

²²³Fr-Comments on evaluation of the decay data

Huang Xiaolong, Wang Baosong

This evaluation was completed in 2008. Literature available by December 2008 was included.

1 Decay Scheme

²²³Fr disintegrates 0.020 (4) % by α emission to levels in ²¹⁹At and 99.980 (4) % by β^- emission to levels in ²²³Ra. ²²³Fr ground state has $J^\pi=3/2^-$ (2001Br31).

The α decay scheme of ²²³Fr was built based on the measurement of 2001Li44. The β^- decay scheme of ²²³Fr was built based on the measurement of 1993Ab01.

The adopted $Q(\alpha)$ and $Q(\beta^-)$ values of Audi(2003Au03) are in good agreement with the $Q(\alpha)$ and $Q(\beta^-)$ values deduced from the decay scheme data.

2 Nuclear Data

The Q values are from the 2003Au03 atomic-mass adjustment.

Level energies have been deduced from a least-squares fit to γ -ray energies (GTOL computer code). Spin and parities are from 2001Br31 and 2001Li44.

The measured and our recommended ²²³Fr half-life values are listed in Table 1.

Table 1 Measured half-life values of ²²³Fr and recommended value, in minutes.

$T_{1/2}$ (min)	References	measurement method
22 (1)	1955Ad10	
21.8 (4)	1967Li17	G-M counter
22.00 (7)	1993Ab01	HPGe detector
22.00 (7)	2001Br31	NDS, weighted average of 1967Li17, 1993Ab01
21.93 (7)		Unweighted mean
21.99 (7)		LWM, $\chi^2=0.12$
22.00 (7)		Recommended value, from 1993Ab01

The recommended value is from the measurement of 1993Ab01.

2.1 γ Transitions

The γ -ray transition probabilities were deduced using the γ -ray emission intensities and relevant theoretical internal conversion coefficients.

Multipolarities and mixing ratios of γ -ray transitions for β^- decay are from 2001Br31, for α decay from 2001Li44. The mixing ratio of the 29.78keV γ -ray is from the experimental data of 1990Br23, the uncertainty was assumed to be 10 %.

The internal conversion coefficients (ICC) and their associated uncertainties have been obtained using the BrIcc computer program, which applies the ‘‘Frozen Orbital’’ approximation (2002Ba85).

2.2 α Transitions

The measured and evaluated energies of alpha particles were listed in table 2. The recommended values are from 2001Li44.

Table 2. Measured and recommended values of α -particle energies from ²²³Fr decay

1955Ad10	2001Li44	recommended
	5462 (3)	5462 (3)
	5403 (3)	5403 (3)
5340 (80)	5314 (4)	5314 (4)
	5291 (4)	5291 (4)
	5172 (5)	5172 (5)

The measured and evaluated alpha particle emission probabilities are listed in table 3. The recommended values are from 2001Li44.

Table 3. Measured and recommended α -particle emission probabilities from ²²³Fr decay

E_α/keV	$P_\alpha(10^{-4})$		
	2001Li44	Calc.	recommended
5462 (3)	33 (15)	0	33 (15)
5403 (3)	44 (20)	95 (40)	44 (20)
5314 (4)	53 (23)	70 (35)	53 (23)
5291 (4)	60 (26)	60 (30)	60 (26)
5172 (5)	9 (5)	8 (5)	9 (5)

2.3 β^- transition

The maximum energies of the β^- transitions in the decay of ²²³Fr have been deduced from the Q value (2003Au03) and the level energies.

The adopted ϵ and β^- transition probabilities and their associated uncertainties were deduced from the γ transition probability balance at each level of the decay scheme.

The electron capture subshell probabilities and $lg ft$ values were calculated using the LOGFT program.

3. Atomic data

Atomic fluorescence yields ($\omega_K, \omega_L, \omega_M, \eta_{KL}$ and η_{LM}) are from Schönfeld (1996Sc06).

The X-ray and Auger electron emission probabilities have been deduced from γ -ray and conversion electron data using the computer code RADLST. Measured and calculated X-ray emission probabilities are compared in Table 4.

Table 4 Comparison of calculated and measured Ra X-ray emission intensities

	1982AIZL	Adopted (deduced)
$K_{\alpha 1}$	2.4 (5)	2.3 (3)
$K_{\alpha 2}$	1.43 (28)	1.44 (19)

The radium KX-ray emission probabilities, deduced from γ -ray data, agree with the measured values of 1982AIZL, thus confirming the completeness of the decay scheme.

4. Electron Emissions.

The conversion electron emission probabilities have been deduced from γ -ray emission probabilities and theoretical conversion coefficients.

5. Photon Emissions

5.1 γ -ray energy values

There is one measurement of γ -ray energies from ²²³Fr α decay, that's 2001Li44. Our recommended γ -ray energies from ²²³Fr α decay are from 2001Li44. The 24.14keV γ -ray, which was observed in ²²³Fr decay was assigned by evaluators to ²²³Fr α decay.

The measured and recommended γ -ray energies from ²²³Fr β^- decay are listed in table 5. The recommended values are from 1993Ab01.

Table 5 Measured and recommended values of γ -ray energies from ²²³Fr β^- decay

1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
			20.27 (5)	20.27 (5)
			27.27 (3) ^b	27.27 (3) ^b
			29.78 (4)	29.78 (4)
			31.69 (5)	31.69 (5)
			43.5 (2)	43.5 (2)
			44.0 (1)	44.0 (1)
			49.80 (5)	49.80 (5)
50 (2)	50.8 (5)	50.087 (12)	50.10 (2)	50.10 (2)
	61.0 (15)		61.43 (5)	61.43 (5)
			62.31 (6)	62.31 (6)
			73.5 (1)	73.5 (1)
80 (2)	80.0 (4)	79.651 (13)	79.65 (2)	79.65 (2)
		88.483 (11)	89.08 (10)	89.08 (10)
100 (5)			93.88 (5)	93.88 (5)
			111.05 (3)	111.05 (3)
136 (5)	134.4 (4)	134.641 (22)	134.60 (2)	134.60 (2)
			150.6 (4) ^b	150.6 (4) ^b
			155.5 (5)	155.5 (5)
167 (8)	173.1 (5)	173.393 (38)	173.35 (5)	173.35 (5)
	184.5 (5)	184.693 (38)	184.65 (5)	184.65 (5)
191 (15)			200.7 (2)	200.7 (2)
205 (5)	204.8 (4)	204.948 (15)	204.85 (5)	204.85 (5)
			205.6 (2)	205.6 (2)
			210.60 (5)	210.60 (5)
			218.80 (5)	218.80 (5)
			222.9 (3) ^b	222.9 (3) ^b
234 (3)	234.6 (4)	234.796 (10)	234.70 (5)	234.70 (5)
			236.05 (5)	236.05 (5)
	246 (1)	245.56 (21)	245.60 (5)	245.60 (5)
	250.6 (10)	250.12 (12)	250.25 (5) ^a	250.25 (5) ^a
			254.6 (2)	254.6 (2)
	256 (1)	256.09 (18)	256.18 (5)	256.18 (5)

1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
			262.9 (2)	262.9 (2)
			269.6 (3) ^b	269.6 (3) ^b
			272.8 (2)	272.8 (2)
			280.7 (5) ^a	280.7 (5) ^a
	286.0 (15)	285.9 (6)	286.0 (2)	286.0 (2)
289 (10)	289.6 (15)	289.73 (10)	289.67 (5)	289.67 (5)
			293.2 (2) ^b	293.2 (2) ^b
			296.5 (2)	296.5 (2)
	300.0 (15)	299.92 (20)	299.95 (5)	299.95 (5)
	304.2 (15)		304.40 (5)	304.40 (5)
	307.3 (15)	307.63 (20)	307.93 (5) ^a	307.93 (5) ^a
	313.3 (15)	312.7 (7)	312.65 (5)	312.65 (5)
			314.6 (2)	314.6 (2)
318 (10)	319.0 (5)	319.266 (22)	319.25 (5)	319.25 (5)
	330.0 (15)		329.80 (5)	329.80 (5)
	333.1 (15)		334.30 (6)	334.30 (6)
	338.7 (10)		339.50 (5)	339.50 (5)
	343.0 (15)		342.50 (7)	342.50 (7)
355 (12)			350.5 (2)	350.5 (2)
	369.0 (5)	369.46 (6)	369.32 (5)	369.32 (5)
			382.3 (2) ^b	382.3 (2) ^b
			434.4 (1)	434.4 (1)
			439.6 (3)	439.6 (3)
			444.5 (3)	444.5 (3)
			452.9 (2) ^a	452.9 (2) ^a
			457.5 (2)	457.5 (2)
			469.3 (2) ^a	469.3 (2) ^a
			475.4 (1) ^a	475.4 (1) ^a
			480.9 (3)	480.9 (3)
			493.4 (2)	493.4 (2)
			506.9 (2)	506.9 (2)
			516.7 (2)	516.7 (2)
			524.8 (2)	524.8 (2)
			533.1 (3)	533.1 (3)
			537.2 (2) ^a	537.2 (2) ^a
			539.8 (2)	539.8 (2)
			545.4 (4)	545.4 (4)
			552.3 (2)	552.3 (2)
			556.3 (3)	556.3 (3)
		568.85 (15)	569.03 (8)	569.03 (8)
			576.1 (4)	576.1 (4)
			581.3 (4)	581.3 (4)
			592.3 (2)	592.3 (2)
			596.9 (4)	596.9 (4)
			600.7 (4)	600.7 (4)

1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
			607.6 (3)	607.6 (3)
			613.6 (4)	613.6 (4)
			632.7 (3)	632.7 (3)
			663.7 (3)	663.7 (3)
			671.9 (4)	671.9 (4)
			682.3 (3) ^b	682.3 (3) ^b
			694.6 (3) ^b	694.6 (3) ^b
			708.3 (3)	708.3 (3)
	723 (1)	723.7 (7)	722.65 (5)	722.65 (5)
			724.15 (5)	724.15 (5)
			737.4 (3)	737.4 (3)
			742.4 (3)	742.4 (3)
	746.5 (15)	746.3 (9)	746.30 (5)	746.30 (5)
			753.65 (5)	753.65 (5)
	756 (2)		757.20 (5)	757.20 (5)
			762.6 (2)	762.6 (2)
	766.5 (20)	764.7 (7)	766.64 (5)	766.64 (5)
	776.0 (6)	776.0 (7)	775.83 (5)	775.83 (5)
781 (10)			780.8 (1)	780.8 (1)
	784 (2)		784.93 (5)	784.93 (5)
			787.6 (2) ^a	787.6 (2) ^a
	793 (2)		792.2 (3)	792.2 (3)
	797.5 (20)		796.22 (5)	796.22 (5)
		803.7 (7)	803.77 (5)	803.77 (5)
	804 (1)		806.0 (2)	806.0 (2)
	813 (2)	812.0 (10)	812.40 (6)	812.40 (6)
			816.5 (2)	816.5 (2)
	821.5 (25)		823.20 (7)	823.20 (7)
	826 (1)	826.4 (11)	825.95 (7)	825.95 (7)
	835 (2)		833.9 (2)	833.9 (2)
			837.5 (1)	837.5 (1)
	840.5 (20)	842.0 (9)	842.2 (1)	842.2 (1)
	847 (1)	847.7 (10)	846.85 (10) ^a	846.85 (10) ^a
	860 (2)		863.6 (1)	863.6 (1)
	864 (2)		867.4 (1)	867.4 (1)
	876.5 (10)	876.2 (10)	876.5 (1)	876.5 (1)
			878.1 (2)	878.1 (2)
	892 (3)		893.1 (2)	893.1 (2)
	897.5 (20)	896.7 (10)	896.7 (2)	896.7 (2)
	908 (2)	907.7 (10)	907.6 (2)	907.6 (2)
			911.3 (2)	911.3 (2)
			913.6 (3)	913.6 (3)
			926.5 (3)	926.5 (3)
			941.2 (3)	941.2 (3)
			949.3 (4)	949.3 (4)

1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
			958.0 (7)	958.0 (7)
			969.2 (4)	969.2 (4)
			975.2 (5)	975.2 (5)
			978.7 (4)	978.7 (4)
			989.4 (5)	989.4 (5)
			994.3 (3)	994.3 (3)
			999.3 (5)	999.3 (5)
			1025.1 (5)	1025.1 (5)

a: multiply placed. b: not placed in level scheme.

5.2 Relative values of γ -ray intensities

The measured and recommended γ -ray emission probabilities from ²²³Fr α decay are listed in table 6. The recommended values are from 2001Li44.

Table 6. Measured and recommended values of γ -ray energies and emission probabilities from ²²³Fr α decay

E_γ (keV)		P_γ (10^{-4} %)	
2001Li44	recommended	2001Li44	recommended
	24.14 (3)		60 (26) ^a
58.9 (2)	58.9 (2)	8 (3)	8 (3)
150.9 (2)	150.9 (2)	56 (5)	56 (5)
145.3 (3)	145.3 (3)	2 (1)	2 (1)

^a: ($\gamma+ce$), from intensity balance.

Measured values of the relative γ -ray intensities, the 234.7 keV being the reference line, from ²²³Fr β^- decay are listed in Table 7. 1964Yt01 and 1967MA19 are replaced by 1993Ab01, these three references coming from the same group. There is no detailed experimental information in 1982ALZL and only the data table are given. It's noted that among 131 γ -rays, 87 γ -rays are new and observed in 1993Ab01. Compared to 1993Ab01, 1982ALZL did not provide the γ -rays with low energy; their γ -ray intensities are in agreement with those reported by 1993Ab01 for some γ -rays, and for most of the weak γ -rays quite different. Then, the present adopted values are from 1993Ab01.

Table 7 Measured and recommended relative γ -ray intensities from ²²³Fr β^- decay.

E_γ /keV	I_γ				
	1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
20.27 (5)				53 (5)	53 (5)
27.27 (3) ^b				2.3 (4)	2.3 (4)
29.78 (4)				2.6 (4)	2.6 (4)
31.69 (5)				0.05	0.05
43.5 (2)				0.08	0.08
44.0 (1)				0.05	0.05
49.80 (5)				93 (8)	93 (8)
50.10 (2)	100	1000	1200 (80)	1224 (50)	1224 (50)
61.43 (5)		< 8		0.13	0.13

E_γ/keV	I_γ				
	1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
62.31 (6)				0.6 (2)	0.6 (2)
73.5 (1)				0.05 (3)	0.05 (3)
79.65 (2)	32.8 (3)	240 (24)	290 (20)	335 (20)	335 (20)
89.08 (10)			88 (3)	2.0 (1)	2.0 (1)
93.88 (5)			31 (1)	2.2 (3)	2.2 (3)
111.05 (3)			10.6 (4)	0.18 (4)	0.18 (4)
134.60 (2)	1.0 (1)	16.0 (16)	17.3 (10)	18.5 (5)	18.5 (5)
150.6 (4) ^b				0.10 (3)	0.10 (3)
155.5 (5)				0.1	0.1
173.35 (5)	0.6 (1)	4.0 (4)	3.35 (25)	4.26 (5)	4.26 (5)
184.65 (5)		9.0 (9)	7.7 (6)	8.27 (5)	8.27 (5)
200.7 (2)				0.10 (3)	0.10 (3)
204.85 (5)	2.1 (2)	34.0 (34)	30.9 (17)	33.7 (3)	33.7 (3)
205.6 (2)				0.22	0.22
210.60 (5)				0.36 (2)	0.36 (2)
218.80 (5)				0.32 (2)	0.32 (2)
222.9 (3) ^b				0.08 (2)	0.08 (2)
234.70 (5)	8.9 (8)	100	100.0 (35)	100	100
236.05 (5)				1.0 (2)	1.0 (2)
245.60 (5)		1.3 (4)	1.1 (4)	0.71 (3)	0.71 (3)
250.25 (5) ^a		1.3 (4)	1.0 (4)	0.11	0.11
250.25 (5) ^a				0.58	0.58
254.6 (2)				0.21 (2)	0.21 (2)
256.18 (5)		1.3 (4)	1.2 (4)	0.75 (3)	0.75 (3)
262.9 (2)				0.13 (3)	0.13 (3)
269.6 (3) ^b				0.03 (1)	0.03 (1)
272.8 (2)				0.15 (2)	0.15 (2)
280.7 (5) ^a				0.02	0.02
280.7 (5) ^a				0.02	0.02
286.0 (2)		0.52 (15)	0.2	0.17 (2)	0.17 (2)
289.67 (5)	1.4 (2)	7.2 (7)	7.6 (4)	7.7	7.7
293.2 (2) ^b				0.14 (3)	0.14 (3)
296.5 (2)				0.05 (1)	0.05 (1)
299.95 (5)		1.3 (4)	0.57 (13)	0.75 (4)	0.75 (4)
304.40 (5)		0.67 (20)		0.32 (2)	0.32 (2)
307.93 (5) ^a		0.90 (27)	0.7 (3)	0.45 (5)	0.45 (5)
307.93 (5) ^a				0.05 (5)	0.05 (5)
312.65 (5)		0.75 (22)	0.36 (18)	0.60 (5)	0.60 (5)
314.6 (2)				0.08 (2)	0.08 (2)
319.25 (5)	1.9 (3)	16.2 (16)	15.4 (8)	17.0 (5)	17.0 (5)
329.80 (5)		1.0 (3)		0.90 (5)	0.90 (5)
334.30 (6)		0.45 (13)		0.31 (2)	0.31 (2)
339.50 (5)		2.0 (4)		2.3 (2)	2.3 (2)
342.50 (7)		0.90 (27)		0.43 (4)	0.43 (4)

E_γ/keV	I_γ				
	1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
350.5 (2)	0.3 (1)			0.10 (5)	0.10 (5)
369.32 (5)		3.2 (3)	3.40 (33)	3.3 (2)	3.3 (2)
382.3 (2) ^b				0.03 (1)	0.03 (1)
434.4 (1)				0.08 (2)	0.08 (2)
439.6 (3)				0.011 (3)	0.011 (3)
444.5 (3)				0.04 (1)	0.04 (1)
452.9 (2) ^a				0.03	0.03
452.9 (2) ^a				0.03	0.03
457.5 (2)				0.03	0.03
469.3 (2) ^a				0.04	0.04
469.3 (2) ^a				0.04	0.04
475.4 (1) ^a				0.11	0.11
475.4 (1) ^a				0.1	0.1
480.9 (3)				0.05 (1)	0.05 (1)
493.4 (2)				0.09 (2)	0.09 (2)
506.9 (2)				0.08 (2)	0.08 (2)
516.7 (2)				0.12 (2)	0.12 (2)
524.8 (2)				0.16 (3)	0.16 (3)
533.1 (3)				0.07 (2)	0.07 (2)
537.2 (2) ^a				0.07	0.07
537.2 (2) ^a				0.12	0.12
539.8 (2)				0.22 (5)	0.22 (5)
545.4 (4)				0.011 (3)	0.011 (3)
552.3 (2)				0.10 (2)	0.10 (2)
556.3 (3)				0.04 (1)	0.04 (1)
569.03 (8)			1.9 (3)	1.8 (2)	1.8 (2)
576.1 (4)				0.04 (1)	0.04 (1)
581.3 (4)				0.05 (1)	0.05 (1)
592.3 (2)				0.12 (3)	0.12 (3)
596.9 (4)				0.03 (1)	0.03 (1)
600.7 (4)				0.020 (5)	0.020 (5)
607.6 (3)				0.08 (2)	0.08 (2)
613.6 (4)				0.04 (1)	0.04 (1)
632.7 (3)				0.08 (2)	0.08 (2)
663.7 (3)				0.04 (1)	0.04 (1)
671.9 (4)				0.020 (5)	0.020 (5)
682.3 (3) ^b				0.03 (1)	0.03 (1)
694.6 (3) ^b				0.03 (1)	0.03 (1)
708.3 (3)				0.05 (1)	0.05 (1)
722.65 (5)		1.5 (3)		1.4 (2)	1.4 (2)
724.15 (5)			1.9 (8)	0.52 (8)	0.52 (8)
737.4 (3)				0.033 (8)	0.033 (8)
742.4 (3)				0.04 (1)	0.04 (1)
746.30 (5)		0.70 (15)	0.7 (2)	0.74 (8)	0.74 (8)

E_γ/keV	I_γ				
	1964Yt01	1967MA19	1982ALZL	1993Ab01	recommended
753.65 (5)				0.35 (5)	0.35 (5)
757.20 (5)		0.40 (8)		0.28 (5)	0.28 (5)
762.6 (2)			0.7 (2)	0.09 (2)	0.09 (2)
766.64 (5)		0.80 (16)		0.83 (8)	0.83 (8)
775.83 (5)		12.3 (12)	15.1 (10)	16.8 (5)	16.8 (5)
780.8 (1)	1.9 (2)			0.11 (3)	0.11 (3)
784.93 (5)		0.70 (15)		0.32 (5)	0.32 (5)
787.6 (2) ^a				0.09 (2)	0.09 (2)
787.6 (2) ^a				0.01 (1)	0.01 (1)
792.2 (3)		0.40 (6)		0.020 (5)	0.020 (5)
796.22 (5)		0.30 (6)		0.40 (5)	0.40 (5)
803.77 (5)		1.70 (25)	2.4 (6)	2.2 (3)	2.2 (3)
806.0 (2)				0.05 (1)	0.05 (1)
812.40 (6)		0.60 (9)	0.66 (22)	0.78 (8)	0.78 (8)
816.5 (2)				0.05 (1)	0.05 (1)
823.20 (7)		0.30 (9)		0.26 (3)	0.26 (3)
825.95 (7)		1.4 (2)	2.3 (4)	2.0 (3)	2.0 (3)
833.9 (2)				0.05 (1)	0.05 (1)
837.5 (1)		0.20 (6)		0.36 (4)	0.36 (4)
842.2 (1)		0.20 (6)	0.5	0.18 (2)	0.18 (2)
846.85 (10) ^a		1.4 (2)	2.4 (11)	1.8 (3)	1.8 (3)
846.85 (10) ^a				0.2 (1)	0.2 (1)
863.6 (1)		0.10 (3)		0.14 (2)	0.14 (2)
867.4 (1)				0.06 (1)	0.06 (1)
876.5 (1)		1.3 (2)	1.4 (4)	1.4 (2)	1.4 (2)
878.1 (2)				0.12 (2)	0.12 (2)
893.1 (2)		0.10 (3)		0.09 (2)	0.09 (2)
896.7 (2)		0.50 (8)	0.7 (3)	0.50 (5)	0.50 (5)
907.6 (2)		0.40 (7)	0.3	0.53 (5)	0.53 (5)
911.3 (2)				0.03 (1)	0.03 (1)
913.6 (3)				0.015 (5)	0.015 (5)
926.5 (3)				0.06 (1)	0.06 (1)
941.2 (3)				0.11 (2)	0.11 (2)
949.3 (4)				0.012 (3)	0.012 (3)
958.0 (7)				0.013 (3)	0.013 (3)
969.2 (4)				0.012 (3)	0.012 (3)
975.2 (5)				0.006 (2)	0.006 (2)
978.7 (4)				0.025 (5)	0.025 (5)
989.4 (5)				0.005 (1)	0.005 (1)
994.3 (3)				0.004 (1)	0.004 (1)
999.3 (5)				0.007 (2)	0.007 (2)
1025.1 (5)				0.005 (1)	0.005 (1)

^a: multiply placed. ^b: not placed in level scheme.

5.3 Absolute values of γ -ray emission intensities

The reference gamma-ray line, in the table above, is 234.70 keV. But the measured absolute gamma-ray intensity was given for the 204.8 keV gamma-ray. So the normalization factor N is deduced from the 204.8 keV gamma-ray.

The calculation is:

The measured absolute gamma-ray intensity for the 204.8 keV line (1981Va28) is: $P(204.8 \text{ keV}) = 0.92 (18) \%$, the recommended relative gamma-ray intensity is $I(204.8 \text{ keV}) = 33.7 (3)$.

So $N = P(204.8 \text{ keV}) / I(204.8 \text{ keV}) = 0.92 (18) / 33.7 (3) = 0.027 (5)$.

This value is very close to that calculated with the formula $N = 100 / \sum [I(\text{ce}+\gamma)(\text{g.s.})]$ assuming $I_{\beta^-}(\text{g.s.}) \leq 1 \%$.

So, N has been taken from 1981Va28, that's $N = 0.027 (5)$.

The recommended absolute γ -ray emission probabilities are equal to the relative values given in table 7 multiplied by 0.027 (5).

6. Branching Ratio

The measured and recommended total branching ratios from ²²³Fr decay are listed in table 8. The recommended value of $\% \alpha = 0.020 (4) \%$ is from 2001Li44. Thus, $\% \beta^- = 99.980 (4) \%$.

Table 8 Measured and recommended α -branching ratio from ²²³Fr decay.

$I_{\alpha} / \%$	References
0.006	1955Ad10
0.020 (4)	2001Li44
0.020 (4)	Recommended value, from 2001Li44

7. References

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