Magnetism

Equipment

- Hall-effect probe (magnetic field sensor), voltage probe, DMM
- Battery eliminator, assorted resistors, alligator clips, compass
- Optional: High power variable resistor, motion (position) sensor

Objective

Physics Concepts

- Magnetic field and electromagnetism
- Hall Effect

Experimental analysis

- Graph time varying functions, combine measurements to graph new quantities
- Fit curves to data to determine mathematical relationships
- Recognizing the uncertainty in measurements

Conceptual (C-Level)

You place a compass above a wire running north-south.

- Draw a schematic diagram when no current is flowing in the circuit.
- Draw a schematic diagram when current is flowing north in the wire.

Place a conducting plate, of height *h*, perpendicular to a magnetic field. When you run a current down its length a potential difference V appears across the height. This effect was discovered in 1879 by the American physicist E. H. Hall and now bears his name.

- Draw a diagram and prove that $V=vhB$, where *v* is the velocity of the charge carrier.

Explore the simulation "Faraday's Electromagnetic Lab". In particular you can examine the magnetic field produced by a bar magnet and electromagnet. Use the compass and/or magnetic field meter to examine the resulting magnetic fields.

Basic Lab (B-Level)

Use a magnetometer to explore the magnetic field around wires and loops.

- Using a cow magnet graph B as a function of distance from one pole
- Using a straight wire graph B as a function of I and/or distance
- Using a loop of wire graph B as a function of I and/or z (axial distance)

Advanced/Extended Lab Ideas (A-Level)

- Compare your measurements to theory.
- Apply advanced error analysis to your results.
- Make a simple DC motor and explain its operation (you may want to play with a St Louis motor).
- Graph B as a function of other variables and compare with theory
- Ideas of your choosing.