Analysis of β ray spectroscopy

PH3105

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Contents

I. Introduction

In this experiment, we perform β ray epectroscopy using a scintillation detector and then measure the pulse heights using a multi channel analyser. In the previous experiment we used a single channel analyser by varying the window and baseline to measure pulses within the window. The Multi Channel Analyser(MCA) measures all the pulses in all the windows at the same time.

II. Theory

We lay out, in brief, the theory behind the β ray spectrometer used, and the decay of the radioactive sources that produce the β rays in our interaction.

II.1. β ray spectrometer

β-spectrometer theory goes here.

II.2. Decay Scheme of $^{22}_{11}\mathrm{Na}$ and $^{90}_{38}\mathrm{Sr}$

We detail the β ray decay scheme of the $^{22}_{11}\mathrm{Na}$ and $^{90}_{38}\mathrm{Sr}$, both of which we will use in the experiment.

II.2.A. Decay scheme for $^{22}_{11}\mathrm{Na}$

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II.2.B. Decay scheme for $^{90}_{38}\mathrm{Sr}$

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II.3. Kinetic Energy of β Particles

Derivation daalo idhar.

III. Results and Analysis

III.1. $^{22}_{11}\mathrm{Na}$ Source

For the $^{22}_{11}\mathrm{Na}$ source, for each voltage we took 2 runs, for 60 seconds each. The energy was calculated using the formula derived above, in kilo electron volts.

III.1.A. Table for $^{22}_{11}\mathrm{Na}$ Source

Magnetic Field(mT)	Voltage (V)	Current (A)	Counts(Run 1)	Counts(Run 2)	Avg. Counts	Energy (keV)
12.7	0.13	0.3	59	63	61	3.43E+01
25.9	0.26	0.6	116	102	109	1.31E+02
36.9	0.38	0.9	121	122	121	2.42E+02
39.4	0.41	1	125	121	123	2.70E+02
42.9	0.45	1.1	138	130	134	3.11E+02
47.7	0.5	1.2	113	130	121	3.68E+02

51.3	0.54	1.3	114	123	118	4.12E+02
55.6	0.58	1.4	108	104	106	4.67E+02
61.1	0.64	1.5	117	93	105	5.38E+02
69.5	0.74	1.8	66	76	71	6.50E+02
91.9	0.9	2.1	37	40	38	9.59E+02
95.8	0.99	2.4	49	42	45	1.01E+03

III.1.B. Plot of Energy vs Count for $^{22}_{11}$Na Source

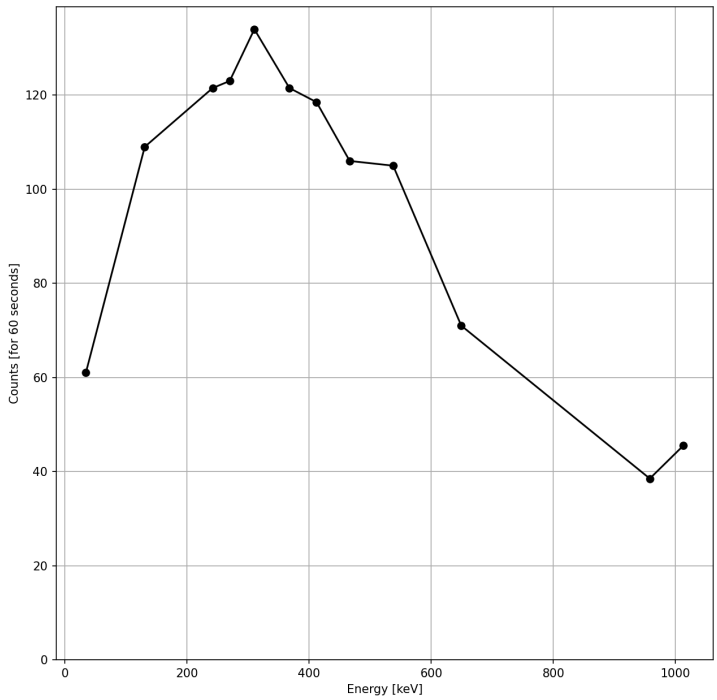

Figure 1 :: β-ray spectrum of $^{22}_{11}$Na

III.1.C. Energy corresponding to the maximum count for $^{22}_{11}$Na source

The peak of the spectrum was observed to be at an energy of 310.36 keV with the average count of 134.

III.2. $^{90}_{38}$Sr Source

For the $^{90}_{38}$Sr source, we decided to take only one run for each voltage, again, for 60 seconds. However, this time the voltage was varied at a slower rate compared to that of the $^{22}_{11}$Na source, to make sure we have more close-by datapoints to get a better and more accurate spectrum.

III.2.A. Table for $^{90}_{38}$Sr Source

Magnetic Field(mT)	**Voltage (V)**	**Current (A)**	**Counts**	**Corrected Counts (no background)**	**Energy (keV)**

0	0	0	109	0	0.00E+00
4.6	0.06	0.1	216	107	4.63E+00
5.6	0.08	0.2	230	121	6.85E+00
7	0.1	0.2	256	147	1.07E+01
7.9	0.12	0.3	280	171	1.36E+01
9.4	0.14	0.3	301	192	1.91E+01
10.8	0.16	0.4	329	220	2.50E+01
12.2	0.18	0.4	327	218	3.18E+01
14.2	0.2	0.4	351	242	4.26E+01
15.1	0.22	0.5	398	289	4.79E+01
16.7	0.24	0.5	444	335	5.81E+01
17.9	0.26	0.6	428	319	6.62E+01
19	0.28	0.6	471	362	7.41E+01
20.6	0.3	0.7	488	379	8.61E+01
22.4	0.32	0.7	563	454	1.01E+02
24.6	0.34	0.8	609	500	1.19E+02
25.2	0.36	0.8	643	534	1.25E+02
27.3	0.38	0.9	666	557	1.44E+02
28.6	0.4	0.9	698	589	1.56E+02
30.7	0.42	1	772	663	1.77E+02
31.9	0.44	1	796	687	1.89E+02
33.6	0.46	1.1	826	717	2.07E+02
34.6	0.48	1.1	830	721	2.17E+02
36.7	0.5	1.2	951	842	2.40E+02
38.5	0.52	1.2	1034	925	2.60E+02
39.6	0.54	1.3	975	866	2.72E+02
41.9	0.56	1.3	1126	1017	2.99E+02
43.3	0.58	1.3	1126	1017	3.15E+02
45.4	0.6	1.4	1118	1009	3.40E+02
46.7	0.62	1.4	1256	1147	3.56E+02
48.4	0.64	1.5	1235	1126	3.77E+02
51.2	0.68	1.6	1353	1244	4.11E+02
54.7	0.72	1.7	1389	1280	4.55E+02
59	0.76	1.8	1480	1371	5.11E+02
62.2	0.8	1.9	1500	1391	5.52E+02
65.3	0.84	1.9	1545	1436	5.93E+02
70.5	0.9	2.1	1580	1471	6.63E+02
75.6	0.96	2.2	1547	1438	7.32E+02
81.2	1.02	2.4	1528	1419	8.09E+02

87.8	1.08	2.5	1494	1385	9.01E+02
92.2	1.14	2.7	1530	1421	9.63E+02
98.1	1.2	2.8	1414	1305	1.05E+03
102.2	1.26	2.9	1373	1264	1.10E+03
107.7	1.32	3.1	1265	1156	1.18E+03
113.3	1.38	3.3	1138	1029	1.26E+03
118.1	1.45	3.4	1081	972	1.33E+03
123.4	1.5	3.5	962	853	1.41E+03
128	1.56	3.7	869	760	1.47E+03
132.5	1.62	3.8	781	672	1.54E+03
137	1.68	4	748	639	1.61E+03
142.4	1.74	4.2	744	635	1.68E+03
149.1	1.8	4.3	561	452	1.78E+03
151.3	1.86	4.5	508	399	1.81E+03
155.9	1.92	4.6	508	399	1.88E+03
161.3	2	4.8	398	289	1.96E+03

III.2.B. Plot of Energy vs Count for $^{90}_{38}\mathrm{Sr}$ Source

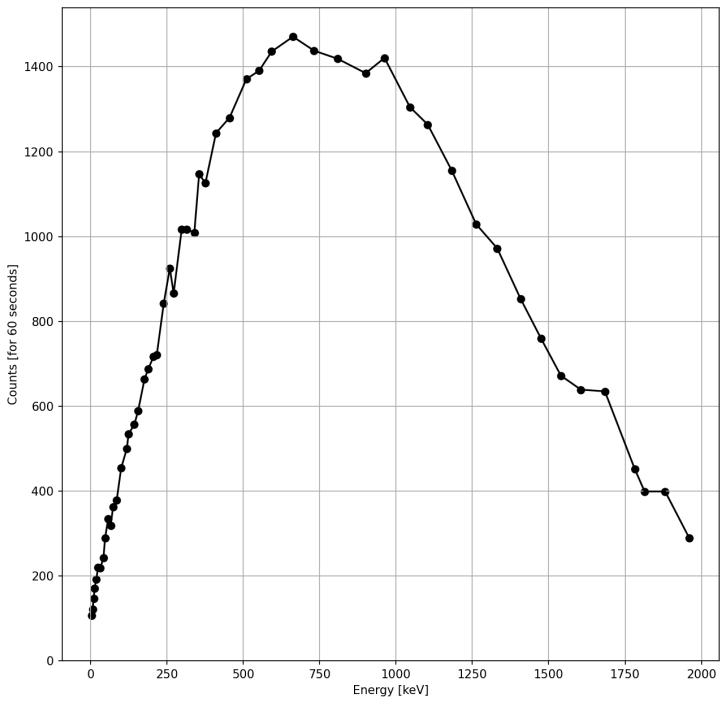

Figure 2 :: β-ray spectrum of $^{90}_{38}\mathrm{Sr}$

III.2.C. Energy corresponding to the maximum count for $^{90}_{38}\mathrm{Sr}$ source

The peak of the spectrum was observed to be at an energy of 662.83 keV with the average count of 1471.

IV. Conclusion

Maybe the real conclusion of this experiment is sitting in the room with us rn.