Physics 202, Lecture 13

Today's Topics

- Sources of the Magnetic Field (Ch. 27)
  - B field of infinite wire

    Force between parallel wires
  - Biot-Savart Law

    Examples: ring, straight wire
  - Ampere's Law:

    Example: Infinite wire

Magnetic Fields of Current Distributions

$$\vec{F} = \int I d\vec{l} \times \vec{B}$$

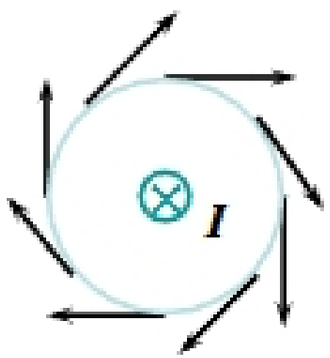
2 ways to calculate B:

– **Biot-Savart Law**
("Brute force")

$$d\vec{B} = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \times \hat{r}}{r^2}$$

– **Ampere's Law**
("high symmetry")

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enclosed}$$



–AMPERIAN LOOP

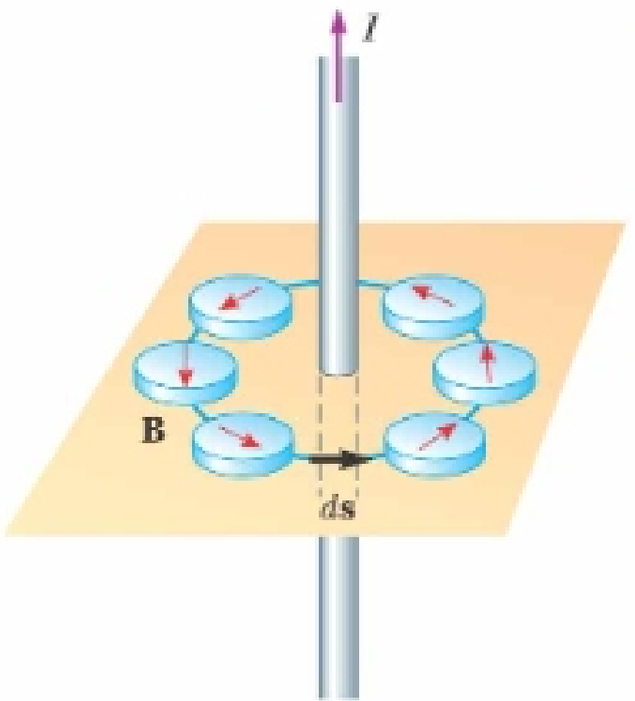
$$\mu_0 = 4\pi k_m$$

$\mu_0 = 4\pi x10^{-7}$ T·m/A:
permeability of free space

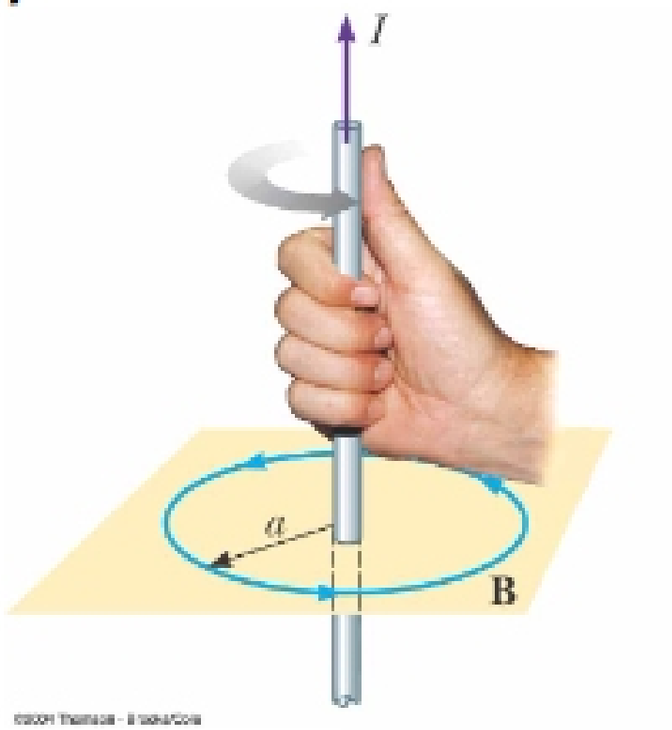
Magnetic Field of Infinite Wire

Result (we'll derive this both ways):

$$\vec{B} = \frac{\mu_0 I}{2\pi r}\hat{\theta}$$



right-hand rule



closed circular loops centered on current