(M1-4) Magnetic Field of a Solenoid Current Loop

Aim of experiment

Determination of magnetic field distribution arises from a solenoid current inside along its axis.

Apparatus

Solenoids of Different Numbers of Turns per Unit Length –D.C Power Supply – Tesla Meter– Ammeter.

Theory of experiment

A solenoid is a long wire wounded in closed packed helix and carrying a current *i*. the solenoid field is the vector sum of the fields set up by all the turns that make up the solenoid. To find this field let us apply Ampere's law, to the rectangular path abcd in the ideal solenoid of *figure 1* one obtains.

$$\oint B.ds = Bl = \mu_0 NI$$

$$B = \mu_o \frac{N}{l} I$$

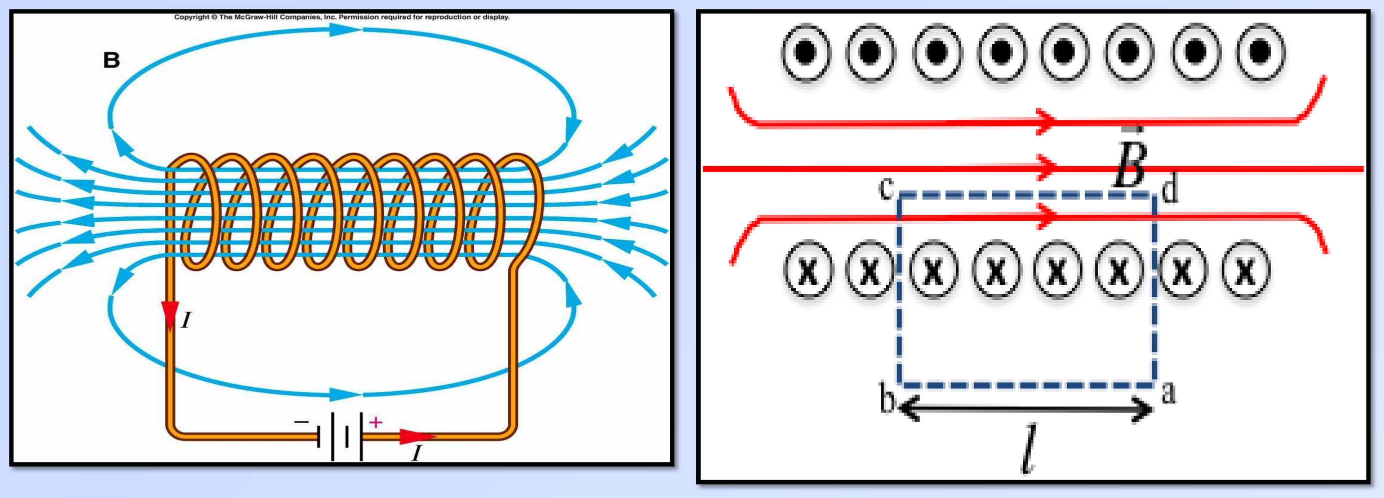

Figure 1. The pattern of the magnetic field due a current passing through it

where, N is the number of turns, and l the length of solenoid. This equation is valid inside a very long solenoid, (ideal solenoid). At a point at the end, and on the axis of the solenoid, the magnetic field strength drops to half its value inside it.

In the experiment, he magnetic field along the axis and inside of the solenoid is measured as a function of axial distance.

Procedure

1. Connect the solenoid to the D.C power supply and ammeter.
2. Set the current at a fixed value, e.g. $1\,A$.
3. Put the magnetic probe along the solenoid axis and at one end of the solenoid.
4. Measure B as a function of distance along inside the solenoid axis up to the other end, in steps of 1 cm.
5. Repeat step 4 at least two extra times and tabulate your results.
6. Draw the relation between the axial distance on x-axis and B on y-axis.
7. Comment on the obtained figure.

Results

$x(m)$	$B_1\ (T)$	$B_2(T)$	$B_3(T)$	$B_{av}\ (T)$

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