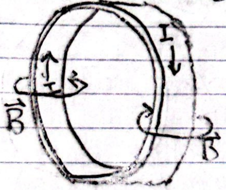
Caden Roberts

Lab Static Mag Fields

5N-01 10/31

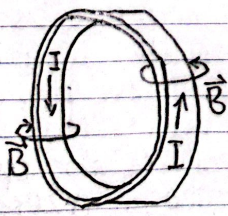
Experiment 1

- We are doing this experiment to observe the right hand rule and current flow.
- We connect the power to a large diameter coil and, using the right-hand rule, we determine current is flowing clockwise.
- Using the magnaprobe and right hand rule, we observe the magnetic field as below:



we measured
~-0.0026 tesla or -26 gauss

- When we swap the leads, the gauss reading becomes positive, and the field of the coil is as below:



we measured
~0.0026 tesla or 26 gauss

Experiment 2

- We are doing this experiment to investigate the magnetic fields of metal base mounted coils, each of which has 200 turns and a 103 mm radius.

- When using the magnaprobe at $z=0$, we observe a maximum gauss reading of -12, and -9 for both $z=5$ and $z=-5$, which follows in relation to eq. 18.

- For $0 = \frac{4\pi \cdot 10^{-7} \cdot 200 \cdot 1 \cdot (0.103)^2}{2(z^2+(0.103)^2)^{3/2}}$, z must be ∞. Indeed, when testing this I had to move the probe quite far back and still then had a -3 gauss reading. The instrument may not be properly calibrated or it may be able to pick up other magnetic fields.

Experiment 3

- When measuring in between the coils, we get a 0 gauss reading, which disagrees with my prelab answer. We measure 8 gauss in the middle of the first coil to recieve power and -8 gauss in the center of the second coil. We observe a 4 cm distance reduces the gauss reading by 10%. The field should theoretically drop to 0 an infinite distance away.

- When swapping cables on one coil, we measure 14 gauss at the midpoint and 12 gauss at each midpoint of the coils. This follows from the principle of superposition.

exp 3 cont.

- There are 7 gauss 4cm outside of either coil, and with the coils being 8cm apart, it makes sense 14 gauss is the reading between the two. At the center of a coil is 12 gauss, 9 gauss from the coil itself and 3 gauss from the coil 8cm away.

Experiment 4

- We are doing this experiment to observe how solenoid magnetic fields behave

- We measure -46 gauss in the middle of the solenoid. Current is flowing clockwise

- $\vec{B}(0,0,0) = 4\pi \cdot 10^{-7} \cdot 565 \cdot 1 = 0.00071$ tesla or 7.1 gauss

  and $F = \dfrac{(0.147)}{\sqrt{(0.147)^2 + (0.06)^2}} = 0.925$

- We measure that it takes 4cm to reduce the reading by 10% to 90% of its max reading.

Scanned with CamScanner

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Pre-lab Static Magnetic Fields

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1. At the center of a single 200-turn coil with a radius of 103mm.

$$B = \left[\frac{4\pi \cdot 10^{-7} \cdot 200 \cdot 1}{2 \cdot 0.103}\right] = 1.227 \cdot 10^{-3} \text{ Tesla or } 12.27 \text{ gauss}$$

2. At the midpoint between two 200-turn coaxial coils of radii 103mm and separated by a distance of 103 mm.

$$B = \left[\frac{4\pi \cdot 10^{-7} \cdot 200 \cdot (103 \cdot 10^{-3})^2}{((51.5 \cdot 10^{-3})^2 + (103 \cdot 10^{-3})^2)^{3/2}}\right] \approx 1.746 \cdot 10^{-3} \text{ Tesla or } 17.46 \text{ gauss}$$

3. At the center of a 565-turn, 146mm-long solenoid of radius 34.1mm.

$$B = 4\pi \cdot 10^{-7} \cdot \frac{565}{34.1 \cdot 10^{-3}} \cdot 1 = 2.087 \cdot 10^{-2} \text{ Tesla or } 208.2 \text{ gauss}$$