π (10^{-4})
$\gamma_{11,8}$(Fe)	263,41 (10)	0,023 (2)					
$\gamma_{8,7}$(Fe)	411,38 (8)	0,0254 (25)					
$\gamma_{8,6}$(Fe)	486,54 (11)	0,057 (5)					
$\gamma_{10,7}$(Fe)	655,0 (8)	0,043 (5)					
$\gamma_{11,7}$(Fe)	674,7 (8)	0,031 (5)					
$\gamma_{8,5}$(Fe)	733,5137 (23)	0,1911 (40)	M1+0,04%E2	2,66 (4)	0,254 (4)	2,95 (5)	
$\gamma_{7,3}$(Fe)	787,7451 (23)	0,310 (5)	M1+42%E2	2,69 (21)	0,257 (21)	2,98 (24)	
$\gamma_{1,0}$(Fe)	846,7707 (19)	99,9713 (32)	E2	2,67 (4)	0,256 (4)	2,96 (5)	
$\gamma_{12,7}$(Fe)	852,79 (5)	0,049 (3)					
$\gamma_{8,4}$(Fe)	896,511 (7)	0,071 (4)					
$\gamma_{10,5}$(Fe)	977,3722 (40)	1,422 (7)	M1(+0,49%E2)	1,480 (21)	0,1407 (20)	1,641 (23)	
$\gamma_{11,5}$(Fe)	996,949 (5)	0,113 (4)	M1+82%E2	1,71 (5)	0,163 (5)	1,90 (6)	
$\gamma_{5,2}$(Fe)	1037,8436 (24)	14,06 (5)	M1	1,312 (19)	0,1246 (18)	1,455 (21)	
$\gamma_{9,4}$(Fe)	1089,04 (24)	0,054 (7)	M1+16%E2	1,23 (3)	0,1171 (25)	1,37 (3)	
$\gamma_{10,4}$(Fe)	1140,368 (7)	0,1329 (30)					
$\gamma_{11,4}$(Fe)	1159,946 (8)	0,091 (5)	M1+0,41%E2	1,057 (15)	0,1003 (14)	1,200 (17)	0,0290 (4)
$\gamma_{12,5}$(Fe)	1175,1011 (22)	2,254 (7)	M1+1,9%E2	1,033 (15)	0,0980 (14)	1,185 (17)	0,0401 (6)
$\gamma_{8,3}$(Fe)	1198,79 (20)	0,047 (5)					
$\gamma_{2,1}$(Fe)	1238,2883 (22)	66,42 (17)	E2	1,077 (15)	0,1025 (15)	1,349 (19)	0,1548 (22)
$\gamma_{13,5}$(Fe)	1272,2 (6)	0,0195 (10)					
$\gamma_{15,5}$(Fe)	1335,397 (29)	0,1219 (30)					
$\gamma_{7,2}$(Fe)	1360,2138 (40)	4,281 (21)	M1+1,2%E2	0,781 (11)	0,0740 (11)	1,183 (17)	0,318 (5)
$\gamma_{10,3}$(Fe)	1442,77 (8)	0,180 (4)					
$\gamma_{11,3}$(Fe)	1462,36 (12)	0,0777 (11)					
$\gamma_{12,3}$(Fe)	1640,476 (5)	0,0616 (30)					
$\gamma_{8,2}$(Fe)	1771,3571 (30)	15,436 (40)	M1+0,0016%E2	0,481 (7)	0,0456 (7)	2,14 (3)	1,603 (23)
$\gamma_{3,1}$(Fe)	1810,7575 (40)	0,640 (5)	M1+3,14%E2	0,464 (7)	0,0439 (7)	2,28 (4)	1,770 (25)
$\gamma_{9,2}$(Fe)	1963,740 (11)	0,704 (3)	M1+4,6%E2	0,403 (6)	0,0381 (6)	2,86 (4)	2,41 (4)
$\gamma_{10,2}$(Fe)	2015,215 (5)	3,020 (15)	M1+31,6%E2	0,391 (6)	0,0370 (6)	3,23 (5)	2,79 (5)
$\gamma_{11,2}$(Fe)	2034,792 (5)	7,753 (20)	M1+0,53%E2	0,378 (6)	0,0357 (5)	3,11 (5)	2,69 (4)
$\gamma_{4,1}$(Fe)	2113,135 (6)	0,3762 (40)	M1+6,8%E2	0,355 (5)	0,0336 (5)	3,46 (5)	3,07 (5)
$\gamma_{12,2}$(Fe)	2212,9450 (30)	0,3883 (40)	M1+90%E2	0,342 (5)	0,0324 (5)	4,48 (10)	4,1 (1)
$\gamma_{5,1}$(Fe)	2276,41 (16)	0,119 (5)	E2	0,327 (5)	0,0310 (5)	4,84 (7)	4,48 (7)
$\gamma_{15,2}$(Fe)	2373,75 (40)	0,081 (6)					
$\gamma_{6,1}$(Fe)	2523,1 (8)	0,061 (5)	M1+6%E2	0,264 (4)	0,0249 (4)	5,14 (10)	4,85 (10)
$\gamma_{7,1}$(Fe)	2598,5028 (40)	16,78 (8)	M1+7,3%E2	0,251 (4)	0,0237 (4)	5,47 (8)	5,19 (8)
$\gamma_{3,0}$(Fe)	2657,5 (8)	0,019 (3)					
$\gamma_{8,1}$(Fe)	3009,6459 (40)	1,028 (12)	M1+0,42%E2	0,198 (3)	0,0187 (3)	7,06 (10)	6,84 (10)
$\gamma_{9,1}$(Fe)	3202,028 (11)	3,181 (18)	M1+20%E2	0,181 (3)	0,01706 (24)	8,02 (12)	7,82 (11)
$\gamma_{10,1}$(Fe)	3253,504 (5)	7,67 (3)	E2	0,181 (3)	0,01708 (24)	9,09 (13)	8,89 (13)

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K (10^{-4})	α_L (10^{-4})	α_T (10^{-4})	α_π (10^{-4})
$\gamma_{11,1}$(Fe)	3273,081 (6)	1,813 (14)	M1+14,99%E2	0,1744 (25)	0,01645 (23)	8,24 (12)	8,05 (12)
$\gamma_{6,0}$(Fe)	3369,80 (30)	0,0097 (10)					
$\gamma_{12,1}$(Fe)	3451,2333 (40)	0,928 (9)	E2	0,1651 (24)	0,01558 (22)	9,87 (14)	9,68 (14)
$\gamma_{13,1}$(Fe)	3548,05 (6)	0,1943 (20)	M1+8,3%E2	0,1537 (22)	0,01450 (21)	9,19 (13)	9,02 (13)
$\gamma_{14,1}$(Fe)	3600,62 (40)	0,0163 (7)					
$\gamma_{15,1}$(Fe)	3611,9 (8)	0,0084 (4)					

3 Atomic Data

3.1 Fe

ω_K	:	0,355	(4)
$\bar{\omega}_L$	:	0,0060	(6)
n_{KL}	:	1,447	(4)

3.1.1 X Radiations

		Energy (keV)	Relative probability
X_K			
	$K\alpha_2$	6,39091	51,07
	$K\alpha_1$	6,40391	100
	$K\beta_1$	7,05804	} 20,66638
	$K\beta_5''$	7,1083	}
X_L			
	$L\ell$	0,617	
	$L\alpha$	0,7075 - 0,7084	
	$L\eta$	0,6306	
	$L\beta$	0,7148 - 0,8454	
	$L\gamma$	0,72841 - 0,72841	

3.1.2 Auger Electrons

	Energy (keV)	Relative probability
Auger K		
KLL	5,370 - 5,645	100
KLX	6,158 - 6,400	27,4
KXY	6,926 - 7,105	1,87
Auger L	0,5223 - 0,8421	

4 Electron Emissions

		Energy (keV)	Electrons (per 100 disint.)
e_{AL}	(Fe)	0,5223 - 0,8421	109,7 (6)
e_{AK}	(Fe)		
	KLL	5,370 - 5,645	45,57 (30)
	KLX	6,158 - 6,400	
	KXY	6,926 - 7,105	
$ec_{1,0\ T}$	(Fe)	839,6660 - 846,7774	0,0296 (5)
$ec_{10,5\ T}$	(Fe)	970,281 - 977,393	0,0002334 (35)
$ec_{5,2\ T}$	(Fe)	1030,7540 - 1037,8651	0,002046 (30)
$ec_{12,5\ T}$	(Fe)	1168,014 - 1175,126	0,0002671 (39)
$ec_{2,1\ T}$	(Fe)	1231,2150 - 1238,3263	0,00896 (13)
$ec_{7,2\ T}$	(Fe)	1353,132 - 1360,244	0,000506 (8)
$ec_{8,2\ T}$	(Fe)	1764,279 - 1771,391	0,003302 (47)
$ec_{3,1\ T}$	(Fe)	1803,700 - 1810,812	0,0001459 (28)
$ec_{9,2\ T}$	(Fe)	1956,672 - 1963,784	0,0002012 (29)
$ec_{10,2\ T}$	(Fe)	2008,147 - 2015,259	0,000975 (16)
$ec_{11,2\ T}$	(Fe)	2027,720 - 2034,832	0,002410 (39)
$ec_{4,1\ T}$	(Fe)	2106,082 - 2113,194	0,0001301 (23)
$ec_{12,2\ T}$	(Fe)	2205,880 - 2212,992	0,0001738 (43)
$ec_{7,1\ T}$	(Fe)	2591,46 - 2598,57	0,00917 (14)
$ec_{8,1\ T}$	(Fe)	3002,605 - 3009,717	0,000725 (13)
$ec_{9,1\ T}$	(Fe)	3195,00 - 3202,11	0,002547 (41)
$ec_{10,1\ T}$	(Fe)	3246,473 - 3253,585	0,00696 (10)
$ec_{11,1\ T}$	(Fe)	3266,046 - 3273,158	0,001491 (25)
$ec_{12,1\ T}$	(Fe)	3444,206 - 3451,318	0,000914 (16)
$ec_{13,1\ T}$	(Fe)	3541,04 - 3548,15	0,0001782 (31)
$\beta^+_{0,1}$	max:	2697,83 (40)	0,72 (20)
	avg:	1223,77 (19)	
$\beta^+_{0,2}$	max:	1459,54 (40)	18,25 (19)
	avg:	623,27 (18)	
$\beta^+_{0,4}$	max:	584,7 (4)	0,0016 (7)
	avg:	271,31 (18)	
$\beta^+_{0,5}$	max:	421,7 (4)	1,042 (10)
	avg:	178,87 (17)	
$\beta^+_{0,6}$	max:	174,74 (41)	0,0000040 (17)
	avg:	87,08 (19)	
$\beta^+_{0,7}$	max:	99,33 (40)	0,00808 (19)
	avg:	45,58 (17)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy (keV)	Photons (per 100 disint.)	
XL	(Fe)	0,617 - 0,8454	0,571 (17)	
XKα_2	(Fe)	6,39091	7,46 (10)	} Kα
XKα_1	(Fe)	6,40391	14,61 (17)	}
XKβ_1	(Fe)	7,05804	} 3,02 (5)	K$'\beta_1$
XKβ_5''	(Fe)	7,1083	}	

5.2 Gamma Emissions

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{11,8}$(Fe)	263,41 (10)	0,023 (2)
$\gamma_{8,7}$(Fe)	411,38 (8)	0,0254 (25)
$\gamma_{8,6}$(Fe)	486,54 (11)	0,057 (5)
$\gamma^{\pm}$	511	40,04 (38)
$\gamma_{10,7}$(Fe)	655,0 (8)	0,043 (5)
$\gamma_{11,7}$(Fe)	674,7 (8)	0,031 (5)
$\gamma_{8,5}$(Fe)	733,5085 (23)	0,191 (4)
$\gamma_{7,3}$(Fe)	787,7391 (23)	0,310 (5)
$\gamma_{1,0}$(Fe)	846,7638 (19)	99,9417 (32)
$\gamma_{12,7}$(Fe)	852,78 (5)	0,049 (3)
$\gamma_{8,4}$(Fe)	896,503 (7)	0,071 (4)
$\gamma_{10,5}$(Fe)	977,363 (4)	1,422 (7)
$\gamma_{11,5}$(Fe)	996,939 (5)	0,113 (4)
$\gamma_{5,2}$(Fe)	1037,8333 (24)	14,06 (5)
$\gamma_{9,4}$(Fe)	1089,03 (24)	0,054 (7)
$\gamma_{10,4}$(Fe)	1140,356 (7)	0,1329 (30)
$\gamma_{11,4}$(Fe)	1159,933 (8)	0,091 (5)
$\gamma_{12,5}$(Fe)	1175,0878 (22)	2,254 (7)
$\gamma_{8,3}$(Fe)	1198,78 (20)	0,047 (5)
$\gamma_{2,1}$(Fe)	1238,2736 (22)	66,41 (17)
$\gamma_{13,5}$(Fe)	1272,2 (6)	0,0195 (10)
$\gamma_{15,5}$(Fe)	1335,380 (29)	0,1219 (30)
$\gamma_{7,2}$(Fe)	1360,196 (4)	4,280 (21)
$\gamma_{10,3}$(Fe)	1442,75 (8)	0,180 (4)
$\gamma_{11,3}$(Fe)	1462,34 (12)	0,0777 (11)
$\gamma_{12,3}$(Fe)	1640,450 (5)	0,0616 (30)
$\gamma_{8,2}$(Fe)	1771,327 (3)	15,43 (4)
$\gamma_{3,1}$(Fe)	1810,726 (4)	0,640 (5)

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{9,2}$(Fe)	1963,703 (11)	0,7036 (30)
$\gamma_{10,2}$(Fe)	2015,176 (5)	3,018 (15)
$\gamma_{11,2}$(Fe)	2034,752 (5)	7,749 (20)
$\gamma_{4,1}$(Fe)	2113,092 (6)	0,376 (4)
$\gamma_{12,2}$(Fe)	2212,898 (3)	0,388 (4)
$\gamma_{5,1}$(Fe)	2276,36 (16)	0,119 (5)
$\gamma_{15,2}$(Fe)	2373,7 (4)	0,081 (6)
$\gamma_{6,1}$(Fe)	2523,0 (8)	0,061 (5)
$\gamma_{7,1}$(Fe)	2598,438 (4)	16,76 (8)
$\gamma_{3,0}$(Fe)	2657,4 (8)	0,019 (3)
$\gamma_{8,1}$(Fe)	3009,559 (4)	1,027 (12)
$\gamma_{9,1}$(Fe)	3201,930 (11)	3,176 (18)
$\gamma_{10,1}$(Fe)	3253,402 (5)	7,656 (30)
$\gamma_{11,1}$(Fe)	3272,978 (6)	1,810 (14)
$\gamma_{6,0}$(Fe)	3369,69 (30)	0,0097 (10)
$\gamma_{12,1}$(Fe)	3451,119 (4)	0,926 (9)
$\gamma_{13,1}$(Fe)	3547,93 (6)	0,1939 (20)
$\gamma_{14,1}$(Fe)	3600,5 (4)	0,0163 (7)
$\gamma_{15,1}$(Fe)	3611,8 (8)	0,0084 (4)

6 Main Production Modes

$^{56}Fe(p,n)^{56}Co$
Possible impurities: ^{57}Co, ^{58}Co

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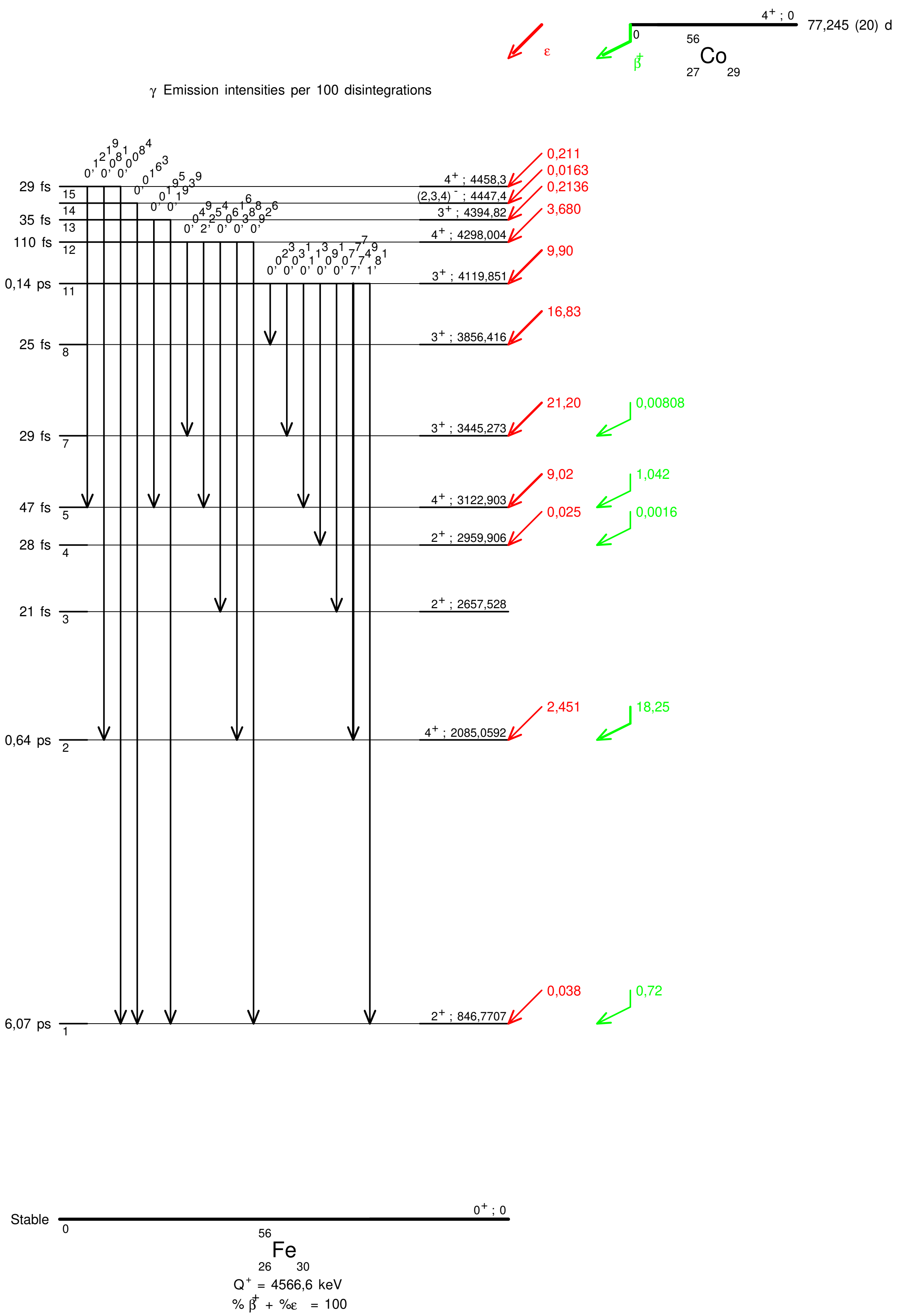
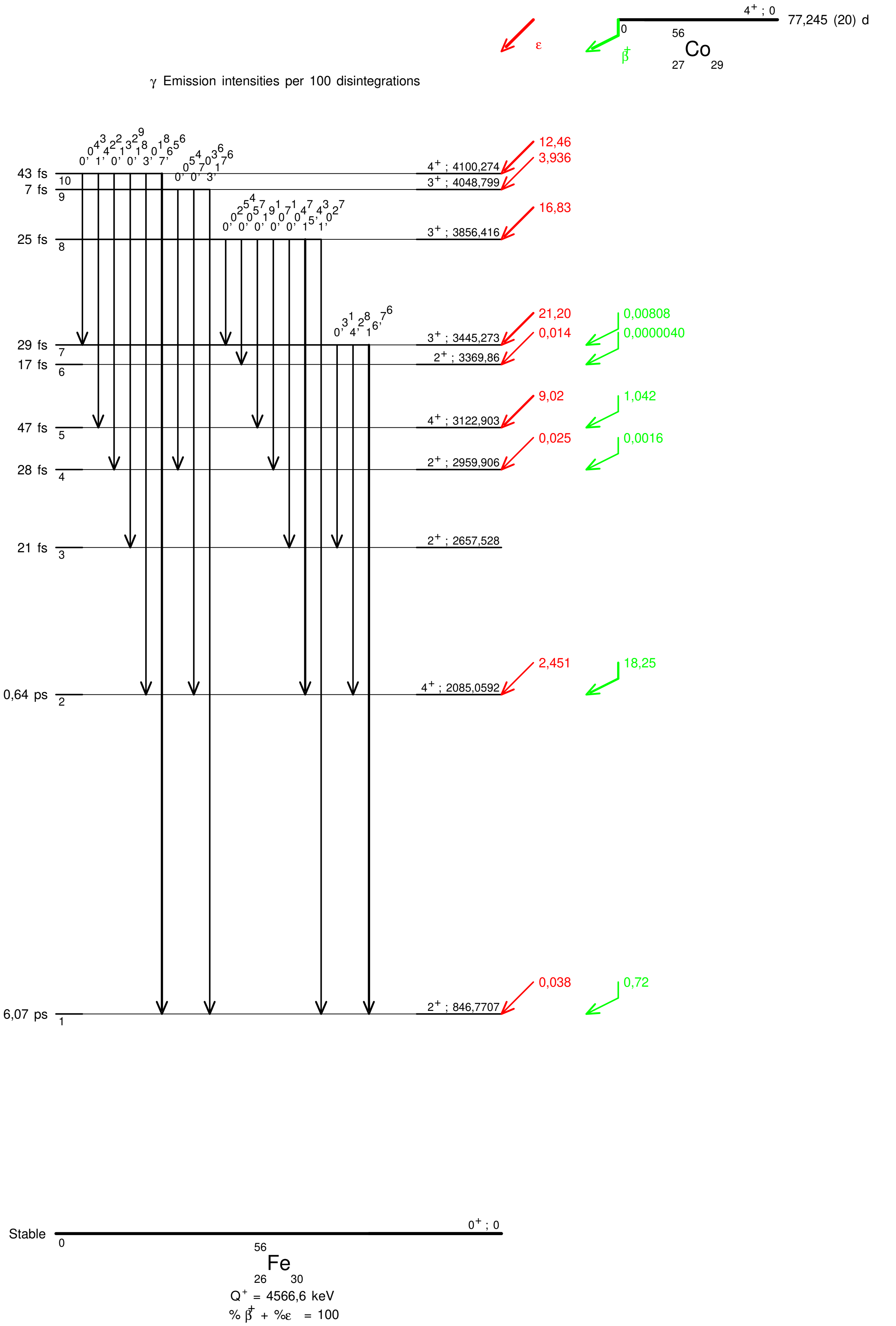

4+ ; 0
77,245 (20) d
ε
β+
56 Co 27 29
γ Emission intensities per 100 disintegrations
29 fs
35 fs
110 fs
0,14 ps
25 fs
29 fs
47 fs
28 fs
21 fs
0,64 ps
6,07 ps
Stable
4+ ; 4458,3
(2,3,4)- ; 4447,4
3+ ; 4394,82
4+ ; 4298,004
3+ ; 4119,851
3+ ; 3856,416
3+ ; 3445,273
4+ ; 3122,903
2+ ; 2959,906
2+ ; 2657,528
4+ ; 2085,0592
2+ ; 846,7707
0+ ; 0
0,211
0,0163
0,2136
3,680
9,90
16,83
21,20
0,00808
9,02
1,042
0,025
0,0016
2,451
18,25
0,038
0,72
56 Fe 26 30
Q+ = 4566,6 keV
% β+ + %ε = 100


4+ ; 0
77,245 (20) d
0
56 Co 27 29
ε
β+
γ Emission intensities per 100 disintegrations
43 fs 10
7 fs 9
25 fs 8
29 fs 7
17 fs 6
47 fs 5
28 fs 4
21 fs 3
0,64 ps 2
6,07 ps 1
Stable 0
4+ ; 4100,274
3+ ; 4048,799
3+ ; 3856,416
3+ ; 3445,273
2+ ; 3369,86
4+ ; 3122,903
2+ ; 2959,906
2+ ; 2657,528
4+ ; 2085,0592
2+ ; 846,7707
0+ ; 0
12,46
3,936
16,83
21,20
0,014
9,02
0,025
2,451
0,038
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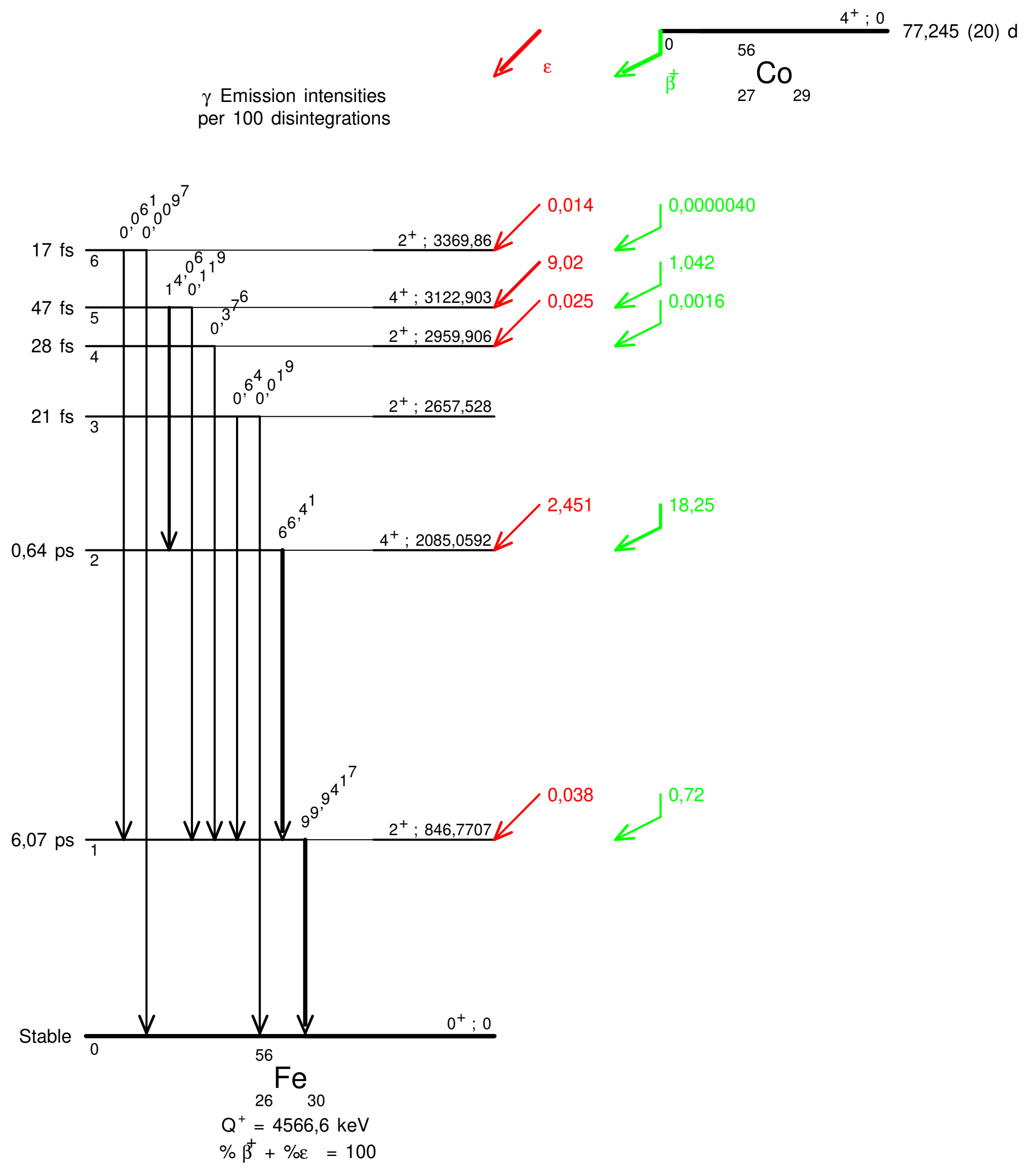
0,0000040
1,042
0,0016
18,25
0,72
56 Fe 26 30
Q+ = 4566,6 keV
% β+ + %ε = 100



4+ ; 0
77,245 (20) d
ε
β+
0
56
Co
27 29
γ Emission intensities
per 100 disintegrations
0,061
0,0097
17 fs
6
2+ ; 3369,86
0,014
0,0000040
14,06
0,119
9,02
1,042
47 fs
5
4+ ; 3122,903
0,376
0,025
0,0016
28 fs
4
2+ ; 2959,906
0,64
0,019
21 fs
3
2+ ; 2657,528
66,41
2,451
18,25
0,64 ps
2
4+ ; 2085,0592
99,9417
0,038
0,72
6,07 ps
1
2+ ; 846,7707
Stable
0
0+ ; 0
56
Fe
26 30
Q+ = 4566,6 keV
% β+ + %ε = 100