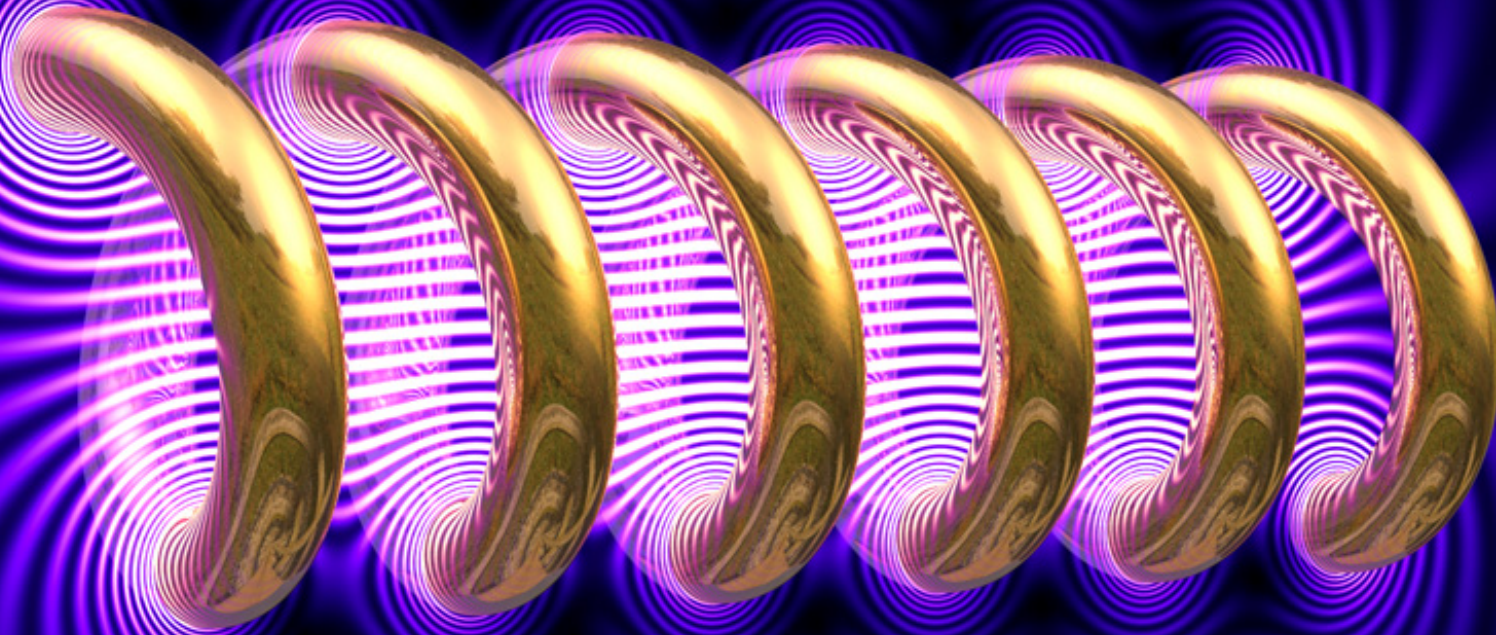


Clase 23

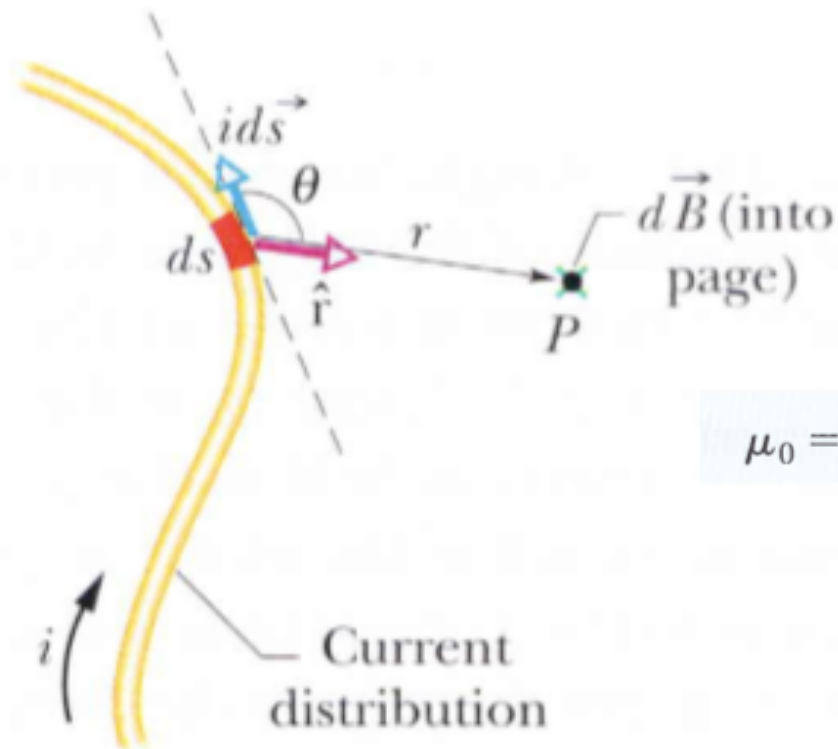
18/04/2013

Lecturas 29.1 - 29.4

Campos magnéticos debidos a corrientes



Cálculo del campo magnético debido a una corriente

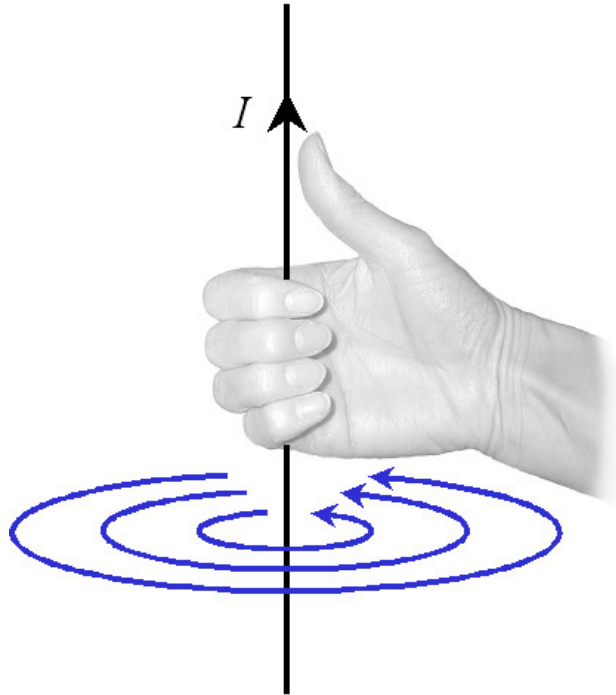


$$dB = \frac{\mu_0}{4\pi} \frac{i ds \sin \theta}{r^2},$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T} \cdot \text{m/A} \approx 1.26 \times 10^{-6} \text{ T} \cdot \text{m/A}.$$

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

Cálculo del campo magnético debido a una corriente



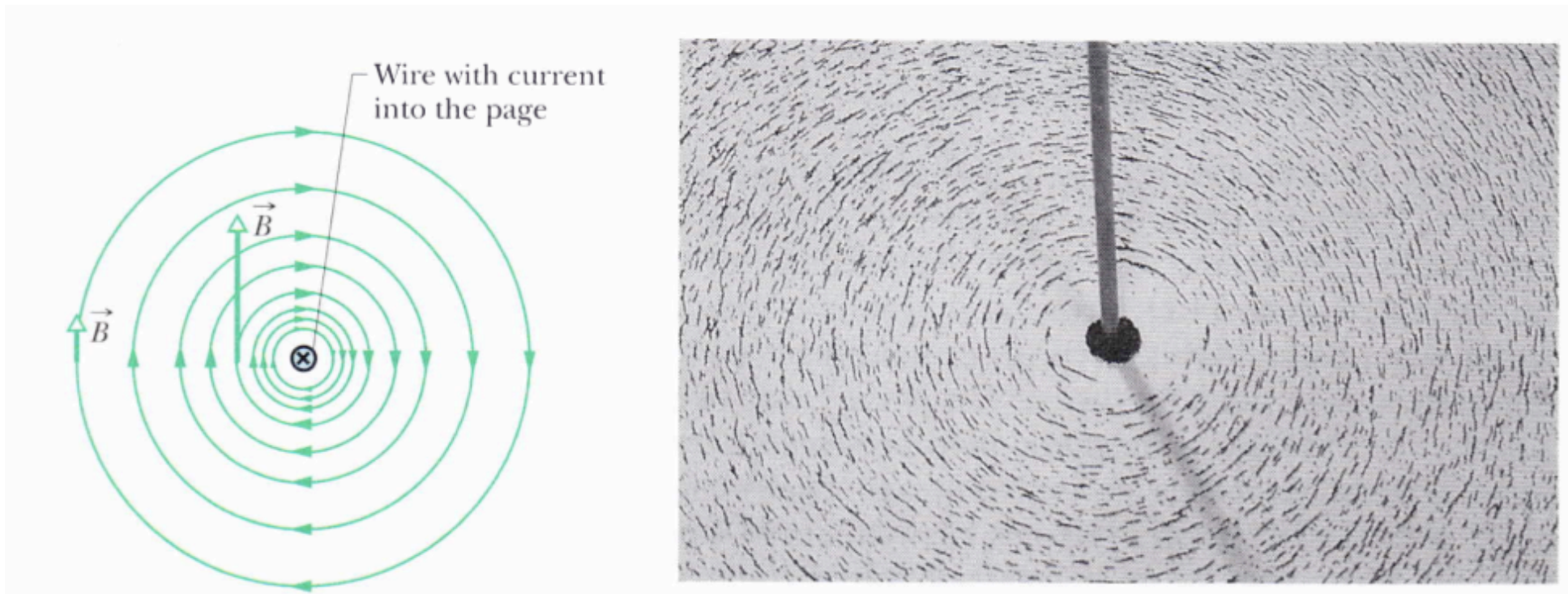
$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{i d\vec{s} \times \hat{r}}{r^2}$$



Ley de Biot-Savart



Cálculo del campo magnético debido a una corriente



Campo magnético debido a una corriente en un alambre recto y largo

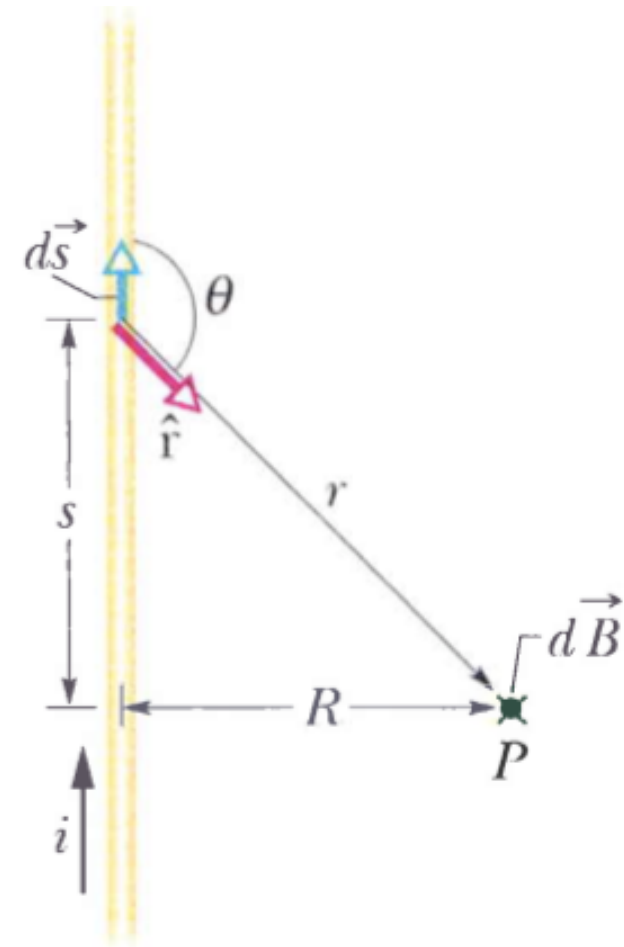
$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{i d\vec{s} \times \hat{r}}{r^2}$$

$$B = 2 \int_0^\infty dB = \frac{\mu_0 i}{2\pi} \int_0^\infty \frac{\sin \theta ds}{r^2}.$$

$$r = \sqrt{s^2 + R^2}$$

$$\sin \theta = \sin(\pi - \theta) = \frac{R}{\sqrt{s^2 + R^2}}.$$

$$\begin{aligned} B &= \frac{\mu_0 i}{2\pi} \int_0^\infty \frac{R ds}{(s^2 + R^2)^{3/2}} \\ &= \frac{\mu_0 i}{2\pi R} \left[\frac{s}{(s^2 + R^2)^{1/2}} \right]_0^\infty = \frac{\mu_0 i}{2\pi R}, \end{aligned}$$



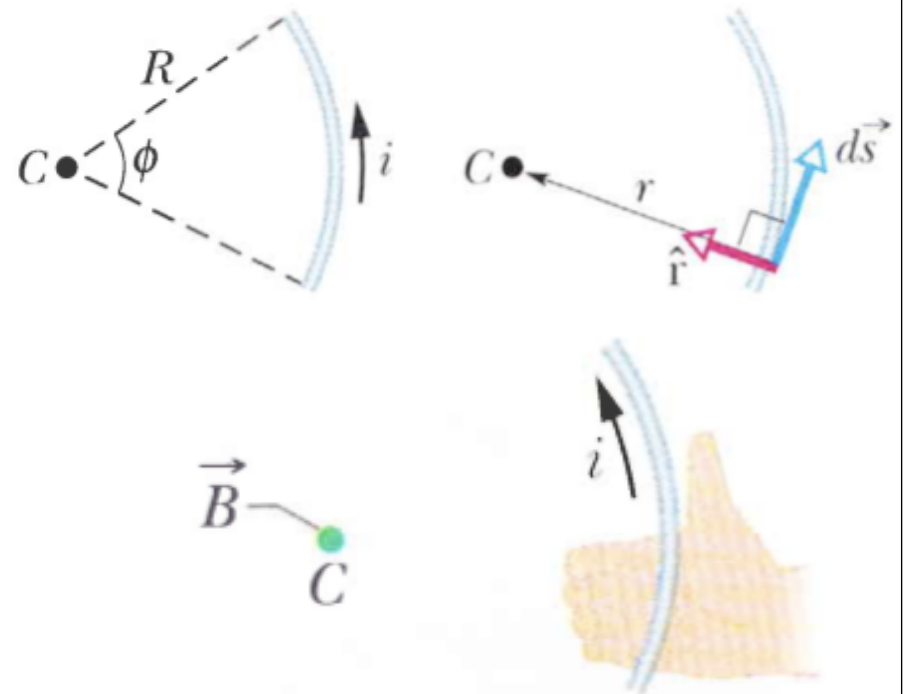
Campo magnético debido a una corriente en un arco circular de alambre

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

$$dB = \frac{\mu_0}{4\pi} \frac{i ds \sin 90^\circ}{R^2} = \frac{\mu_0}{4\pi} \frac{i ds}{R^2}.$$

$$B = \int dB = \int_0^\phi \frac{\mu_0}{4\pi} \frac{iR d\phi}{R^2} = \frac{\mu_0 i}{4\pi R} \int_0^\phi d\phi.$$

$$B = \frac{\mu_0 i \phi}{4\pi R}$$

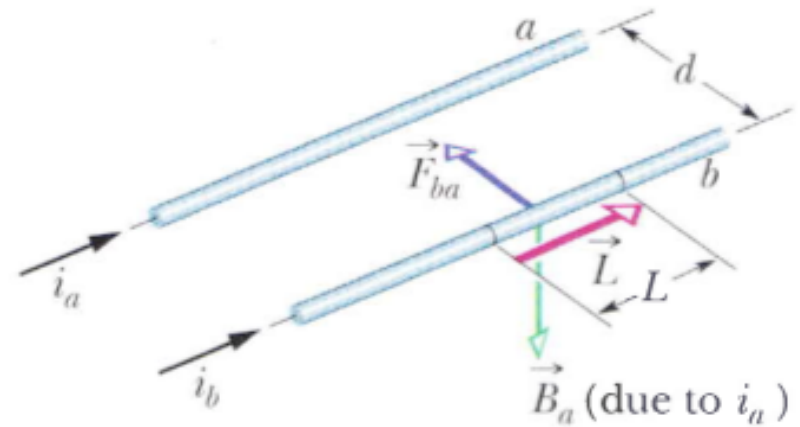


Para un
círculo completo

$$B = \frac{\mu_0 i (2\pi)}{4\pi R} = \frac{\mu_0 i}{2R}$$

Fuerza entre corrientes paralelas

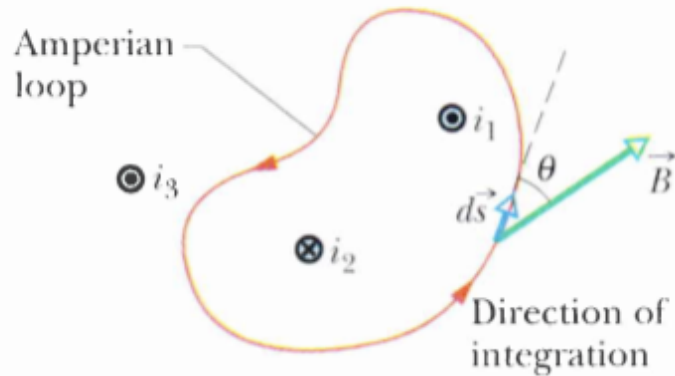
$$B_a = \frac{\mu_0 i_a}{2\pi d}.$$



$$\vec{F}_{ba} = i_b \vec{L} \times \vec{B}_a,$$

$$F_{ba} = i_b L B_a \sin 90^\circ = \frac{\mu_0 L i_a i_b}{2\pi d}.$$

Ley de Ampere

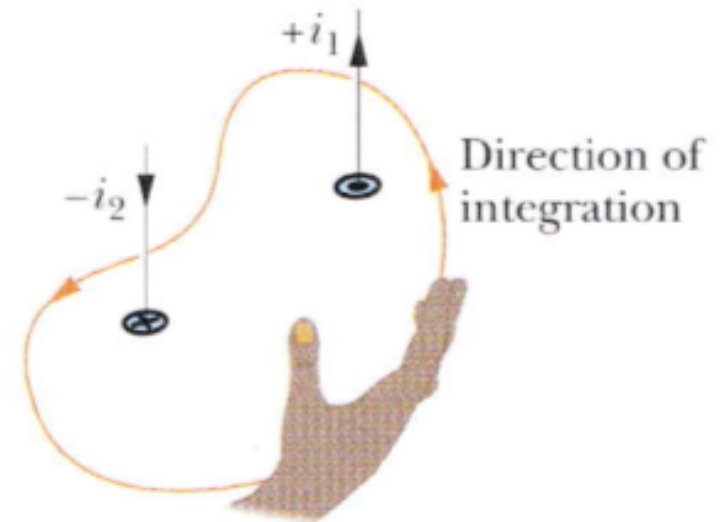


$$\oint \vec{B} \cdot d\vec{s} = \mu_0 i_{\text{enc}}$$

$$\oint \vec{B} \cdot d\vec{s} = \oint B \cos \theta ds = \mu_0 i_{\text{enc}}$$

$$i_{\text{enc}} = i_1 - i_2$$

$$\oint B \cos \theta ds = \mu_0 (i_1 - i_2)$$

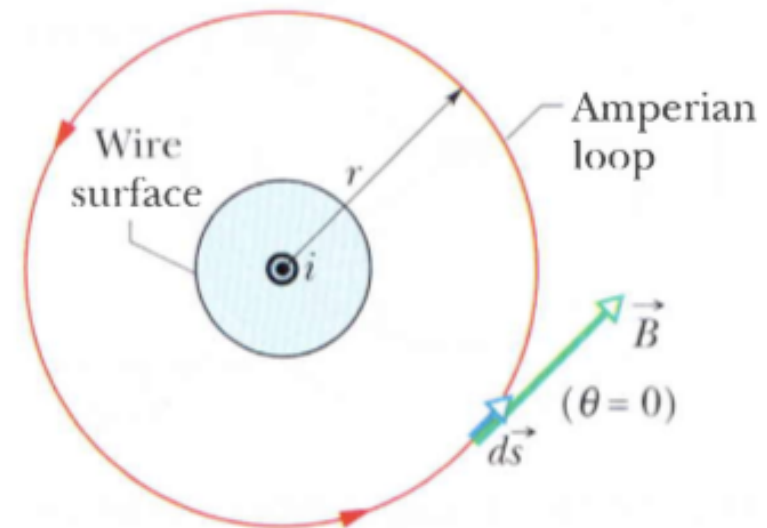


Campo magnético FUERA de un alambre recto y largo con corriente

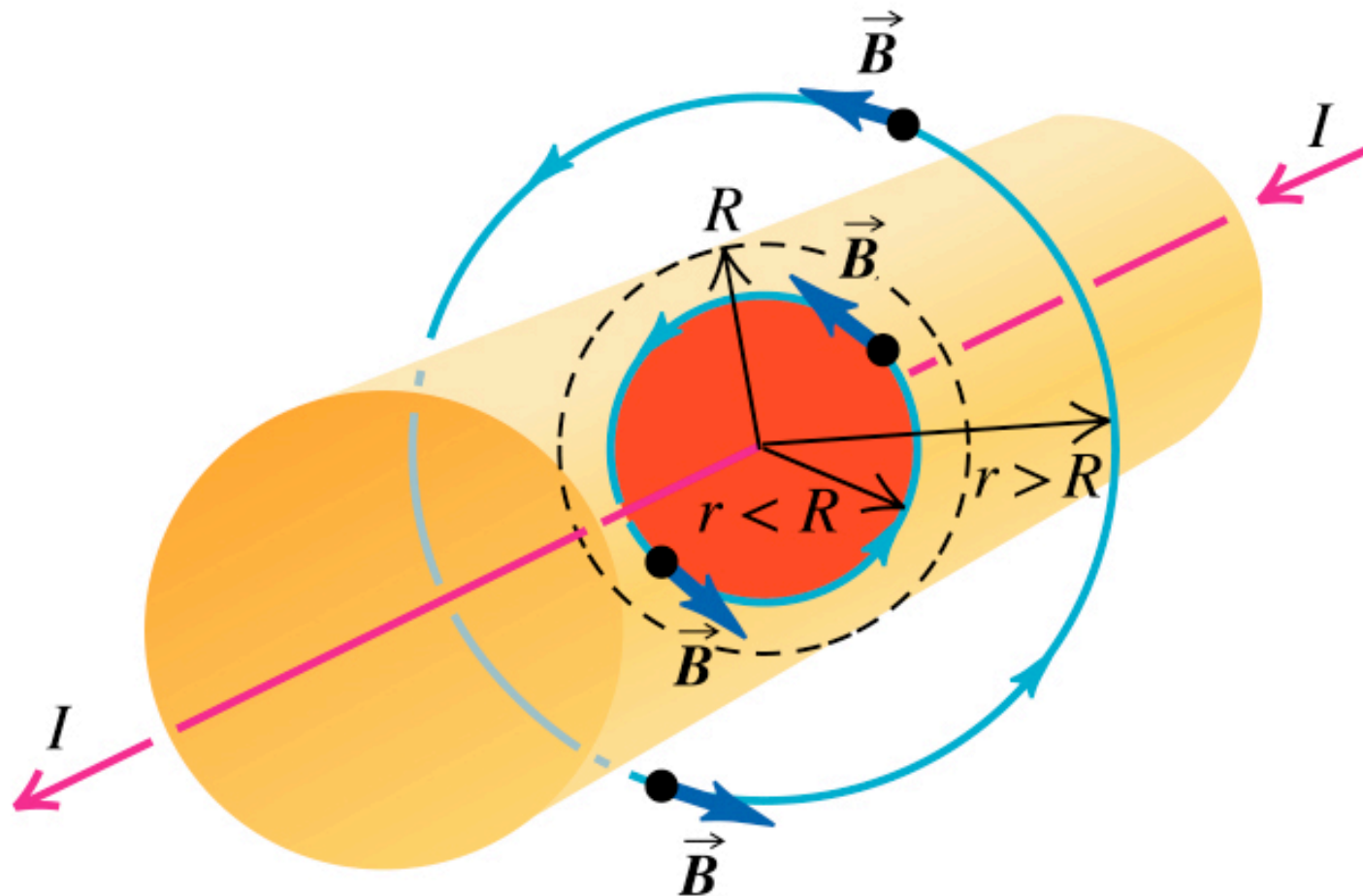
$$\oint \vec{B} \cdot d\vec{s} = \oint B \cos \theta ds = B \oint ds = B(2\pi r).$$

$$B(2\pi r) = \mu_0 i$$

$$B = \frac{\mu_0 i}{2\pi r}$$



Campo magnnético en un alambre recto y largo



Copyright © Addison Wesley Longman, Inc.

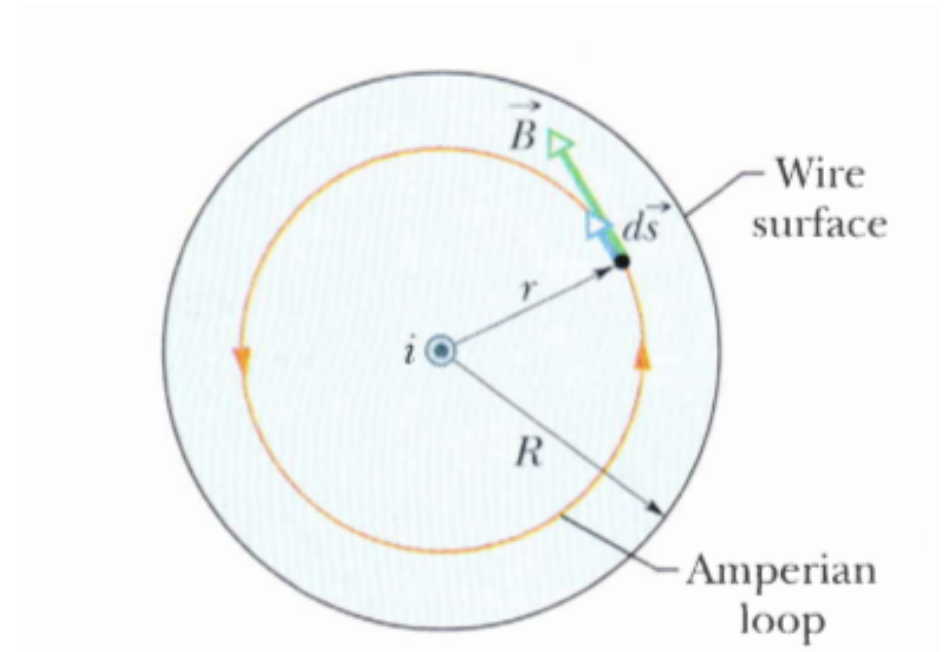
Campo magnético DENTRO de un alambre recto y largo con corriente

$$\oint \vec{B} \cdot d\vec{s} = B \oint ds = B(2\pi r).$$

$$i_{\text{enc}} = i \frac{\pi r^2}{\pi R^2}.$$

$$B(2\pi r) = \mu_0 i \frac{\pi r^2}{\pi R^2}$$

$$B = \left(\frac{\mu_0 i}{2\pi R^2} \right) r$$



Ejercicio para desarrollar en clase

••48 In Fig. 29-71, a long circular pipe with outside radius $R = 2.6 \text{ cm}$ carries a (uniformly distributed) current $i = 8.00 \text{ mA}$ into the page. A wire runs parallel to the pipe at a distance of $3.00R$ from center to center. Find the (a) magnitude and (b) direction (into or out of the page) of the current in the wire such that the net magnetic field at point P has the same magnitude as the net magnetic field at the center of the pipe but is in the opposite direction.

