Physics 202, Lecture 11

Today's Topics

- Magnetic Fields and Forces (Ch. 27)
  - Magnetic materials
  - Magnetic forces on moving point charges
  - Magnetic forces on currents, current loops
  - Motion of charge in uniform B field

Thurs: applications (cyclotron, velocity selector, Hall effect)

Magnetism: Overview

Previously: electrostatics

- **Forces and fields due to stationary charges**
- **Coulomb force F_E, Electrostatic field E:**

$$\vec{F}_E = q\vec{E}$$

Now: magnetism (magnetostatics)
(historically: magnetic materials, Oersted effect)

- **Forces and field due to moving charges (currents)**
- **Magnetic Force F_B, magnetic field B:**

$$\vec{F}_B = qv \times \vec{B} \qquad \text{(charges: Lorentz force)}$$

$$\vec{F}_B = \int Id\vec{l} \times \vec{B} \qquad \text{(currents)}$$

Magnetic Materials (1)

Focus first on bar magnets (permanent magnets):

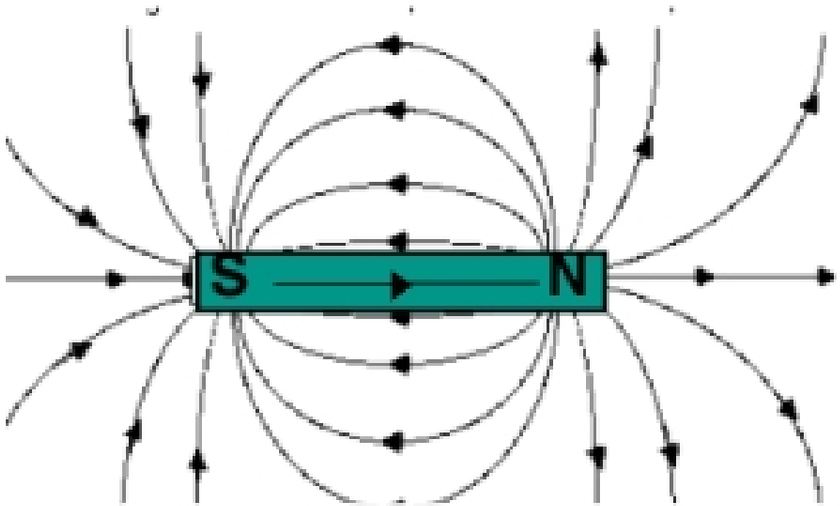
Two types of poles: N and S

Magnetic forces: like poles repel, opposite poles attract

Magnetic field: B (vector field).

Units: 1 Tesla (T) = 1 N/(A m)

Direction: as indicated by compass's "north" pole



Field lines:
Outside magnet: N to S
Inside magnet: S to N