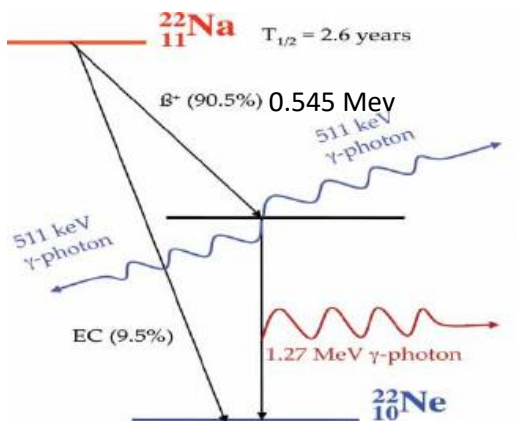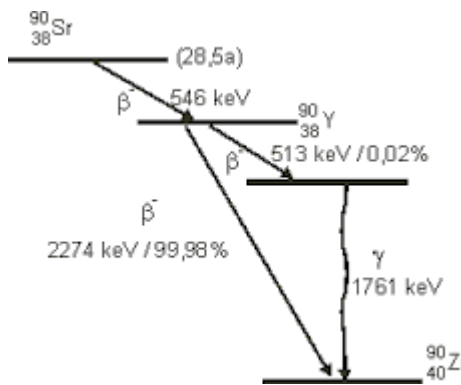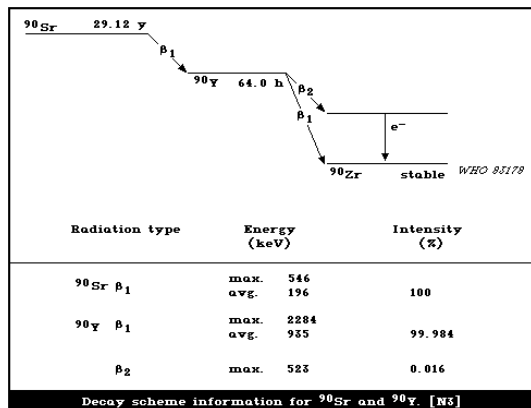# Experiment – 5

Objective : Study of β-spectroscopy

Sources : β-ray source = Sr^{90} , Na^{22}

Scope of Expt :

i) Set the connections for magnet depending upon whether it's a β^- ray or β^+ ray from Sr^{90} or Na^{22}, respectively.
ii) Put the source, Hall probe and GM tube in its place in the β-spectroscope.
iii) Keep your maximum current I = 2 Amp. Set the CC to 2 Amp.
iv) Current I flowing through the coil is proportional to generation of magnetic field, B.
v) Measure counts in GM counter for 100 Sec for different B. Also notedown the voltage, V and Current, I in the coil.
vi) Calculate kinetic energy E_β, of β-particle for each magnetic field, B.
vii) Plot Counts vs E_β.

Theory : Write necessary theory for β-ray spectroscopy. Decay of β-ray sources like Sr^{90} , Na^{22}

Experiment

The β-particle kinetic energy is defined as $E_{kin} = \sqrt{(eBrc)^2 + m_0^2 c^4} - m_0 c^2$

2.2 Technical specifications and physical constants
Average trajectory radius: r = 50 mm
Constants: c = 299792.5 · 10³ m/s
               m_0 = 9.10191 · 10⁻³¹ kg
               e = 1.60210 · 10⁻¹⁹ C

Using the above parameter find out the E_β

Table I : *For Sr⁹⁰ source (Take three Run for counts, 100 sec each)*
                   [See direction of current, I in coil for β⁻]

Sl. No	Coil Voltage (V) (in Volts)	Coil Current (I) (in Amp)	Mag. Field (B) (in mT)	Energy (E$_\beta$) (in KeV)	Counts (for 100 Sec)
1	0	0	3.6		390
2	0.38	0.13	10.1		470
3					
4					
5					
6					
7	5.15	2.0	127.9		2210

Table II : *For Na²² source (Take three Run for counts, 100 sec each)*
                   [See direction of current, I in coil for β⁺]

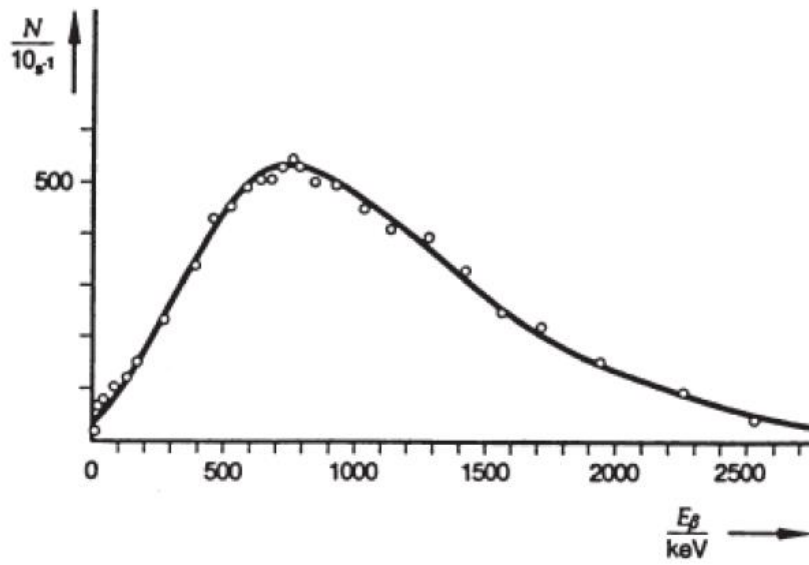| Sl. No	Coil Voltage (V) (in Volts)	Coil Current (I) (in Amp)	Mag. Field (B) (in mT)	Energy (E$_\beta$) (in KeV)	Counts (for 100 Sec)
1	0	0	3.6		320
2	1.94	0.75	50.4		1710
3					
4					
5					
6					
7	5.15	2.0	127.9		-

Graphs :

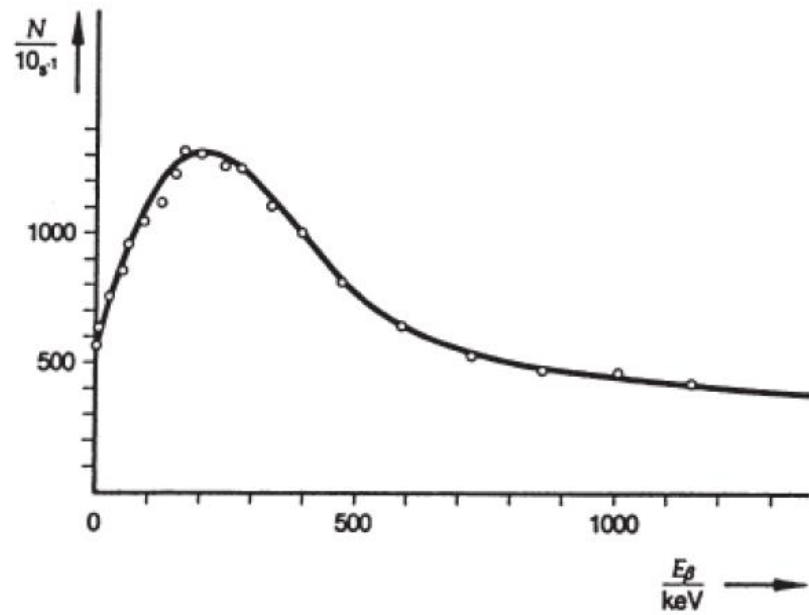Fig. 6: β-spectrum of ^{90}Sr.

Fig. 7: β-spectrumof ^{22}Na.

Conclusion : Write your conclusion on the above observations.