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ภาคผนวก ก

ต้นกำเนิดรังสีเอกซ์ที่ใช้ในการทดลอง

Iron-55

Primary X-ray sources

Annular sources

Iron-55 electrodeposited as iron metal on a copper ring with tungsten alloy backing, sealed in a welded stainless steel capsule with beryllium window.

Capsule	Nominal activity* mCi	MBq	Typical photon output in photons/sec per steradian Mn K X-rays	Code
X.87/5	1	37	6×10^5	IEC.8753
	5	185	3×10^6	IEC.8755
	20	740	$1{\cdot}2 \times 10^7$	IEC.8758

*Tolerance ±10%

Availability: within 4 weeks

Recommended working life: 5 years

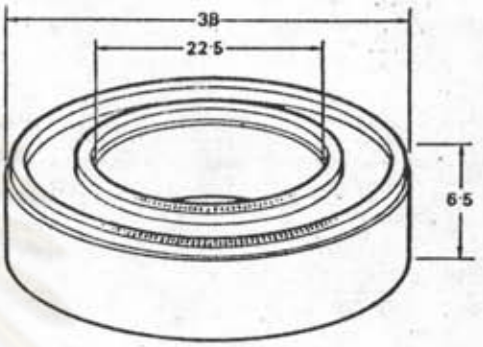
Quality control
Wipe test A
Bubble test D
Immersion test L

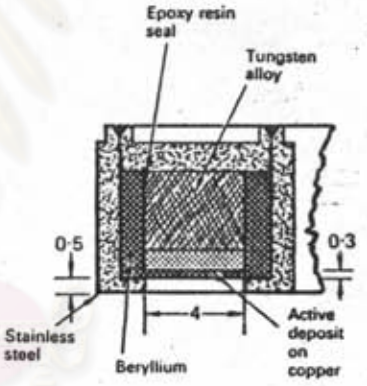
Photon emission checked using a Si(Li) detector.
Total γ-impurities checked using a 75 x 75mm NaI crystal.

Total gamma impurities over 100keV ($^{54}Mn + ^{59}Fe$) <0·1%
Principal emission: 5·9keV (Mn K X-rays).

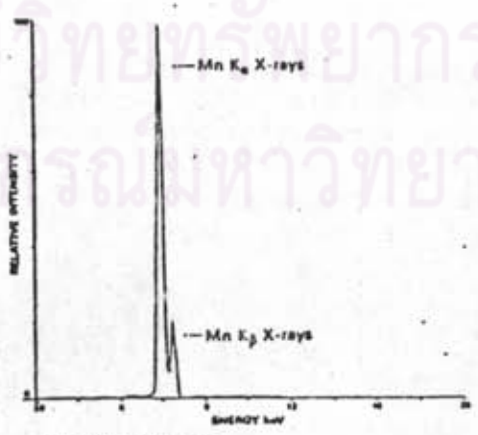
Material with lower impurity levels is normally available, details on request.

X.87/5





Safety performance testing



^{55}Fe X-ray source

ต้นกำเนิดรังสีเอกซ์ที่ใช้ในการทดลอง (ต่อ)

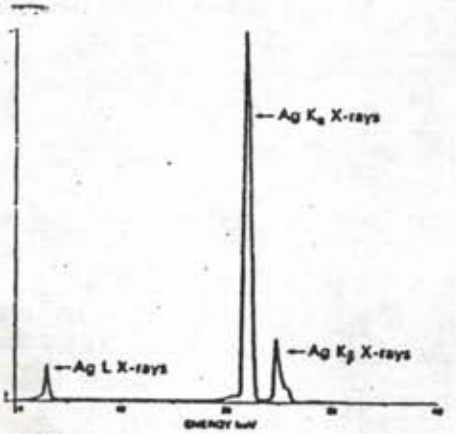
Cadmium-109

γ and primary X-ray sources

Cadmium-109 (cyclotron produced) is electroplated on a silver disc, sealed in a welded monel capsule with brazed beryllium window for disc sources.

For annular sources, the cadmium-109 is electroplated on a silver ring with tungsten alloy backing, sealed in a welded stainless steel capsule with beryllium window.

These sources all emit Ag K X-rays, 88keV γ-rays and some fluorescent X-rays produced in the source backing.



^{109}Cd X-ray source

Type	Capsule	Nominal activity* mCi	MBq	Typical photon output in photons/sec per steradian Ag K X-rays	Code
Annular	X.87/3	3	111	$7{\cdot}5 \times 10^6$	CUC.8733
		5	185	$1{\cdot}25 \times 10^7$	CUC.8734
		10	370	$2{\cdot}5 \times 10^7$	CUC.8735
		20	740	$5{\cdot}0 \times 10^7$	CUC.8736

*Tolerance ±10%

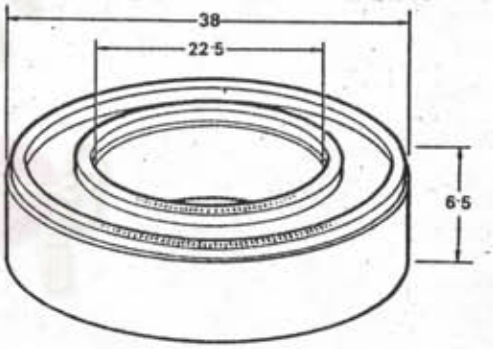
Availability: within 4 weeks

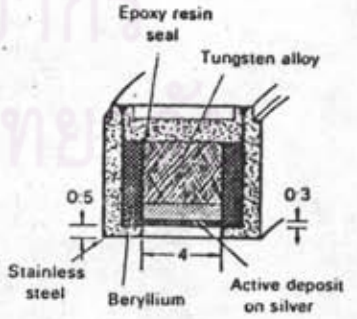
Recommended working life: 5 years

Quality control
Wipe test A
Bubble test D
Immersion test L

Photon emission checked on a Si(Li) detector.
Total γ-impurities checked using a 75 x 75mm NaI crystal.

X.87/3





Safety performance testing

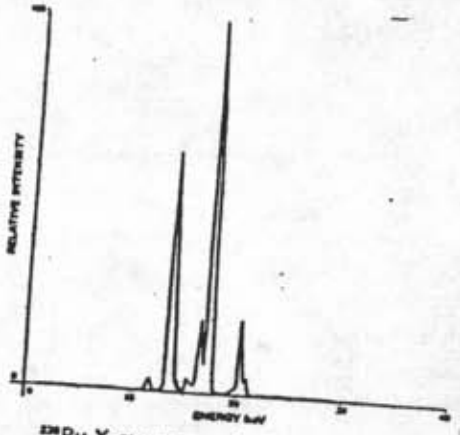
ต้นกำเนิดรังสีเอกซ์ที่ใช้ในการทดลอง(ต่อ)

Plutonium-238

Primary X-ray sources

Plutonium-238 incorporated in a ceramic enamel recessed into a stainless steel support with tungsten alloy backing, sealed in a welded monel capsule with brazed beryllium windows for disc sources; or in a stainless steel capsule with beryllium window for annular sources.

Principal emissions: U L X-rays.



^{238}Pu X-ray source (emitting U L X-rays)

Type	Capsule	Nominal activity* mCi	GBq	Typical photon output in photons/sec per steradian 17·2keV	Code
Annular	X.87/2	10	0·37	$1·5 \times 10^6$	PPC.8724
		30	1·11	$4·5 \times 10^6$	PPC.8725
		100	3·7	$1·3 \times 10^7$	PPC.8726

*Tolerance ±10%

Availability: within 10 days

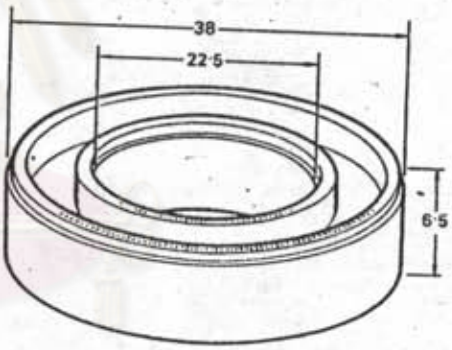
Recommended working life: 10 years

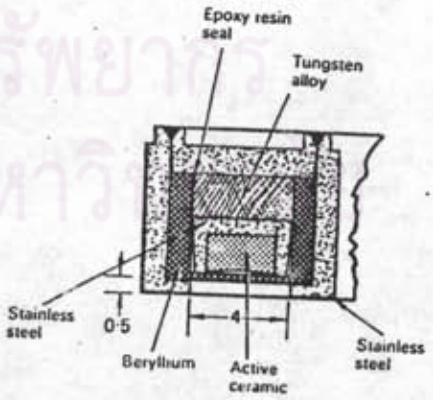
Quality control
Wipe test A
Bubble test D
Immersion test L

Photon emission and spectral purity checked using Si(Li) and Ge(Li) detectors.

Neutron emission
The plutonium-238 sources emit ~10^4 n/sec per Ci due to (α,n) reactions with the low atomic number elements (for examples Si, Al, O) in the active material. The use of beryllium windows does not increase this emission significantly.

X.87/2





Safety performance testing

คุณสมบัติและลักษณะของหัววัดรังสีแบบพรอพอร์ชั่นแนล

LND 422B SERIES

QUADRALATERAL SIDE WINDOW PROPORTIONAL COUNTER

The LND 422B series is a vacuum sealed thin Beryllium window proportional counter. By virtue of its unique quadralateral aluminum cathode construction, the 422B series offers uniform path length over the entire window, greater gas volume, and extreme sensitivity for low energy electrons and gamma or x-rays <10 Å. This tube has been specifically designed to endure the rigors of space applications and will successfully operate in environments from 0 to 1.5 atmospheres.

GENERAL SPECIFICATIONS

Cathode Material:	Aluminum
Operating Temperature Range:	-40°C to +75°C
Gas Filling Available:	Neon Argon Krypton Xenon
Gas Pressure:	760 mm/Hg
Maximum Width:	1 inch
Maximum Length:	3 3/4 inches
Path Length:	.75 inches

WINDOW SPECIFICATIONS

Effective Length x Width	0.187 X .812 inches
Density: (Areal)	9.2 mg/cm^2

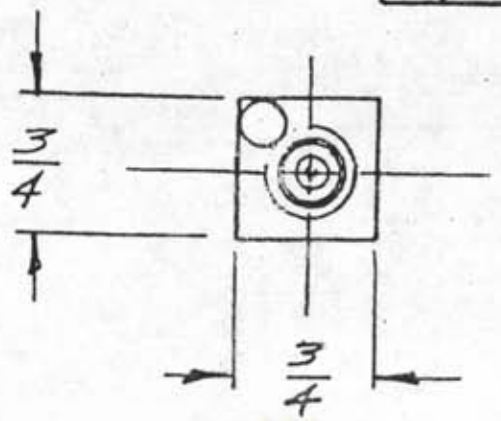
ELECTRICAL SPECIFICATIONS

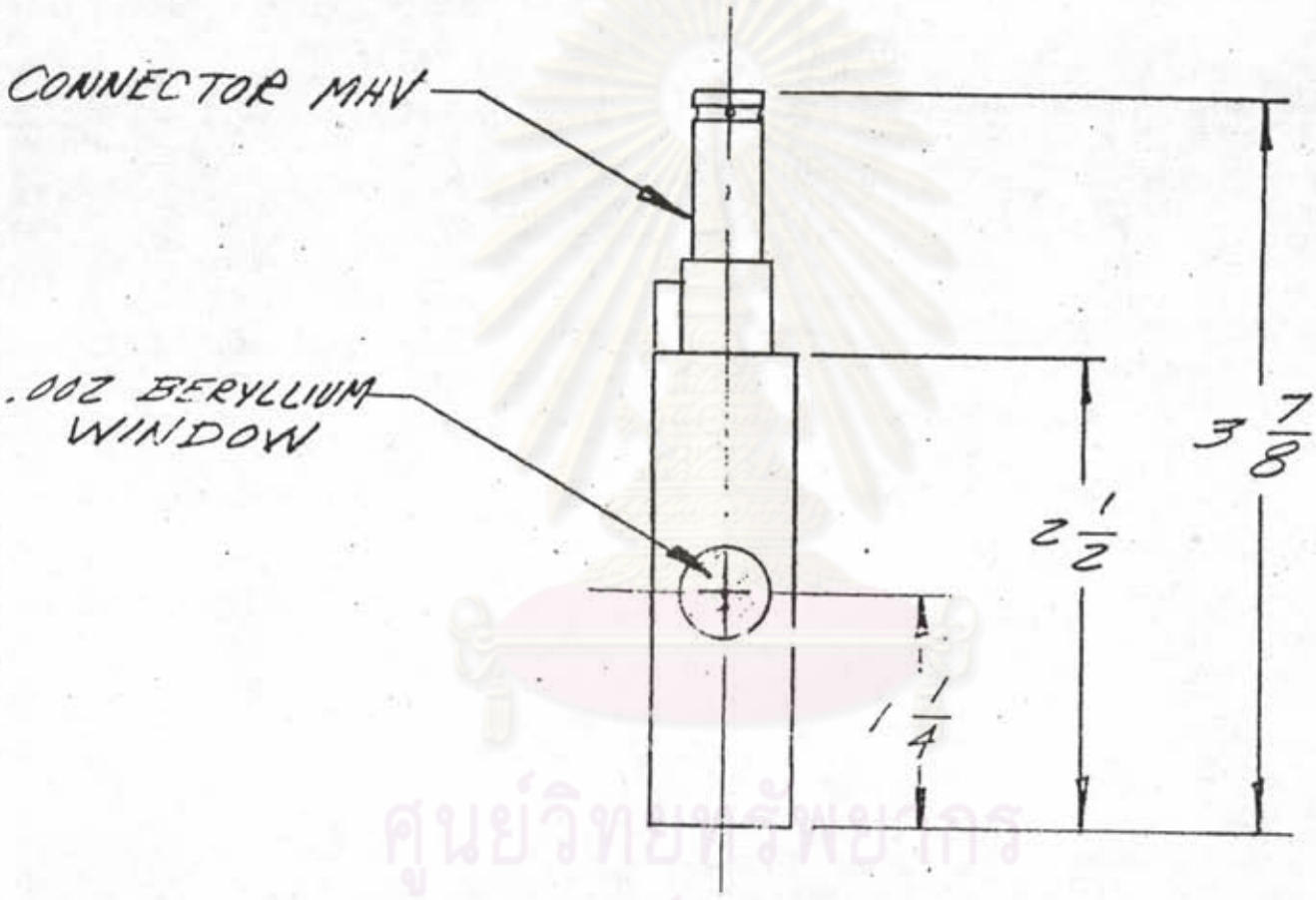
Plateau Length:	250 volts minimum
Plateau Slope:	3%/100 volts maximum
Operating Voltage Range (Argon):	1600-1900
Connector:	MHV
Typical Resolution with Fe55:	16-18% FWHM
Capacitance:	4 pf maximum
Efficiency with Fe55:	>70% (Xenon)

NOTE: 1. Argon is the standard fill. If Neon, Krypton or Xenon is desired, add N, K, or X after tube type.

2. The LND 422B is available upon special request with an exit window.

REV	DESCRIPTION	DATE	APPD





MATERIAL: ALUM	TOL UNLESS OTHERWISE SPECIFIED: FRAC ± 1/64, DEC ± .005, ANG ± 1°	LND, INC. 3230 LAWSON BLVD. OCEANSIDE, N. Y.	
BLANK SIZE: ~	SCALE 1:1	TITLE: SQUARE, SIDE WINDOW, PROPORTIONAL COUNTER	
DRAWN BY: [illegible] Feb 73	REF: 421-1	TUBE TYPE: 421	PART NO.: 421-2 REV:
APP'D BY:			

ตารางแสดงค่าสัมประสิทธิ์การดูดกลืนเชิงมวลของธาตุ

Mass-absorption coefficient μ/ϱ, cm²/g

Wavelength, A 0.15	0.20	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5
0.32	0.34	0.35	0.37	0.38	0.40	0.42	0.43	0.44	0.45	0.45	0.49
0.12	0.12	0.13	0.14	0.14	0.17	0.86	0.20	0.22	0.23	0.25	0.35
0.11	0.11	0.14	0.15	0.15	0.18	0.22	0.25	0.30	0.36	0.42	1.02
0.13	0.14	0.14	0.15	0.16	0.19	0.23	0.28	0.34	0.43	0.53	1.34
0.14	0.14	0.15	0.16	0.19	0.24	0.31	0.40	0.54	0.70	0.92	2.87
0.14	0.15	0.16	0.17	0.21	0.31	0.42	0.59	0.83	1.14	1.54	4.79
0.15	0.16	0.17	0.20	0.28	0.40	0.59	0.88	1.26	1.76	2.37	7.38
0.15	0.16	0.18	0.23	0.34	0.53	0.83	1.27	1.84	2.56	3.45	10.74
0.15	0.18	0.21	0.26	0.43	0.70	1.14	1.77	2.57	3.57	4.81	14.96
0.16	0.19	0.24	0.31	0.54	0.93	1.54	2.38	3.45	4.80	6.47	20.11
0.17	0.21	0.27	0.36	0.66	1.21	2.02	3.11	4.51	6.28	8.45	26.29
0.18	0.23	0.31	0.43	0.83	1.54	2.57	3.97	5.76	8.02	10.79	33.36
0.19	0.26	0.36	0.50	1.03	1.93	3.22	4.96	7.21	10.03	13.50	41.97
0.20	0.29	0.42	0.59	1.27	2.38	3.97	6.11	8.88	12.35	16.63	51.69
0.22	0.31	0.47	0.70	1.54	2.88	4.81	7.41	10.77	14.98	20.14	62.68
0.23	0.35	0.54	0.84	1.85	3.46	5.77	8.88	12.90	17.95	24.16	75.10
0.25	0.39	0.61	0.98	2.19	4.10	5.89	10.52	15.29	21.27	28.63	88.98
0.27	0.43	0.70	1.15	2.57	4.81	8.02	12.34	17.93	24.95	33.58	104.38
0.29	0.50	0.81	1.34	2.99	5.59	9.32	14.36	20.86	29.01	39.05	121.37
0.32	0.55	0.92	1.54	3.45	6.44	10.74	16.54	24.04	33.43	44.99	139.85
0.36	0.61	1.06	1.77	3.95	7.37	12.29	18.93	27.50	38.25	51.49	160.03
0.38	0.69	1.20	2.01	4.49	8.38	13.98	21.53	31.27	43.50	58.55	181.98
0.40	0.76	1.36	2.27	5.07	9.47	15.79	24.31	35.31	49.12	66.11	205.47
0.43	0.83	1.53	2.55	5.70	10.63	17.73	27.30	39.66	55.16	74.25	230.78
0.46	0.92	1.71	2.85	6.37	11.89	19.82	30.52	44.33	61.66	83.00	257.97
0.50	1.02	1.90	3.17	7.09	13.23	22.06	33.96	49.34	68.62	92.36	287.08
0.56	1.13	2.11	3.52	7.86	14.66	24.45	37.64	54.68	76.06	102.17	318.19 K
0.61	1.25	2.33	3.88	8.68	16.19	27.00	41.57	60.38	83.99	113.04	43.84
0.68	1.36	2.56	4.27	9.55	17.82	29.71	45.74	66.45	92.42	120.48	48.58
0.72	1.51	2.81	4.69	10.47	19.54	32.58	50.17	72.88	101.17	136.44	53.65
0.76	1.73	3.08	5.13	11.46	21.39	35.66	54.91	79.76	110.94	149.32	59.31
0.82	1.81	3.35	5.59	12.49	23.31	38.87	59.84	86.93	120.91	162.75	65.10
0.88	1.96	3.63	6.08	13.59	25.36	42.28	65.09	94.56	131.52	[illegible]	71.02
0.96	2.13	3.96	6.60	14.75	27.51	45.87	70.63	102.61	142.71	25.02	77.85
1.04	2.31	4.29	7.15	15.97	29.78	49.66	76.46	111.07	154.49	27.29	84.91
1.12	2.49	4.63	7.72	17.25	32.18	53.65	82.60	120.00	22.05	29.69	92.21
1.21	2.69	4.99	8.32	18.59	34.68	57.82	89.03	129.31	23.99	32.29	100.16
1.30	2.89	5.37	8.96	20.00	37.32	62.22	95.80	18.71	26.03	35.03	108.89
1.40	3.11	5.77	9.62	21.48	40.08	66.82	102.88	20.24	28.16	37.90	117.80
1.50	3.33	6.19	10.31	23.03	42.96	71.63	15.06	21.88	30.43	40.96	127.13
1.60	3.57	6.62	11.03	24.65	45.98	76.66	16.19	21.52	32.72	44.04	136.88
1.71	3.81	7.07	11.79	26.33	49.12	81.90	17.38	25.25	35.12	47.28	146.95
1.83	4.07	7.55	12.58	28.09	52.41	12.12	18.66	27.11	37.70	50.75	157.73
1.95	4.33	8.04	13.40	29.91	55.81	12.97	19.97	29.02	40.36	54.33	168.86
2.07	4.61	8.55	14.26	31.84	59.39	13.87	21.36	31.03	43.16	58.10	180.58
2.20	4.90	9.09	15.14	33.82	61.19	14.81	22.80	33.12	46.07	62.01	192.75
2.34	5.19	9.64	16.07	35.89	9.4	15.7	24.3	35.1	49.1	66.1	205
2.48	5.51	10.22	17.03	38.04	10.0	16.8	25.8	37.6	52.2	70.3	218
2.62	5.83	10.82	18.03	40.27	10.7	17.8	27.5	39.9	55.5	74.7	232
2.77	6.16	11.44	19.06	42.58	11.9	19.9	30.7	44.7	62.1	79.5	240
2.93	6.51	12.08	20.14	44.97	12.0	20.1	30.9	45.0	62.5	84.2	263
3.09	6.87	12.75	21.25	6.85	12.7	21.5	32.4	47.6	66.2	89.1	277

K

Mass-absorption coefficient μ/ϱ, cm²/g

Wavelength, A 2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	15.0	20.0	25.0	30.0
0.52	0.62	0.78	1.25	2.12	1.26	[illegible]	7.1	10.0	11.7	[illegible]	[illegible]	127	[illegible]
0.71	1.31	1.48	3.55	6.90	11.60	[illegible]	[illegible]	17.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.18	1.98	6.60	15.2	28.80	48.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.47	4.44	10.74	24.04	44.91	74.84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.43	12.01	20.01	44.80	81.69	119.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.72	20.01	33.18	74.61	119.1	213.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.53	30.83	51.38	114.9	214.6	357.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24.02	44.85	74.75	167.1	312.1	520.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] K
33.45	62.45	104.0	232.8	434.8	724.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44.98	83.98	139.9	311.0	584.8	974.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
58.71	109.75	182.9	409.1	764.2	1273.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75.03	140.11	233.5	522.3	975.6	1625.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
93.86	175.22	292.0	651.2	1250.1	2033.1	[illegible]	[illegible]	[illegible]	467	[illegible]	[illegible]	[illegible]	[illegible]
115.58	215.78	359.6	804.4	1502.5	2501.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
140.16	261.66	436.1	975.4	1822.0	251.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
167.92	313.48	522.4	1168.6	2182.9	310.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
198.97	371.45	619.0	1384.7	225.1	375.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
233.39	435.70	726.1	156.2	291.9	466.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
271.38	506.63	844.4	190.8	356.4	564.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
312.71	583.78	972.9	232.7	434.7	724.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
357.84	668.01	121.9	272.6	509.1	848.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] L
406.91	85.71	142.7	319.1	596.6	994.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] L
459.43	104.07	173.4	387.9	724.7	1207	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] L
516.03	117.54	195.9	438.1	818.5	1364	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
70.36	132.11	220.1	492.5	919.9	1511	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
79.21	147.88	246.4	551.1	1029	1716	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
88.41	165.04	275.0	615.2	1149	1915	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
98.04	183.02	305.0	682.3	1274	2123	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
108.64	202.82	338.0	756.1	1412	2351	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
119.96	223.95	373.2	834.8	1559	2598	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
132.61	247.57	412.6	922.9	1723	2872	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
145.58	271.78	452.9	1011	1892	3151	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
158.81	296.47	494.1	1105	2064	3440	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
174.08	324.98	541.6	1211	2261	3771	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
189.98	354.52	590.8	1321	2468	4111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
206.33	385.19	641.9	1435	2682	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
224.45	419.02	[illegible]	1562	2917	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
243.49	454.57	752.6	1694	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
263.41	491.75	[illegible]	1833	[illegible]	704	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
284.71	531.50	885.8	1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
306.07	571.37	952.1	2130	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] M
328.99	614.43	1022	2286	568	946	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
352.68	658.40	1097	2454	624	1040	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] M M
378.01	704.85	1174	[illegible]	678	1131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
403.77	[illegible]	1256	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
431.00	[illegible]	1341	[illegible]	804	1340	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
459	857	1429	467	871	1455	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
489	915	1522	[illegible]	[illegible]	1562	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
519	970	1408	546	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] M
561	1086	1480	588	[illegible]	1831	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1097	263	632	1161	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] M
619	1157	807	677	1265	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

L L L M M M M M

...sky, H. G. Pfeiffer, E. H. Winslow, and P. D. Zemany, "X-Rays, Electrons, and Analytical ... Wiley-Interscience, N. Y., [illegible]; courtesy of the authors and publisher.

Mass-absorption coefficient μ/ϱ, cm²/g

Z	Element	0.1	0.15	0.20	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5
53	I	1.36	3.26	7.24	13.44	22.40	7.24	13.5	22.5	34.6	50.4	70.1	94.3	293.
54	Xe	1.42	3.43	7.63	14.16	23.59	7.66	14.2	23.8	36.6	53.3	74.1	99.7	310.
55	Cs	1.48	3.61	8.03	14.90	24.82	8.08	15.0	25.1	38.7	56.2	78.2	105.3	327.
56	Ba	1.53	3.80	8.44	15.66	26.10	8.52	15.9	26.5	40.8	59.3	82.5	111.0	345.
57	La	1.60	3.99	8.86	16.45	27.42	8.98	16.7	27.9	42.9	62.4	86.8	116.9	363.
58	Ce	1.66	4.19	9.30	17.27	28.78	9.45	17.6	29.4	45.2	65.7	91.4	123.1	382.
59	Pr	1.72	4.39	9.76	18.11	4.45	9.94	18.5	30.9	47.5	69.1	96.1	129.4	402.
60	Nd	1.80	4.60	10.23	18.98	4.67	10.4	19.4	32.4	49.9	72.6	101.0	135.9	422.
61	Pm	1.86	4.82	10.71	19.88	4.90	10.9	20.4	34.0	52.4	76.2	106.0	142.7	443.
62	Sm	1.93	5.04	11.21	20.80	5.14	11.4	21.4	35.7	55.0	79.9	111.2	149.7	465.
63	Eu	2.02	5.28	11.73	21.76	5.39	12.0	22.4	37.4	57.7	83.8	116.5	156.9	487.
64	Gd	2.09	5.52	12.26	3.38	5.64	12.6	23.5	39.2	60.3	87.6	122.0	164.2	478.
65	Tb	2.18	5.76	12.80	3.54	5.91	13.2	24.6	41.0	63.2	91.8	127.7	171.7	501.
66	Dy	2.26	6.02	13.37	3.70	6.18	13.8	25.7	42.9	66.0	95.9	133.5	179.6	469.
67	Ho	2.33	6.28	13.95	3.87	6.46	14.4	26.9	44.8	69.0	100.3	139.5	187.8	489.
68	Er	2.42	6.55	14.55	4.05	6.75	15.0	28.1	46.8	72.1	104.8	145.8	196.3	507.
69	Tm	2.50	6.82	15.16	4.23	7.05	15.7	29.3	48.9	75.4	109.5	152.3	205.1	113.
70	Yb	2.58	7.11	15.90	4.42	7.36	16.4	30.6	51.1	78.7	114.4	159.1	214.1	118.
71	Lu	2.66	7.40	2.48	4.61	7.68	17.1	32.0	53.3	82.1	119.3	166.0	223.5	124.
72	Hf	2.75	7.71	2.59	4.80	8.01	17.8	33.3	55.6	85.6	124.4	173.0	232.9	131.
73	Ta	2.82	8.02	2.70	5.01	8.35	18.6	34.7	57.9	89.3	129.7	180.4	242.8	136.
74	W	2.90	8.34	2.81	5.22	8.70	19.4	36.2	60.4	93.0	135.1	188.0	253.0	143.
75	Re	2.96	8.67	2.93	5.44	9.06	20.2	37.7	62.9	96.9	140.8	195.8	249.4	150.
76	Os	3.03	9.00	3.05	5.66	9.44	21.0	39.3	65.5	100.9	146.6	204.0	260.8	157.
77	Ir	3.10	9.35	3.17	5.89	9.82	21.9	40.9	68.2	105.0	152.5	212.2	231.5	165.
78	Pt	3.17	9.71	3.30	6.13	10.2	22.8	42.5	70.9	109.2	158.7	210.1	240.0	172.
79	Au	3.23	10.08	3.43	6.37	10.6	23.7	44.2	73.8	113.6	165.1	218.2	249.0	177.
80	Hg	3.30	1.60	3.57	6.62	11.0	24.6	46.0	76.7	118.1	171.5	191.6	257.9	189.
81	Tl	3.36	1.67	3.71	6.89	11.4	25.6	47.8	79.7	122.8	178.4	198.3	63.5	197.
82	Pb	3.41	1.73	3.86	7.16	11.9	26.6	49.7	82.9	127.7	176.5	205.3	66.6	207.
83	Bi	3.45	1.80	4.01	7.44	12.4	27.7	51.6	86.1	132.6	152.7	212.5	69.6	216.
84	Po	3.52	1.87	4.17	7.73	12.8	28.7	53.7	89.5	137.8	157.8	54.1	72.7	225.
85	At	3.56	1.94	4.33	8.03	13.3	29.8	55.7	92.9	143.3	163.1	57.1	76.8	238.
86	Rn	3.61	2.02	4.49	8.33	13.8	31.0	57.8	96.4	141.6	168.5	59.7	80.4	250.
87	Fr	3.66	2.09	4.65	8.64	14.4	32.1	60.0	100.0	119.8	174.0	62.1	83.6	260.
88	Ra	3.70	2.17	4.83	8.96	14.9	33.3	62.2	103.7	123.6	179.6	64.2	86.4	268.
89	Ac	3.75	2.25	5.00	9.29	15.4	34.5	64.5	107.5	127.6	48.5	67.4	90.8	282.
90	Th	3.81	2.33	5.19	9.63	16.0	35.8	66.8	111.4	131.6	50.2	69.9	94.1	292.
91	Pa	3.86	2.42	5.39	9.98	16.6	37.1	69.3	110.9	135.7	52.3	72.7	97.9	304.
92	U	3.91	2.51	5.58	10.35	17.4	38.5	71.8	90.8	139.9	54.3	75.5	101.5	316.
93	Np	3.95	2.58	5.66	10.7	18	40	83	93	143.0	57	77	104	328.
94	Pu	4.00	2.66	5.74	11.0	19	41	85	96	39.1	59	79	107	342.
95	Am	4.05	2.74	5.82	11.4	20	43	87	99	41	61	81	110	354.
96	Cm	2.50	2.82	5.90	11.8	21	44	89	101	43	61	84	113	367.
97	Bk	2.56	2.90	5.97	12.3	21	45	91	104	46	65	86	117	382.
98	Cf	2.62	2.96	6.01	12.8	22	47	69	106	48	67	89	121	395.
99	Es	2.68	3.03	6.09	13.3	22	50	71	110	50	69	92	125	412.
100	Fm	2.74	3.10	6.15	13.7	23	51	73	35	52	71	95	128	427.

Wavelength, A. Absorption edges: K; L_I, L_{II}, L_{III}

Mass-absorption coefficient μ/ϱ, cm²/g

2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	15.0	20.0	25.0	30.0
655.	1132.	324.	725	1735	2258	3477	5053	7027	9440	15631	34719	16254	27988
693.	1110.	351.	786	1469	2448	3769	5428	7619	10235	17221	9323	17414	29612
731	222.	370.	827	1546	2376	3988	5764	8016	10700	18564	9873	18442	30725
771	236.	394	882	1648	2746	4228	6144	8545	9855	20012	10461	19580	32554
755	250.	417	934	1745	2908	4478	6508	9031	10506	21612	11061	20661	34422
765	266.	443.	992.	1854	3080	4756	6915	8338	10193	5564	12454	23262	36555
786.	283.	471.	1055.	1971.	3284	5036.	7349	8853	10867	5960	13119	24916	41511
805.	298.	497.	1111.	2076.	3460	5327	7743	9382	8404	6263	14016	26181	43619
171.	320.	523.	1191.	2230	3716	5721	7134	9150	8913	6631	14841	27721	46164
177.	331.	551.	1234	2305	3842	5915	7548	7048	9466	7000	15667	29264	48754
186.	349.	581.	1301.	2430	4050	6236	7194	7478	10044	7460	16695	31164	51994
197.	367.	613.	1371.	2561	4269	5789	7606	7910	10627	7943	17778	33207	55525
208.	388.	647.	1448.	2704.	4507	6112	6822	8374	11067	8451	18918	35516	58671
218	407.	679.	1519.	2838.	4730	5725	6157	8840	2690	8994	20130	17681	62642
229	427.	712.	1594	2977	4369	6022	6707	9327	3071	9561	21199	18671	66567
239	446.	744.	1665.	3110	4623	4873	7062	2433	3268	10109	22739	42512	54256
252.	472	787.	1760	3268	4360	5141	7472	2585	3472	10664	24179	45164	57625
265.	495	825	1847.	3450	4513	5417	7632	2745	3687	11474	25679	47986	61517
278.	520	866	1938.	3240	4747	5701	2093	2914	3914	12160	27228	36567	65211
293.	547.	912	2041.	3415	3917	6012	2224	3093	4155	12929	28916	42517	59733
306.	571.	952	2130	3571	4092	6124	2361	3284	4411	13726	30721	45622	63626
321.	599.	999.	2236	3258	4309	1727	2511	3492	4691	14597	32630	48611	47625
336.	628.	1046.	2341	3406.	4530	1837	2670	3713	4968	15520	34715	43618	41124
352.	658.	1097	2455	3562	4767	1951	2836	3944	5290	16466	29611	46568	44644
369.	689.	1149	2324	3884	4786	2077	3019	4199	5640	17351	31075	49503	48136
386.	721.	1202	2444	3144	1433	2207	3208	4461	5991	18647	33016	51491	52466
397.	742	1237	2172	3314	1525	2348	3413	4747	6377	19643	29667	54614	56264
423	791	1318	2268	3456	1625	2498	3631	5030	6764	21110	31961	56884	61416
442.	826.	1377	2330	3455	1728	2652	3855	5362	7110	18301	33667	34761	65466
463.	865.	1442	2027	1098	1829	2817	4094	5693	7648	19714	22967	42956	21545
484.	905.	1508	2126	1166	1943	2992	4348	6047	8124	20901	24295	46314	23610
505	943.	1443	2222	1238	2061	3176	4616	6420	8625	17953	26718	49966	26221
534.	997	1510	2322	1310	2164	3362	4887	6796	9130	19301	28080	17312	28844
559.	1041.	1305	2424	1386	2310	3557	5170	7190	9659	20448	30092	19023	31604
581	1085.	1356	2526	1464	2440	3757	5460	7593	10201	21634	33117	20061	34767
600	1121	1410	2497	1544	2573	3961	5758	8087	10787	15740	13629	21647	40163
631	1085	1459	872	1630	2716	4181	6077	8452	9673	16748	14627	22966	46142
654	1121	1520	921	1724	2873	4424	6429	8942	10290	17797	15620	24062	51751
680	947	1331	964	1801	3011	4630	6715	9339	10652	18817	17047	12963	54916
707	981	1361	1009	1904	3172	4883	7096	8486	9891	19924	19171	16164	60250
729	1000	1415	1050	2030	3360	5170	7450						
755	1021	1470	1130	2140	3590	5460							
785	1042	1480	1170	2260	3880	5750							
580	1063	1450	1230	2370	4160	6060							
430	910	510	1270	2490	4130	6430							
448	930	525	1330	2630	4630								
452	950	540	1370	2750	4800								
470	970	555	1430	2880	5100								

Wavelength, A. Absorption edges: L_I, L_{II}, L_{III}; $M_I M_{II}$, M_{III}, $M_{IV} M_V$; N_I, N_{II}, N_{III}, N_{IV}, N_V

ประวัติผู้เขียน

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