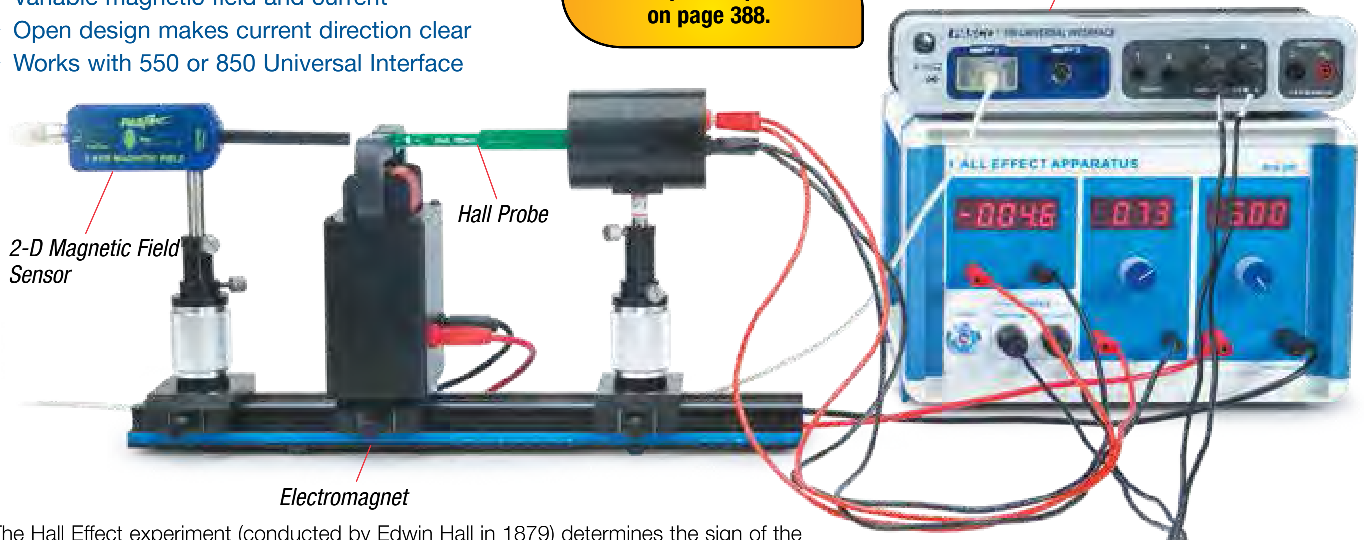
Hall Effect Apparatus (n-doped Semiconductor)

SE-7260

- Variable magnetic field and current
- Open design makes current direction clear
- Works with 550 or 850 Universal Interface

See complete experiment on page 388.



The Hall Effect experiment (conducted by Edwin Hall in 1879) determines the sign of the charge carriers in current flow. A current can be thought of as a negative charge moving in one direction (Figure 1) or as a positive charge moving in the opposite direction (Figure 2). To determine which it actually is, the semiconductor is immersed in the magnetic field transverse to the direction of flow of current. The moving charge experiences a $q\vec{v} \times \vec{B}$ force, causing a charge build-up on one side of the semiconductor (creating an electric field), which in turn leads to a $q\vec{E}$ force. The direction of the electric field will depend on the sign of the charge carriers and the polarity of the Hall voltage across the semiconductor reveals this sign.

The magnitude of the Hall voltage is dependent on the current, the charge carrier density, and the magnitude of the magnetic field. In modern day electronics, the Hall Effect is used to measure the magnitude and direction of magnetic fields.

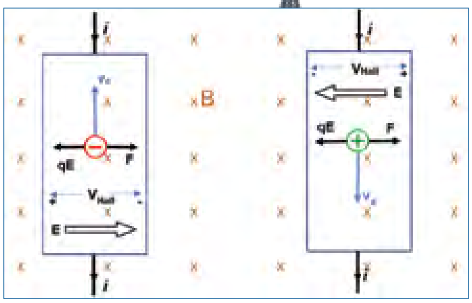


Figure 1 Figure 2

PASCO Advantage

The open design of this Hall Effect apparatus makes it possible for students to see the direction of the current and the magnetic field, enabling them to use the sign of the Hall voltage to deduce the sign of the charge carriers.

The directions of the current and the voltage probe are clearly marked on the probe that holds the semiconductor.

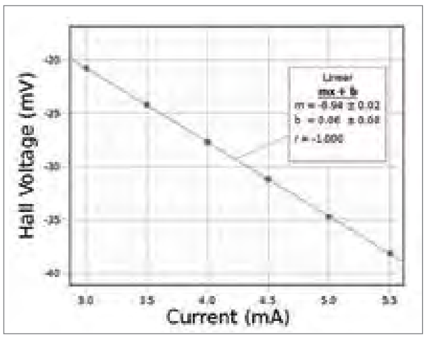
Specifications

n-Doped Semiconductor Material: GaAs
Hall Sensitivity: ≥150 mV/(mA·T)
U-core Electromagnetic Coil (1000 Turns)
Magnet Space: 10 mm
Magnet Field: 0 to 0.065 T (at 1A)
Excitation Current: 0 to 1 A DC
Hall Voltage: 0 to 1.9999 V
Power Supply Digital Readout for Current, Hall Voltage, and Magnet Current

Includes

- Hall Probe Unit, n-Semiconductor (GaAs)
- Hall Effect Power Supply
- U-Core Electromagnetic Coil
- Track, Length 40 cm
- Optical Carrier (2)
- Adjustable Post Holder with 9 cm Post (2)
- Banana Cords (6)
- Connecting Cables for 550/850 Interface (2)
- Manual

Using the 550 Universal Interface to record data, this plot of the Hall Voltage vs. the Current was made in PASCO Capstone software. In this case, the magnetic field was held constant and the current through the semiconductor was varied.



Order Information

Hall Effect Apparatus SE-7260

Note: This apparatus can be used manually by reading the digital displays. Measuring the magnetic field requires a sensor or other Tesla meter. This apparatus includes connector cables for an 850 or 550 interface so data collection can be automated.

Required:

2-Axis Magnetic Field Sensor PS-2162
850 or 550 Universal Interface ....UI-5000 or UI-5001 pp. 28-30
PASCO Capstone Software.. pp. 72-75

Hall Effect

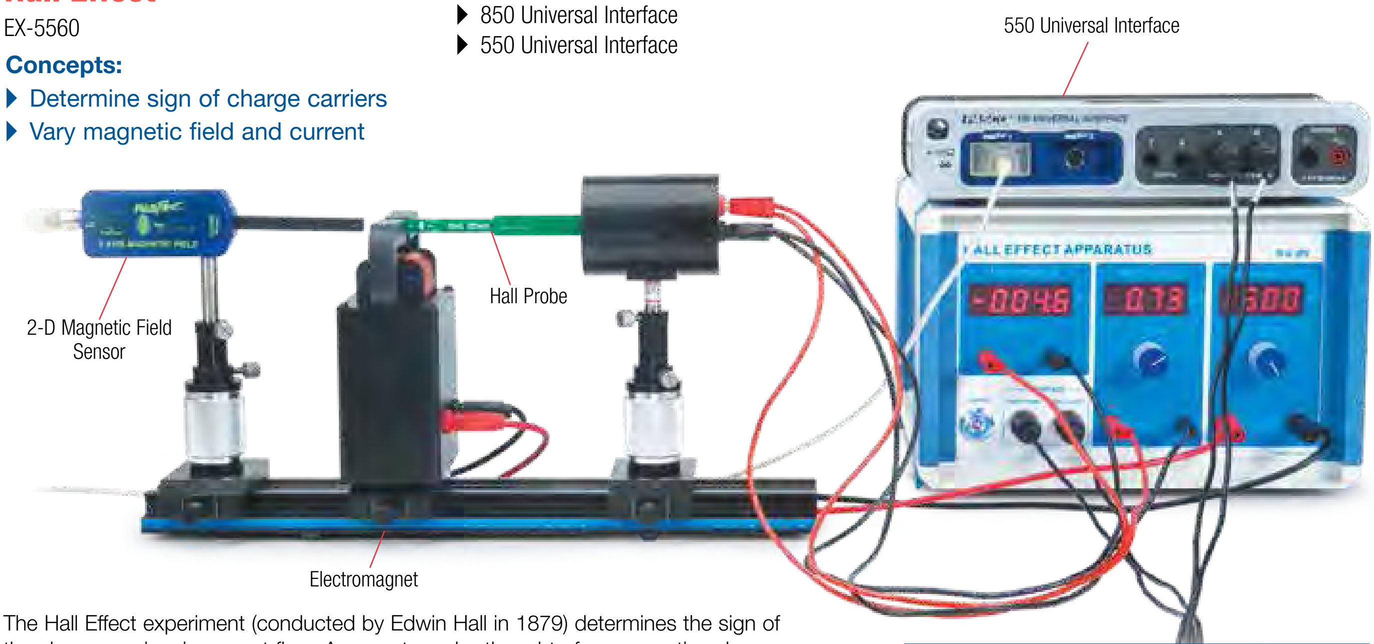
EX-5560

Concepts:

- Determine sign of charge carriers
- Vary magnetic field and current

Designed for use with either of the following:

- 850 Universal Interface
- 550 Universal Interface



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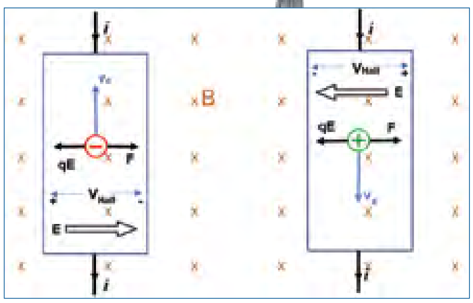
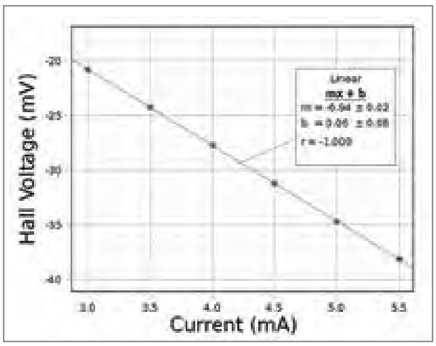


Figure 1 Figure 2



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PASCO Advantage

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Includes

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- Hall Effect Power Supply
- U-Core Electromagnetic Coil
- Track, Length 40 cm
- Optical Carrier (2)
- 2-D Magnetic Field Sensor (PS-2162)
- Adjustable Post Holder with 9 cm Post (2)
- Banana Cords (6)
- Connecting Cables for 550/850 Interface (2)

Download This Experiment

The FREE experiment files include instructions in Microsoft Word®, PASCO Capstone workbook files with sample data, and graphics. Download these experiments at **www.pasco.com/CapstoneExperiments**.

Order Information

Hall Effect EX-5560

Required:

550 or 850 Universal Interface .... pp. 28-30

PASCO Capstone Software..................................... pp. 72-75