$^{232}_{92}\mathrm{U}_{140}$

1 Decay Scheme

Uranium 232 decays primarily by alpha decay to excited states in Th-228. A small branching of exotic decay via Ne-24 emission and a smaller branching of spontaneous fission have been reported.
L'uranium 232 se désintègre essentiellement par transitions alpha vers des niveaux excités de thorium 228. De faibles décroissances par fission spontanée et par émission de néon 24 ont été observées.

2 Nuclear Data

$T_{1/2}(^{232}\mathrm{U})$	:	70,6	(11)	a
$T_{1/2}(^{228}\mathrm{Th})$	:	1,9127	(6)	a
$Q^{\alpha}(^{232}\mathrm{U})$	:	5413,63	(9)	keV

2.1 α Transitions

	Energy keV	Probability × 100	F
$\alpha_{0,8}$	4539,16 (9)	0,0000033 (9)	33
$\alpha_{0,7}$	4581,81 (9)	0,0000214 (16)	10,6
$\alpha_{0,6}$	4894,44 (9)	0,000054 (4)	712
$\alpha_{0,5}$	5017,55 (9)	0,000048 (4)	5270
$\alpha_{0,4}$	5035,45 (9)	0,000051 (6)	6490
$\alpha_{0,3}$	5085,63 (9)	0,00622 (9)	112
$\alpha_{0,2}$	5226,81 (9)	0,325 (6)	16,4
$\alpha_{0,1}$	5355,87 (9)	30,6 (6)	1,04
$\alpha_{0,0}$	5413,63 (9)	69,1 (6)	1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ × 100	Multipolarity	α_K	α_L	α_M	α_T
$\gamma_{1,0}$(Th)	57,752 (13)	30,8 (8)	E2	0	112,2 (16)	30,7 (5)	153,2 (22)
$\gamma_{2,1}$(Th)	129,064 (6)	0,325 (5)	E2	0,264 (4)	2,54 (4)	0,697 (10)	3,74 (6)
$\gamma_{6,4}$(Th)	141,013 (12)	0,0000038 (16)	E1	0,1690 (24)	0,0362 (5)	0,00876 (13)	0,217 (3)
$\gamma_{4,2}$(Th)	191,356 (11)	0,000055 (5)	E2	0,1710 (24)	0,443 (7)	0,1209 (17)	0,776 (11)
$\gamma_{5,2}$(Th)	209,255 (11)	0,0000119 (33)	E1	0,0672 (10)	0,01333 (19)	0,00321 (5)	0,0848 (12)
$\gamma_{3,1}$(Th)	270,244 (6)	0,00332 (7)	E1	0,0376 (6)	0,00716 (10)	0,001717 (24)	0,0470 (7)
$\gamma_{3,0}$(Th)	328,003 (4)	0,00292 (7)	E1	0,0245 (4)	0,00455 (7)	0,001089 (16)	0,0305 (5)
$\gamma_{6,2}$(Th)	332,369 (7)	0,0000505 (31)	E1	0,0238 (4)	0,00441 (7)	0,001056 (15)	0,0297 (5)
$\gamma_{5,1}$(Th)	338,319 (11)	0,0000381 (19)	E1	0,0229 (4)	0,00424 (6)	0,001014 (15)	0,0285 (4)
$\gamma_{8,5}$(Th)	478,395 (21)	0,0000014 (6)	E1	0,011180 (16)	0,00198 (3)	0,000471 (7)	0,01379 (20)
$\gamma_{7,3}$(Th)	503,820 (11)	0,0000147 (9)	E1	0,01009 (15)	0,001775 (25)	0,000422 (6)	0,01243 (18)
$\gamma_{8,3}$(Th)	546,470 (18)	0,0000010 (6)	E1	0,00861 (12)	0,001500 (21)	0,000357 (5)	0,01058 (15)
$\gamma_{7,1}$(Th)	774,064 (11)	0,0000048 (8)	E2	0,01204 (17)	0,00333 (5)	0,000835 (12)	0,01649 (23)
$\gamma_{8,1}$(Th)	816,714 (18)	0,00000083 (31)	M1+E2	0,0284 (4)	0,00566 (8)	0,001369 (20)	0,0359 (5)
$\gamma_{7,0}$(Th)	831,823 (10)	0,000002 (1)	E0				

3 Atomic Data

3.1 Th

ω_K : 0,969 (4)
$\bar{\omega}_L$: 0,476 (18)
n_{KL} : 0,797 (5)

3.1.1 X Radiations

		Energy keV		Relative probability
X_K				
	$K\alpha_2$	89,954		61,82
	$K\alpha_1$	93,351		100
	$K\beta_3$	104,819	}	
	$K\beta_1$	105,604	}	
	$K\beta_5''$	106,239	}	35,58
	$K\beta_2$	108,509	}	
	$K\beta_4$	108,955	}	11,99
	$KO_{2,3}$	109,442	}	
X_L				
	$L\ell$	11,1177		
	$L\alpha$	12,8085 – 12,967		
	$L\eta$	14,509		
	$L\beta$	14,972 – 16,4253		
	$L\gamma$	18,3633 – 19,5043		

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	68,406 – 76,745	100
KLX	83,857 – 93,345	58,8
KXY	99,29 – 109,64	8,64
Auger L	5,8 – 20,3	

4 α Emissions

	Energy keV	Probability × 100
$\alpha_{0,8}$	4460,86 (9)	0,0000033 (9)
$\alpha_{0,7}$	4502,77 (9)	0,0000214 (16)
$\alpha_{0,6}$	4810,01 (9)	0,000054 (4)
$\alpha_{0,5}$	4931,00 (9)	0,000048 (4)
$\alpha_{0,4}$	4948,59 (9)	0,000051 (6)
$\alpha_{0,3}$	4997,90 (9)	0,00622 (9)
$\alpha_{0,2}$	5136,64 (9)	0,325 (6)
$\alpha_{0,1}$	5263,48 (9)	30,6 (6)
$\alpha_{0,0}$	5320,24 (9)	69,1 (6)

5 Electron Emissions

		Energy keV	Electrons per 100 disint.
e_{AL}	(Th)	5,8 - 20,3	11,62 (22)
e_{AK}	(Th)		0,00057 (8)
	KLL	68,406 - 76,745 }	
	KLX	83,857 - 93,345 }	
	KXY	99,29 - 109,64 }	
$ec_{1,0\ L}$	(Th)	37,28 - 41,50	22,4 (6)
$ec_{1,0\ M}$	(Th)	52,57 - 54,42	6,14 (16)
$ec_{1,0\ N}$	(Th)	56,420 - 57,417	1,646 (41)
$ec_{2,1\ L}$	(Th)	108,592 - 112,800	0,1742 (33)

6 Photon Emissions

6.1 X-Ray Emissions

		Energy keV		Photons per 100 disint.	
XL	(Th)	11,1177 — 19,5043		11,00 (24)	
XKα_2	(Th)	89,954		0,00524 (11)	} Kα
XKα_1	(Th)	93,351		0,00847 (16)	}
XKβ_3	(Th)	104,819	}		
XKβ_1	(Th)	105,604	}	0,00301 (7)	K$'\beta_1$
XKβ_5''	(Th)	106,239	}		
XKβ_2	(Th)	108,509	}		
XKβ_4	(Th)	108,955	}	0,001016 (29)	K$'\beta_2$
XKO$_{2,3}$	(Th)	109,442	}		

6.2 Gamma Emissions

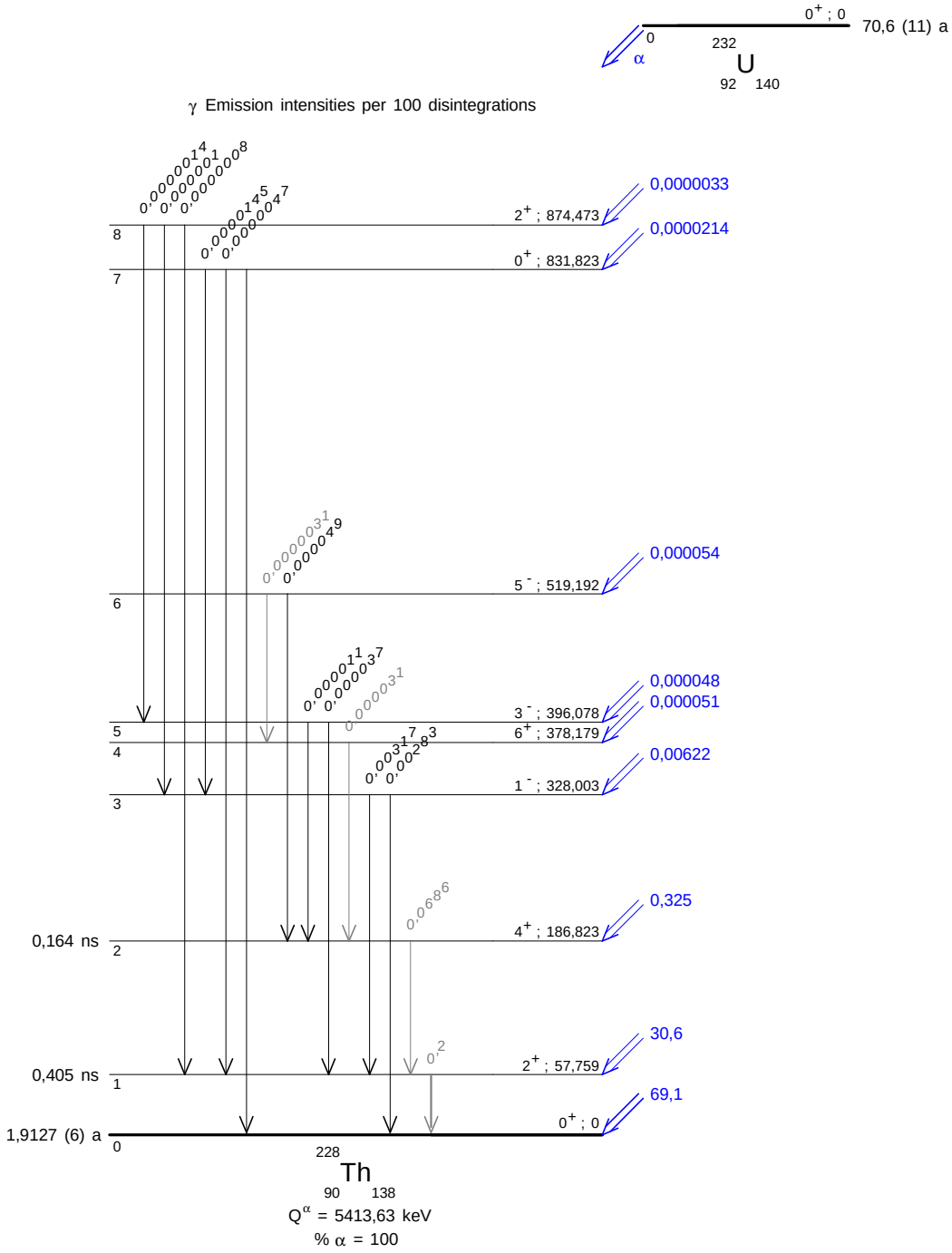
	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$(Th)	57,752 (13)	0,200 (4)
$\gamma_{2,1}$(Th)	129,065 (3)	0,0686 (7)
$\gamma_{6,4}$(Th)	140,999 (20)	0,0000031 (13)
$\gamma_{4,2}$(Th)	191,351 (11)	0,000031 (3)
$\gamma_{5,2}$(Th)	209,252 (6)	0,000011 (3)
$\gamma_{3,1}$(Th)	270,245 (7)	0,00317 (7)
$\gamma_{3,0}$(Th)	328,004 (7)	0,00283 (7)
$\gamma_{6,2}$(Th)	332,371 (6)	0,000049 (3)
$\gamma_{5,1}$(Th)	338,320 (5)	0,0000370 (18)
$\gamma_{8,5}$(Th)	478,41 (5)	0,0000014 (6)
$\gamma_{7,3}$(Th)	503,819 (23)	0,0000145 (9)
$\gamma_{8,3}$(Th)	546,454 (21)	0,0000010 (6)
$\gamma_{7,1}$(Th)	774,05 (9)	0,0000047 (8)
$\gamma_{8,1}$(Th)	816,62 (700)	0,0000008 (3)

7 References

- J. W. Gofman, Seaborg G. T.. National Nuclear Energy Series 14B (1949) 1427
  (Half life)
- R. A. James, A. E. Florin, H. H. Hopkins Jr., A. Ghiorso. National Nuclear Energy Series 14B (1949) 1604
  (Half life)

- P. A. Sellers, C. M. Stevens, M. H. Studier. Phys. Rev. 94 (1954) 952
  (Half life)
- G. Scharff-Goldhaber, E. Mateosian, G. Harbottle, M. McKeown. Phys. Rev. 99 (1955) 180
  (Alpha-particle emissions)
- F. Asaro, I. Perlman. Phys. Rev. 99 (1955) 37
  (Alpha-particle emissions)
- C. M. Lederer. Thesis, Univ. of California UCRL-11028 (1963)
  (Alpha-gamma coincidence measurements)
- J. M. Chilton, R. A. Gilbert, R. E. Leuze, W. S. Lyon. J. Inorg. Nucl. Chem. 26 (1964) 395
  (Half life)
- G. Bertolini, F. Cappellani, G. Restelli, H. L. Scherff. Nucl. Phys. 68 (1965) 170
  (Alpha-particle emissions)
- I. Ahmad. Thesis, Univ. of California UCRL-16888 (1966)
  (Gamma-ray emission probabilities)
- S. A. Baranov, L. G. Aliev, V. M. Kulakov and V. M. Shatinsii. Sov. J. Nucl. Phys. 4 (1967) 673
  (Alpha-particle emissions)
- M. Herment, C. Vieu. C. R. Acad. Sci. B 273 (1971) 1058
  (Gamma-ray emission energies)
- H. W. Taylor. Appl. Rad. Isotopes 24 (1973) 594
  (Gamma-ray emission energies)
- W. Kurcewicz, N. Kaffrell, N. Trautmann, A. Plochocki, J, Zylicz, M. Matul, K. Stryczniewicz. Nucl. Phys. A 289 (1977) 1
  (Gamma-ray emission energies and probabilities)
- H. G. Borner, G. Barreau, W. F. Davidson, P. Jeuch, T. von Egidy, J. Almeida, J. H. White. Nucl. Instrum. Meth. 166 (1979) 251
  (Gamma-ray emission energies.)
- R. G. Helmer. Nucl. Instrum. Meth. 164 (1979) 355
  (Gamma-ray emission energies)
- S. K. Aggarwal, S. B. Manohar, S. N. Acharya, S. Prakash, H. C. Jain. Phys. Rev. C 20 (1979) 1533
  (Half life)
- A. L. Nichols, M. F. James. AEA Winthrith Report 1407 (1981)
  (Previous evaluation)
- A. S. Mahajan, M. S. Bidarkundi. Ind. J. Pure Appl. Phys. 20 (1982) 701
  (Conversion electron measurements)
- R. J. Gerhke, V. J. Novick, Baker J. D.. Appl. Rad. Isotopes 35 (1984) 581
  (Gamma-ray emission probabilities)
- S. W. Barwick, P. B. Price, J. D. Stevenson. Phys. Rev. C 62 (1985) 1984
  (Cluster decay)
- M. F. Banham, R. McChrohon. AERE Report 11353 (1986)
  (Gamma-ray emission probabilities)
- J. Dalmasso, H. Maria, G. Ardisson. Phys. Rev. C 36 (1987) 2510
  (Gamma-ray emission energies)
- R. Bonetti, E. Fioretto, C. Migliorino, A. Pasinetti, F. Barranco, E. Vigezzi, R. A. Brogia.. Phys.Lett. B 241 (1990) 179
  (Cluster decay and spontaneous fission)
- H. Baltzer, K. Frietag, C. Gunther, P. Herzog, J. Manns, U. Muller, R. Paulsen, P. Sevenich, T. Weber, B. Z. Will. Z. Phys. A 352 (1995) 47
  (Gamma-ray emission energies)
- E. Schönfeld, H. Janssen. Nucl. Instrum. Meth. A 369 (1996) 527
  (X-ray and electron emissions)
- A. Artna-Cohen. Nucl. Data Sheets 80 (1997) 723
  (Adopted levels and gamma transitions)
- R. Bonetti, A. Guglielmetti. Phys. Rev. C 62 (2000) 047304
  (Spontaneous fission and cluster decay)
- E. Schönfeld, H. Janssen. Appl. Rad. Isotopes 52 (2000) 596
  (Electron and X-ray emissions)
- R. G. Helmer, C. van der Leun. Nucl. Instrum, Meth. A 450 (2000) 35
  (Gamma-ray reference energies)
- A. H. Wapstra, G. Audi, C. Thibault. Nucl. Phys. A 729 (2003) 129
  (Q-value)

- G. Audi, A. H. Wapstra, C. Thibault. Nucl.Phys. A 729 (2003) 337
(Q-value)
- T. Kibedi, T. W. Burrows, M. B. Trzhaskovskoya, C. W. Nestor. ANU-P 1684 (2004)
(The BrIcc code for internal conversion coefficients)


0+ ; 0
70,6 (11) a
0
α
232
U
92 140
γ Emission intensities per 100 disintegrations
0,0000033
0,0000214
2+ ; 874,473
0+ ; 831,823
8
7
0,000054
5 - ; 519,192
6
0,000048
0,000051
3 - ; 396,078
6+ ; 378,179
5
4
0,00622
1 - ; 328,003
3
0,325
4+ ; 186,823
0,164 ns
2
30,6
2+ ; 57,759
0,405 ns
1
69,1
0+ ; 0
1,9127 (6) a
0
228
Th
90 138
Q α = 5413,63 keV
% α = 100