Electricity and Magnetism
Lab 9
Magnetic Force on a Current Carrying Wire

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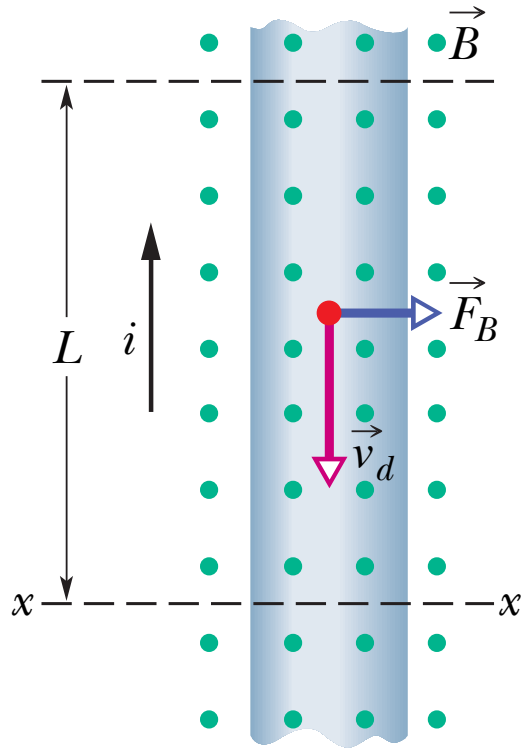
Overview

- reminder about magnetic force on a wire
- lab write up
- setup
- making measurements
- Gauss meter

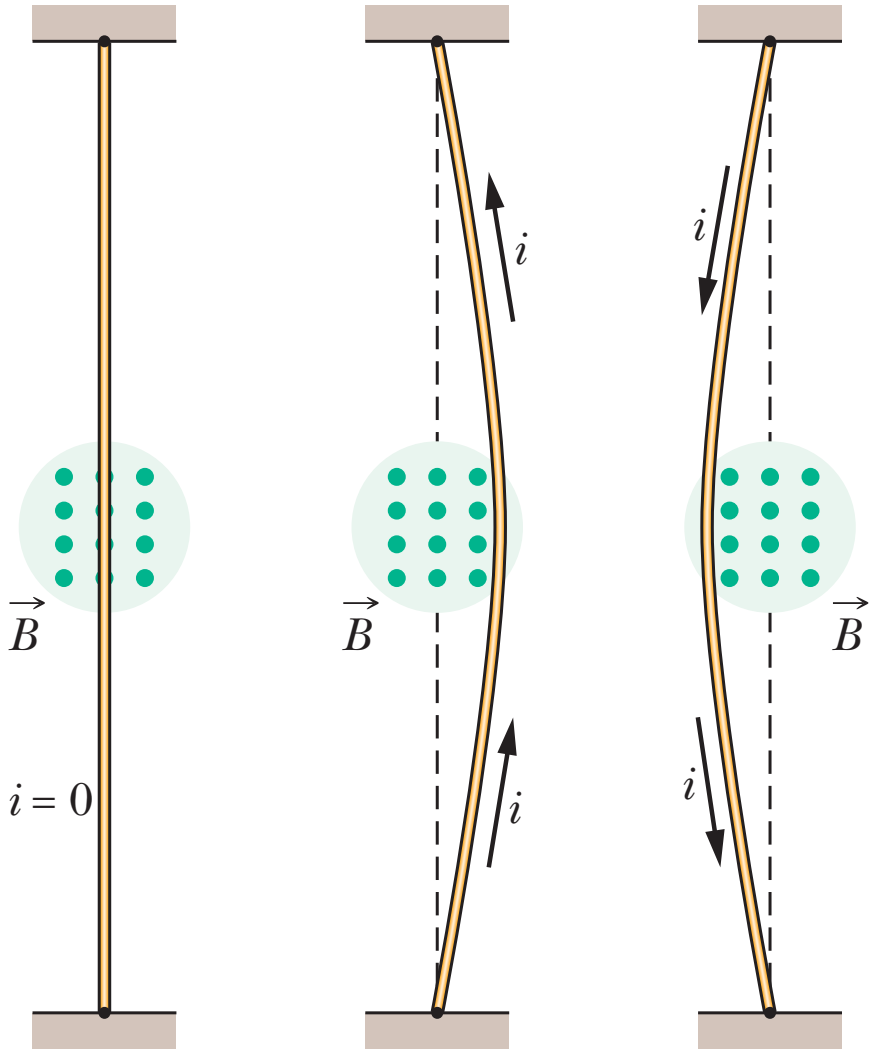
Magnetic Force on a Current Carrying Wire

Charged particles moving in a magnetic field experience a force.



A wire carrying a current also experiences a force, since there is a force on each moving charge confined to the wire.

Magnetic Force on a Current Carrying Wire



The direction of the force depends on the direction of the current.

Magnetic Force on a Current Carrying Wire

The force on the wire in a uniform magnetic field is given by:

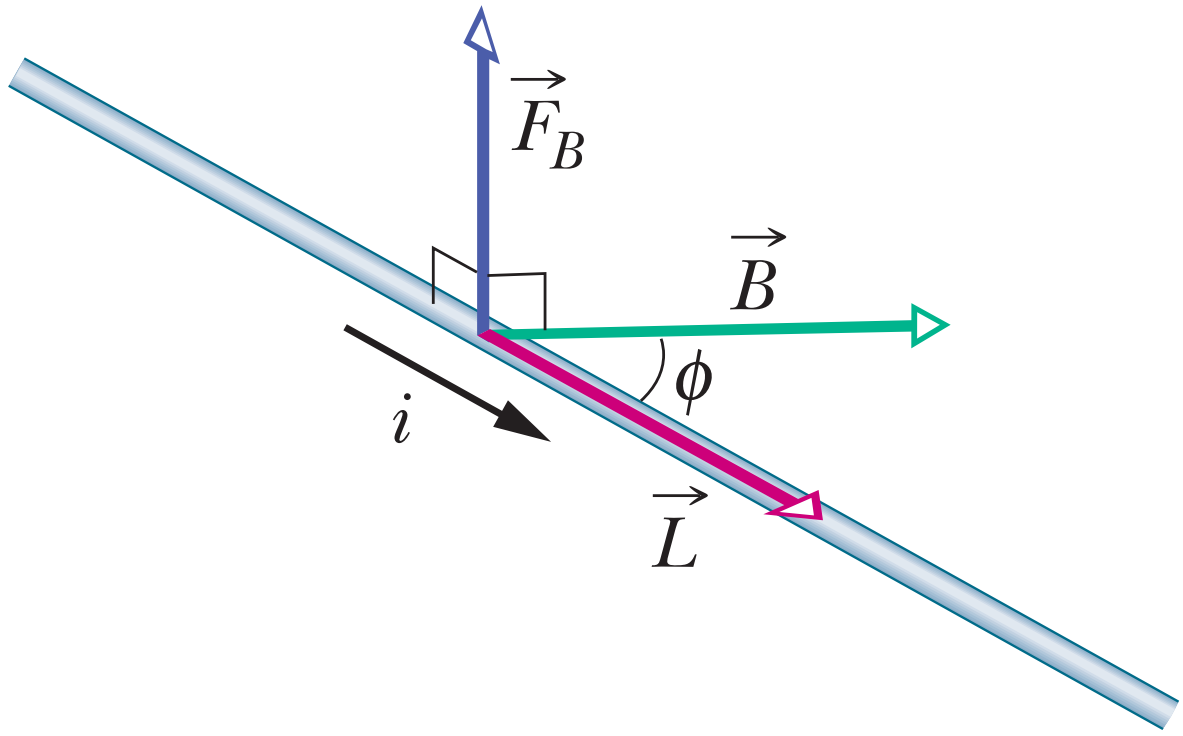
$$\mathbf{F} = I\mathbf{L} \times \mathbf{B}$$

where $\mathbf{L}$ is a distance vector that points along the length of the wire in the direction of the conventional current I and is as long as the part of the wire inside the field is.

By considering the force on an individual charge, we derived this equation.

$$\mathbf{F}_B = q\mathbf{v} \times \mathbf{B}$$

Magnetic Force on a Current Carrying Wire



$$\mathbf{F} = I\mathbf{L} \times \mathbf{B}$$

Lab report

This is the final lab. There will be a lab report. The report will be due Tues, Dec 1st.

Style of the lab report: pretend you are a scientist. Your goals:

- clearly communicate precisely what you did, and the results you got
- let others know exactly how to repeat your experiment, confirm your results
- give an introduction to the reader of any theory involved

Lab report

What to assume about the reader:

- they do not know what was on the instruction sheet
- they do not know what precise equipment you used
- they already know how to use all of the equipment
- they are skeptical

Lab report

The lab report should contain:

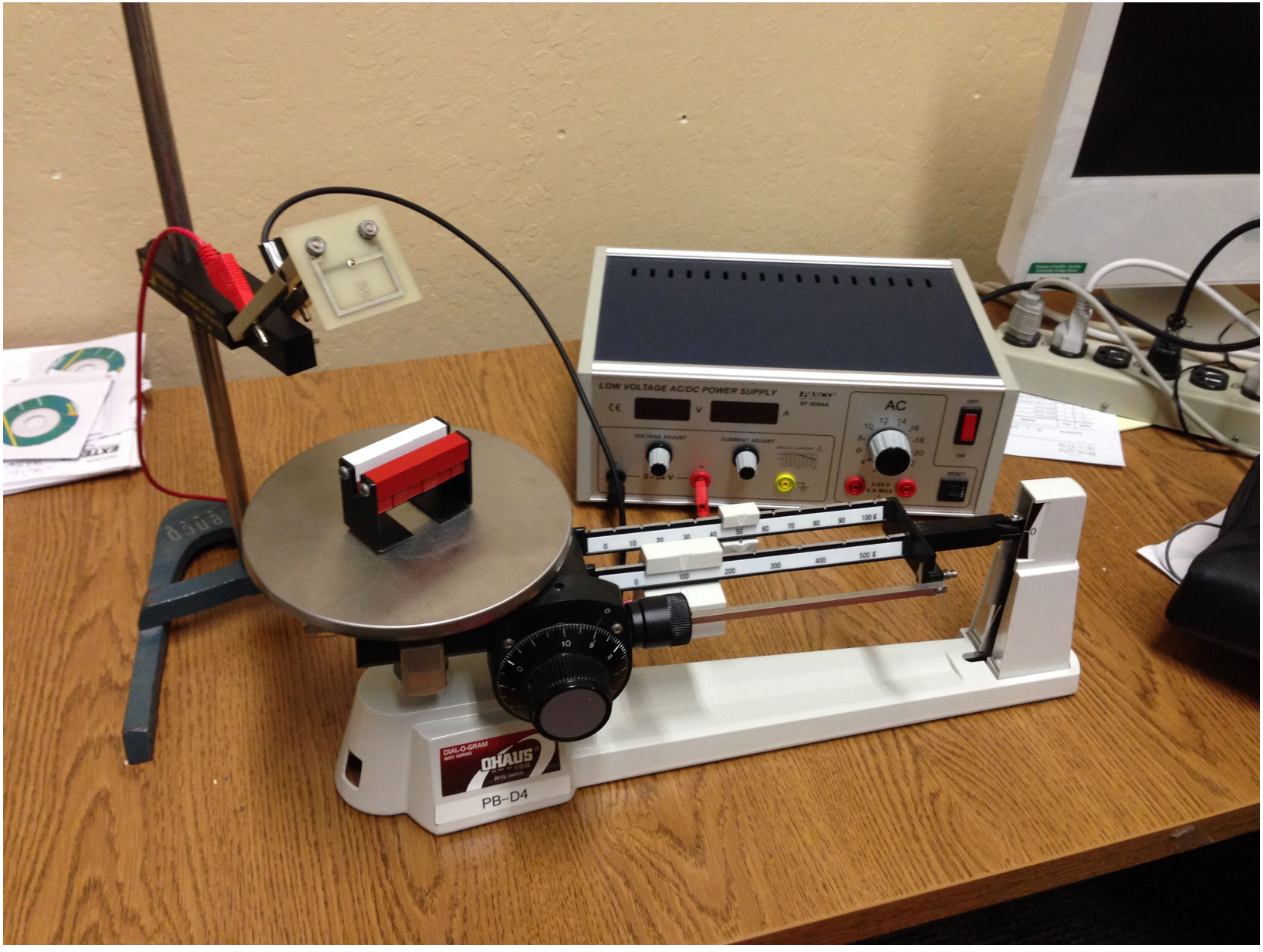
- an introduction: what are you investigating in this experiment
- the hypothesis: the theoretical predictions you are trying to test
- a description of the experimental procedure and all equipment used
- your data / measurements
- analysis: how well did your data agree with the predictions? Were there any sources of experimental error? Were they systematic or random? What would you do differently in the future to improve this experiment?
- conclusion: Does the theory seem correct? Does your data support it? If not, why not? If there are a few data points that deviate from predictions, try to explain what may have occurred. What other related questions could you investigate in similar experiments?

Lab report

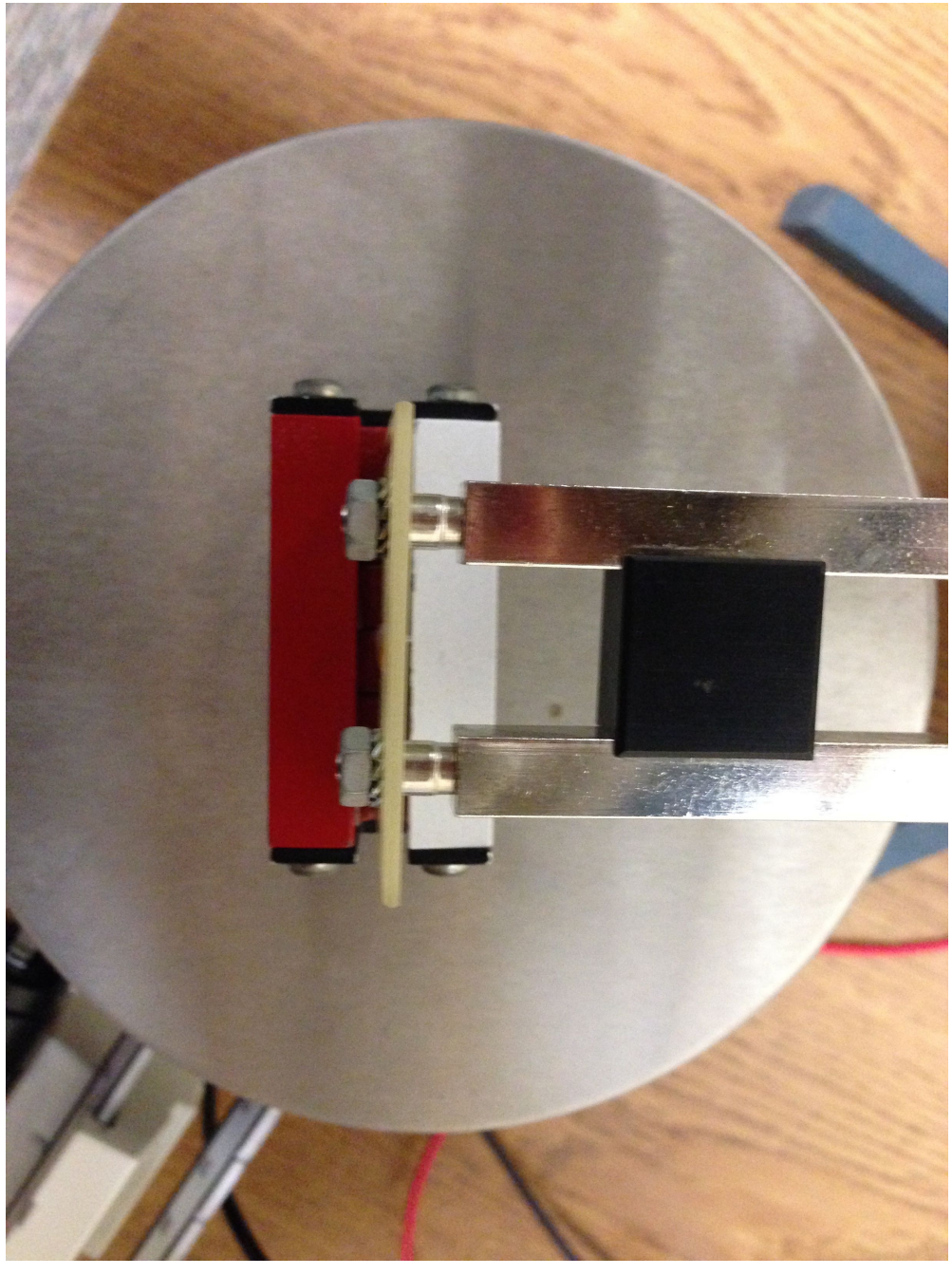
Other things:

- diagrams and tables are often very helpful
- do not make statements without evidence
- do error analysis or give percentage differences where appropriate

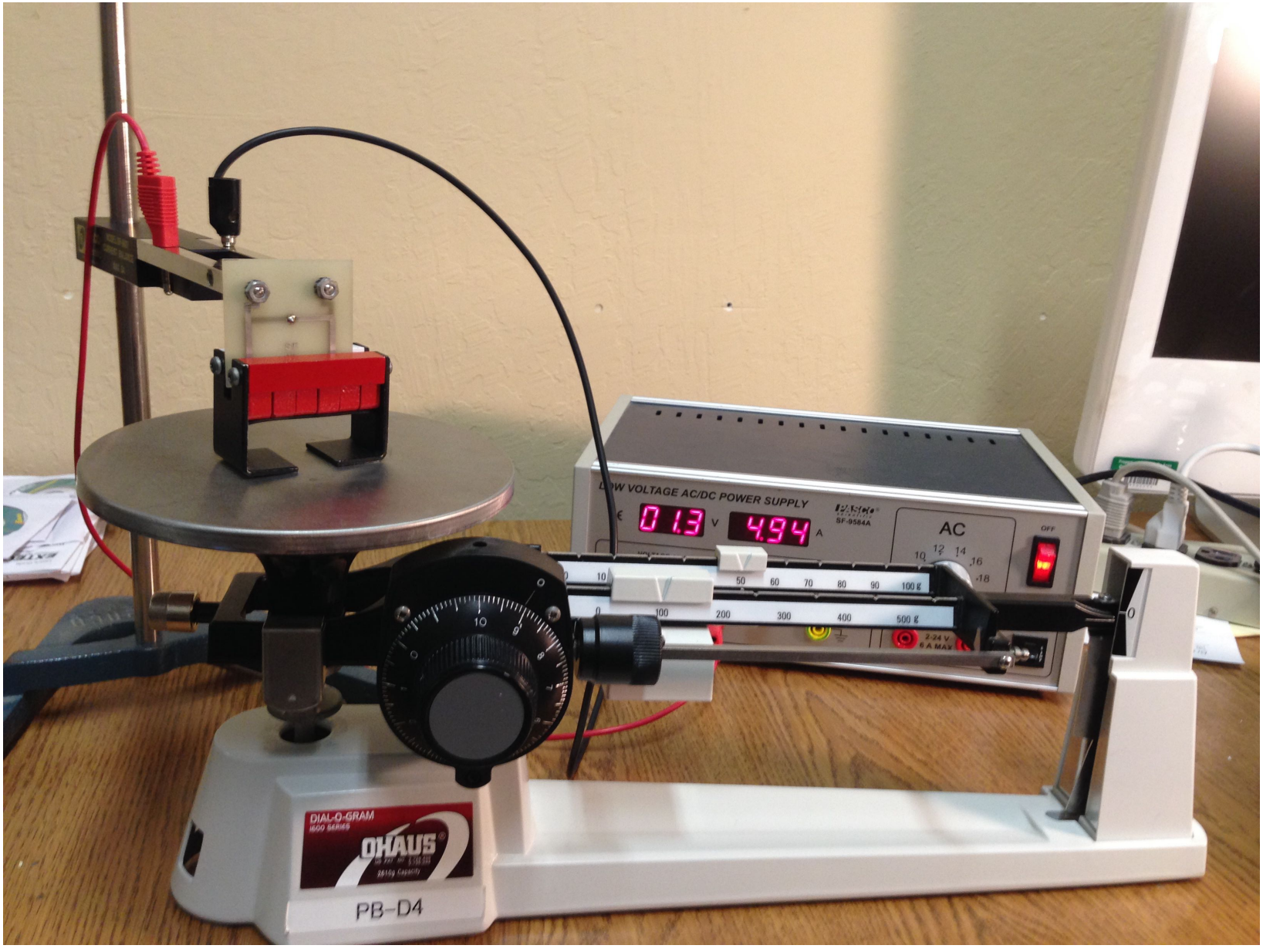
Setup


LOW VOLTAGE AC/DC POWER SUPPLY
AC
VOLTAGE ADJUST
CURRENT ADJUST
DIAL-O-GRAM
OHAUS
PB-D4

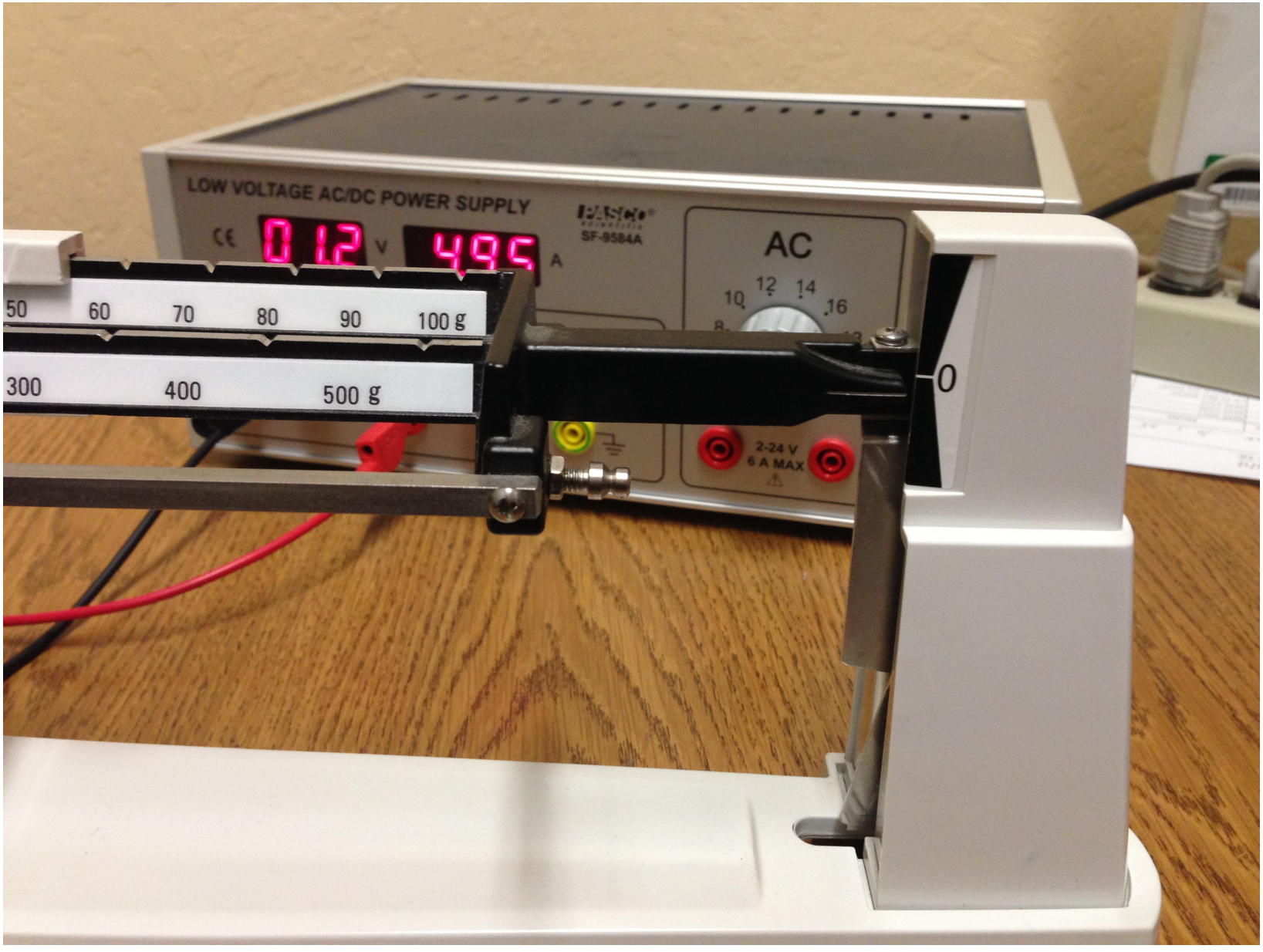
Setup



Making measurements



Using the balance



The Gauss Meter

The Gauss meter probe is delicate and expensive to replace, so when you are done with measuring the forces on the wires, bring your magnet to the front and I will help you measure its B-field.