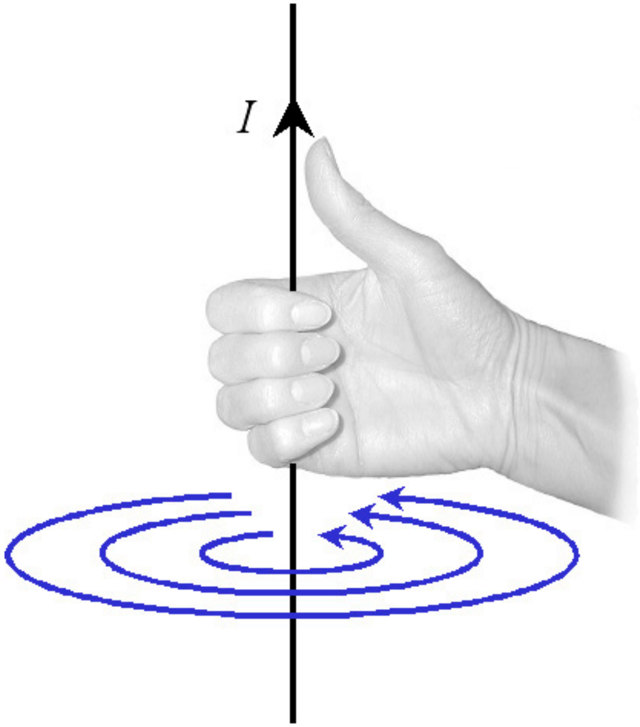
Clase 24

23/04/2013

Lecturas 29.3 - 29.4
30.1 - 30.4

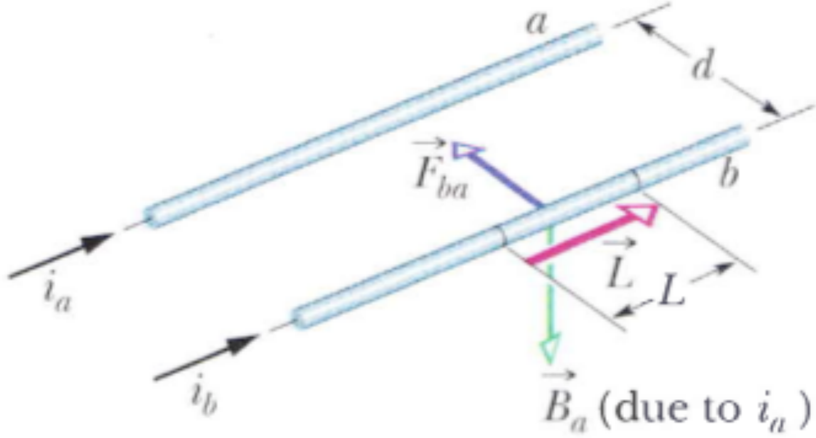
Cálculo del campo magnético debido a una corriente



Ley de Biot-Savart

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

Fuerza entre corrientes paralelas

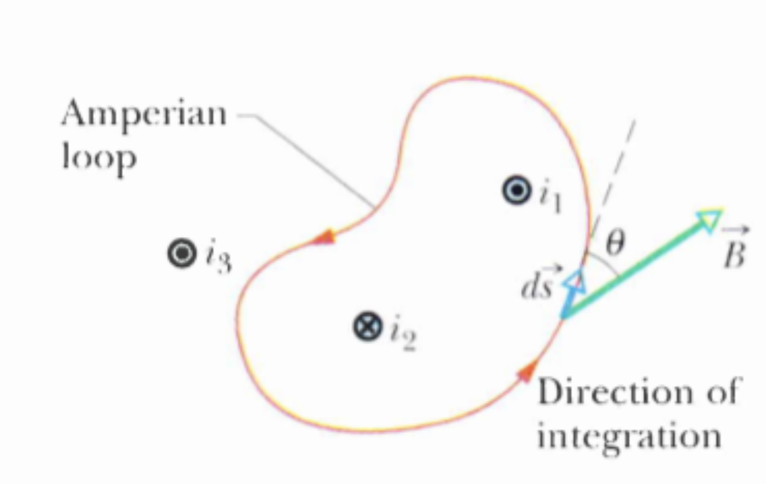


$$B_a = \frac{\mu_0 i_a}{2\pi d}.$$

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

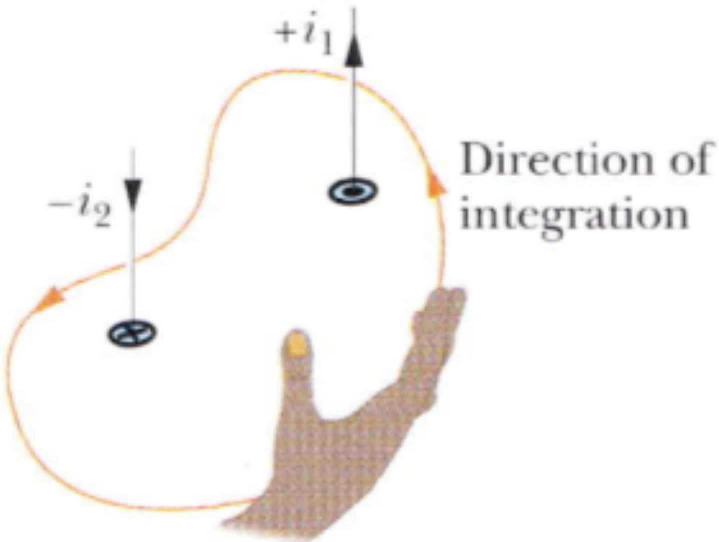
$$F_{ba} = i_b L B_a \sin 90^\circ = \frac{\mu_0 L i_a i_b}{2\pi d}.$$

Ley de Ampere



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

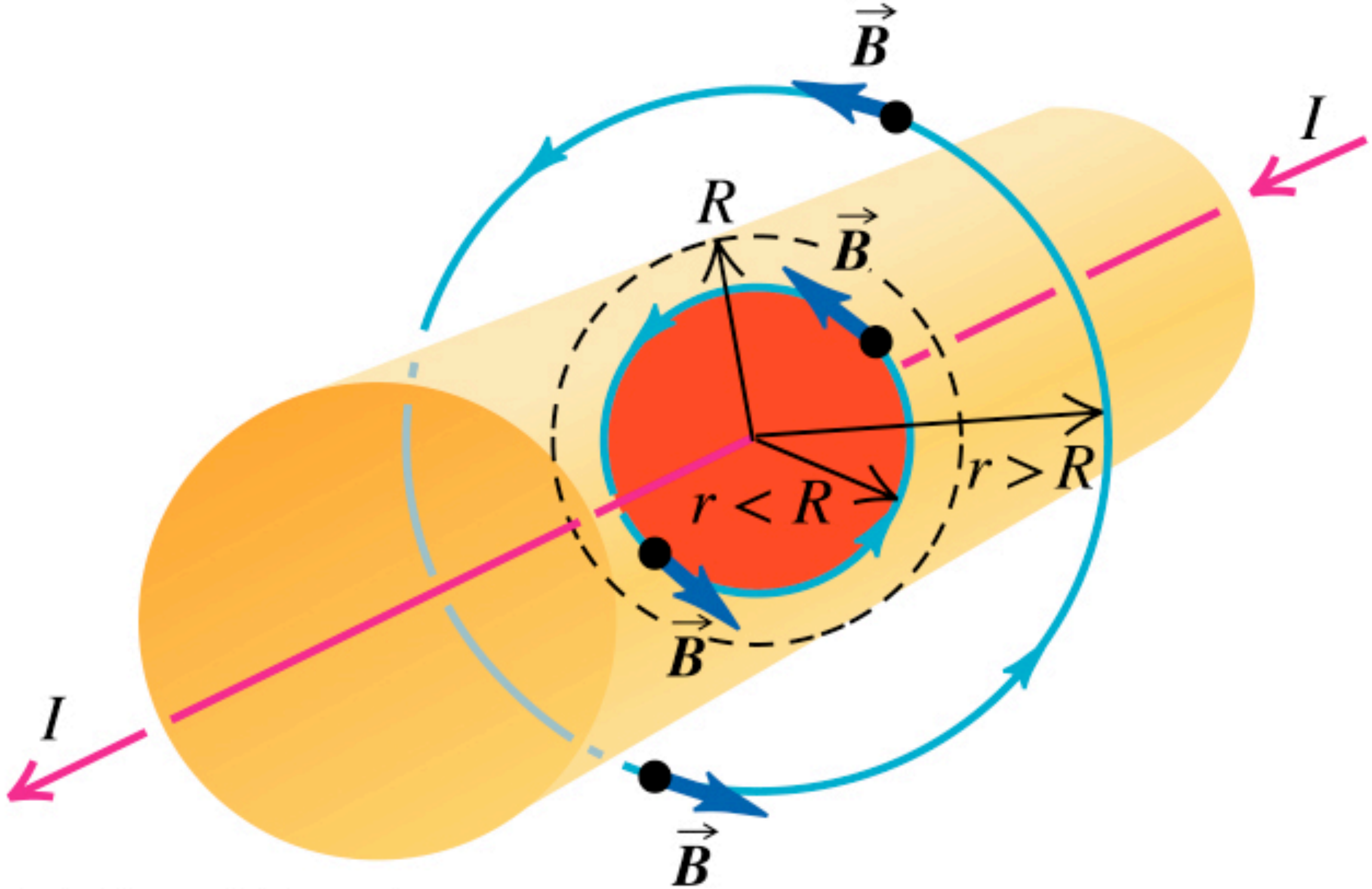
$$\oint \vec{B} \cdot d\vec{s} = \oint B \cos\theta \, ds = \mu_0 i_{enc}.$$



$$i_{enc} = i_1 - i_2.$$

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

Campo magnético en un alambre recto y largo

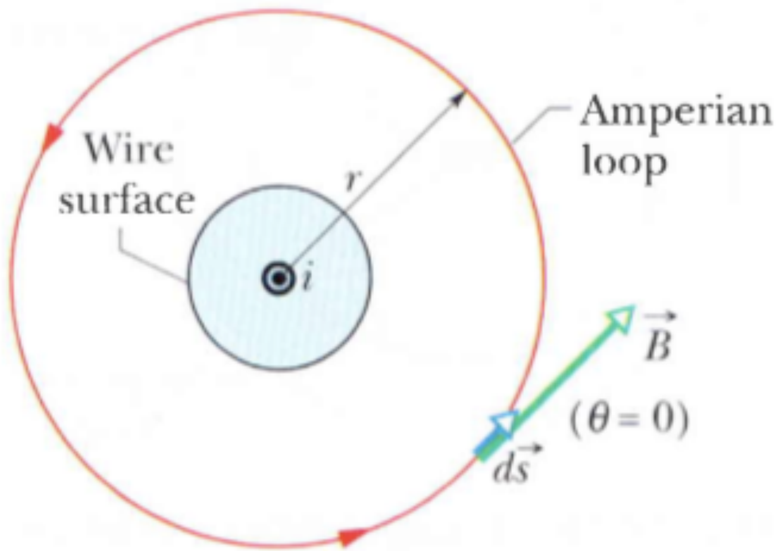


Campo magnético FUERA de un alambre recto y largo con corriente

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

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

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



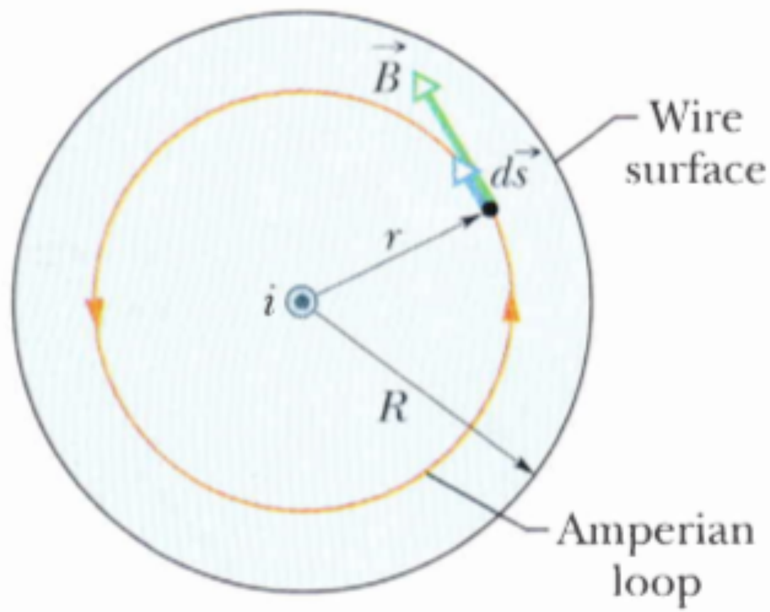
Campo magnético DENTRO de un alambre recto y largo con corriente

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

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

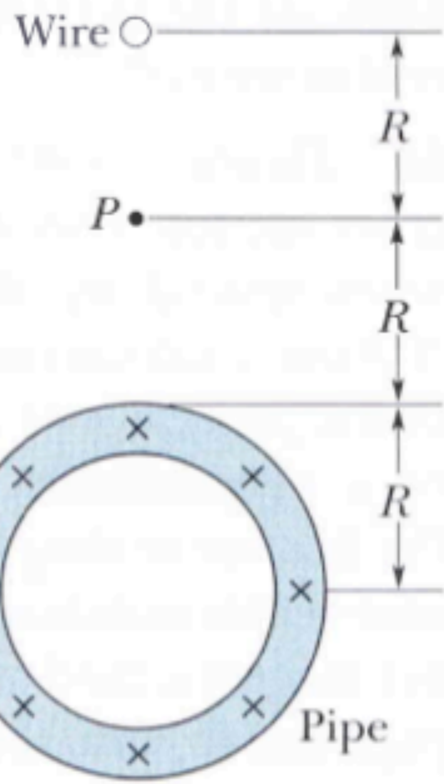
$$B(2\pi r) = \mu_0 i \frac{\pi r^2}{\pi R^2}$$

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

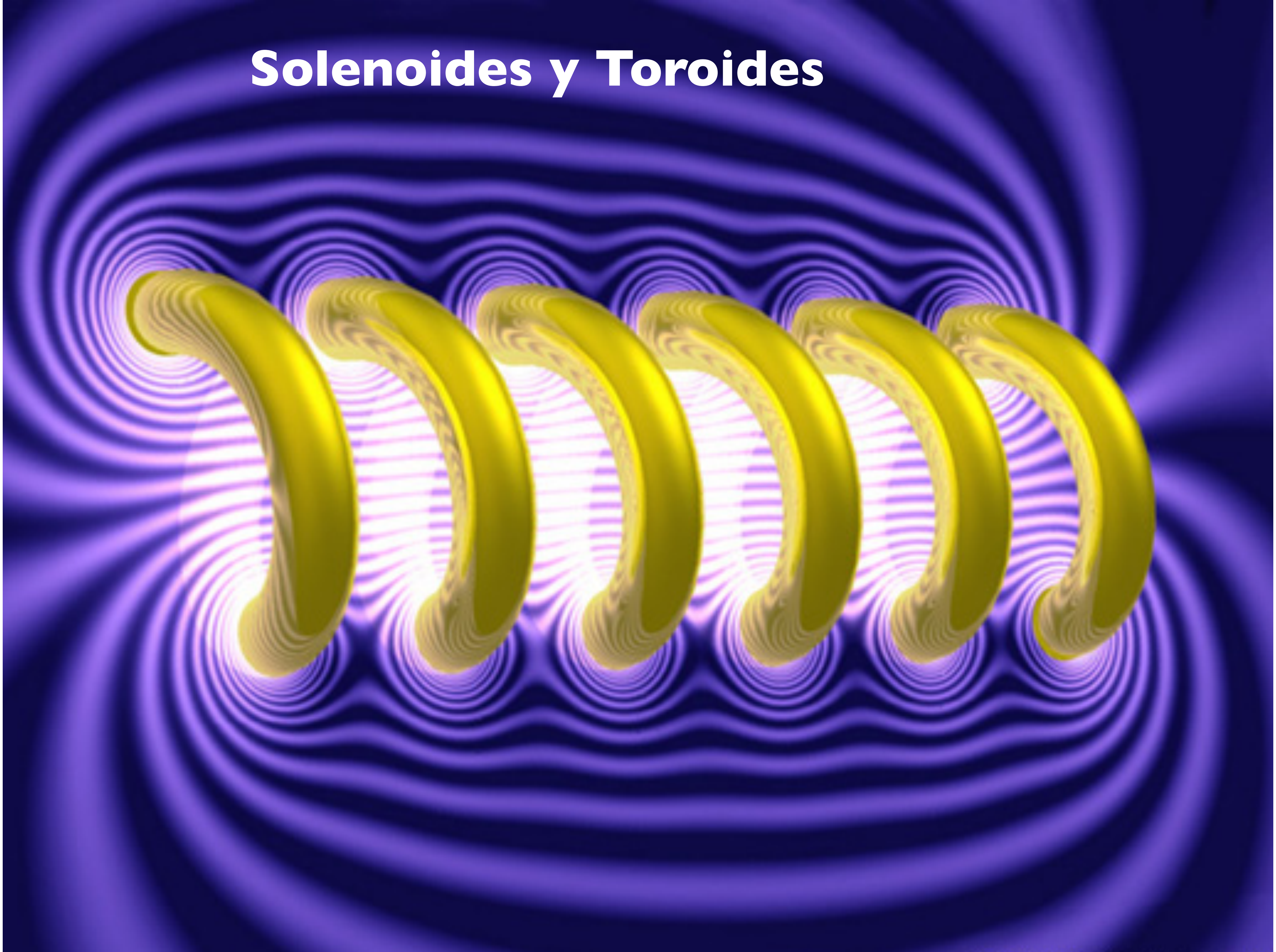


Ejercicio para desarrollar en clase

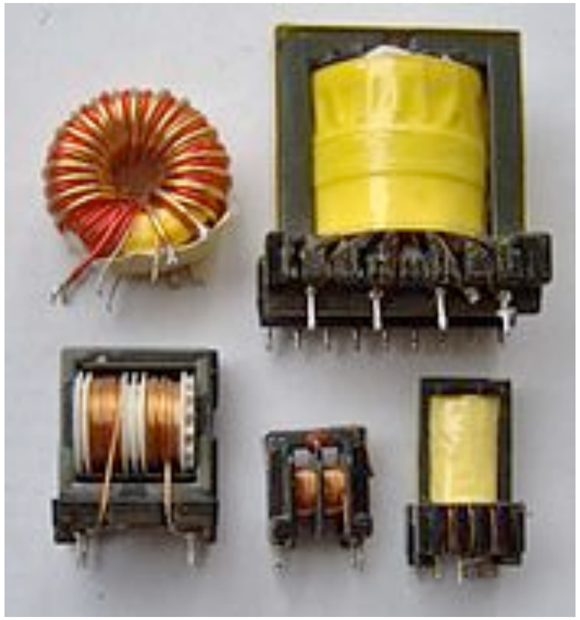
••48 In Fig. 29-71, a long circular pipe with outside radius $R = 2.6$ cm carries a (uniformly distributed) current $i = 8.00$ mA into the page. A wire runs parallel to the pipe at a distance of $3.00R$ from center to center. Find the (a) magnitude and (b) direction (into or out of the page) of the current 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.

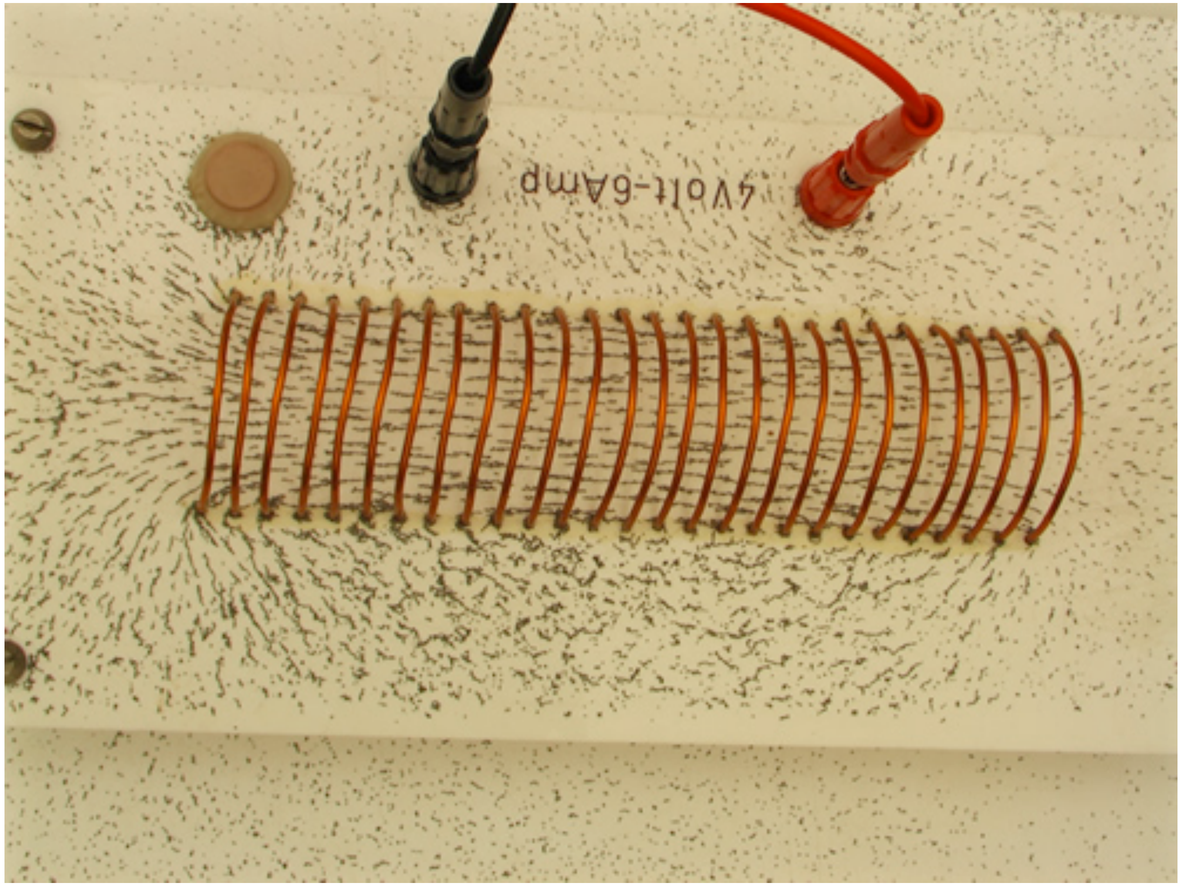


Solenoides y Toroides

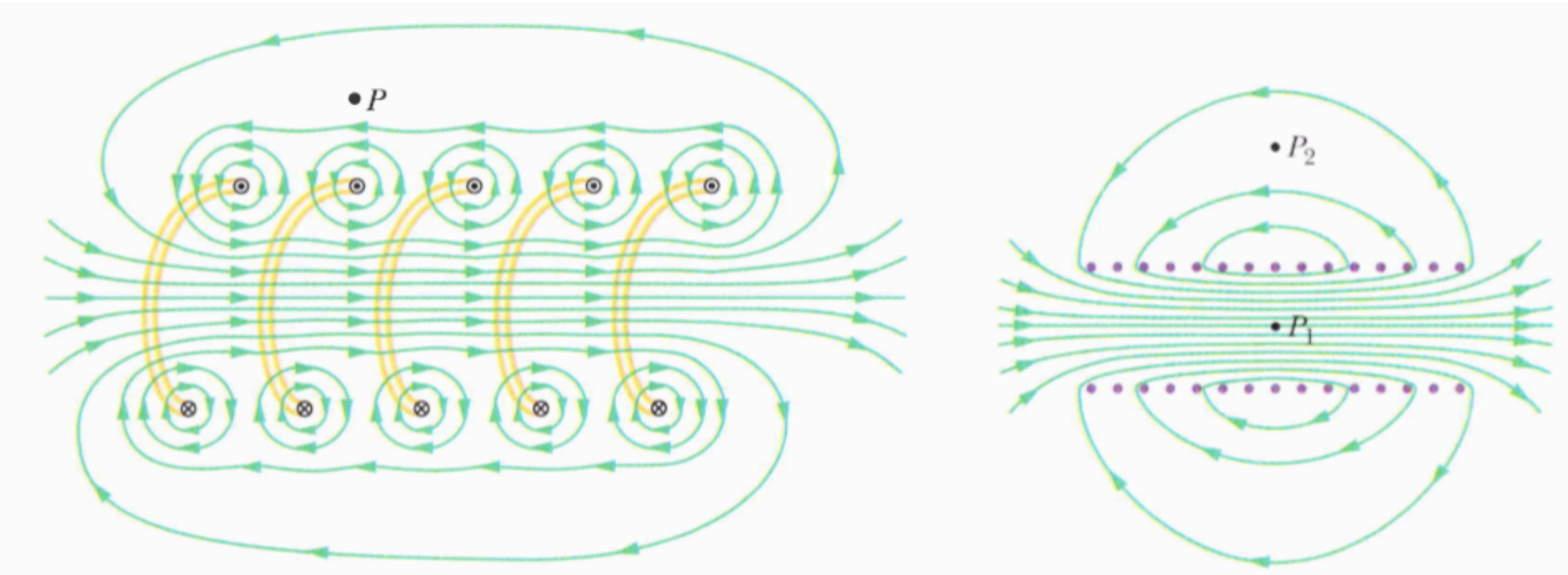


Solenoides y Toroides
Campo magnético



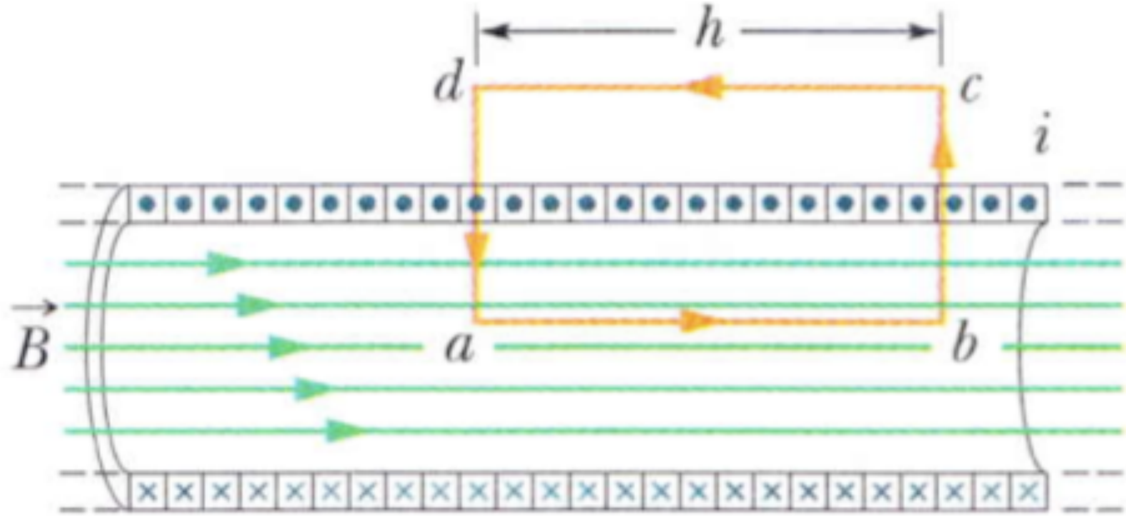


Solenoides
Campo magnético



Solenoides
Campo magnético

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



$$i_{enc} = i(nh).$$

$$Bh = \mu_0 inh$$

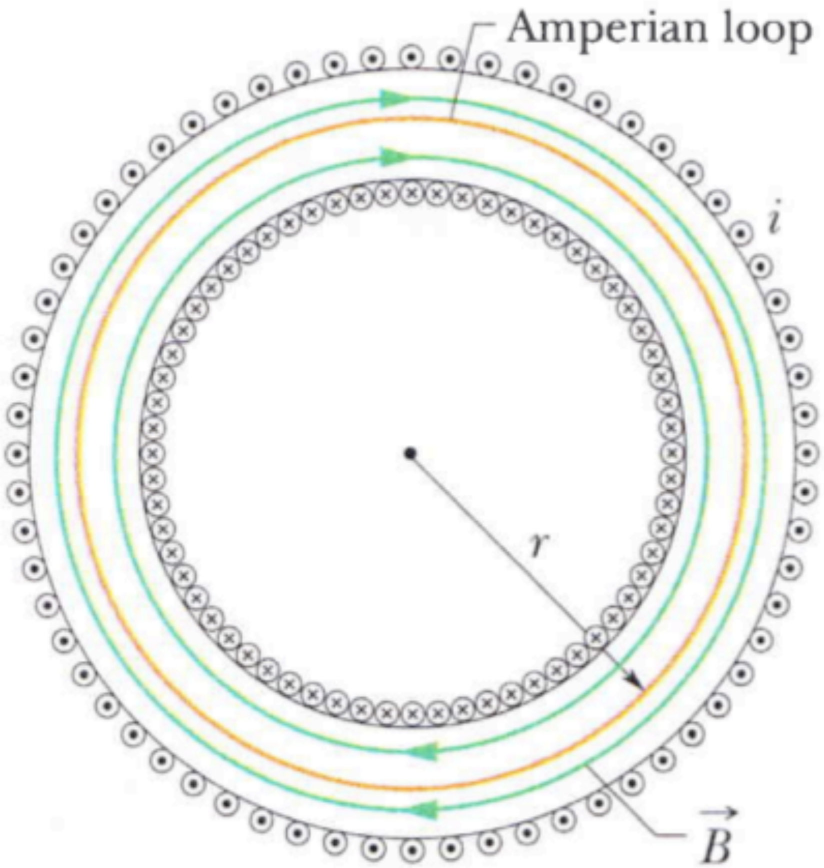
$$B = \mu_0 in$$

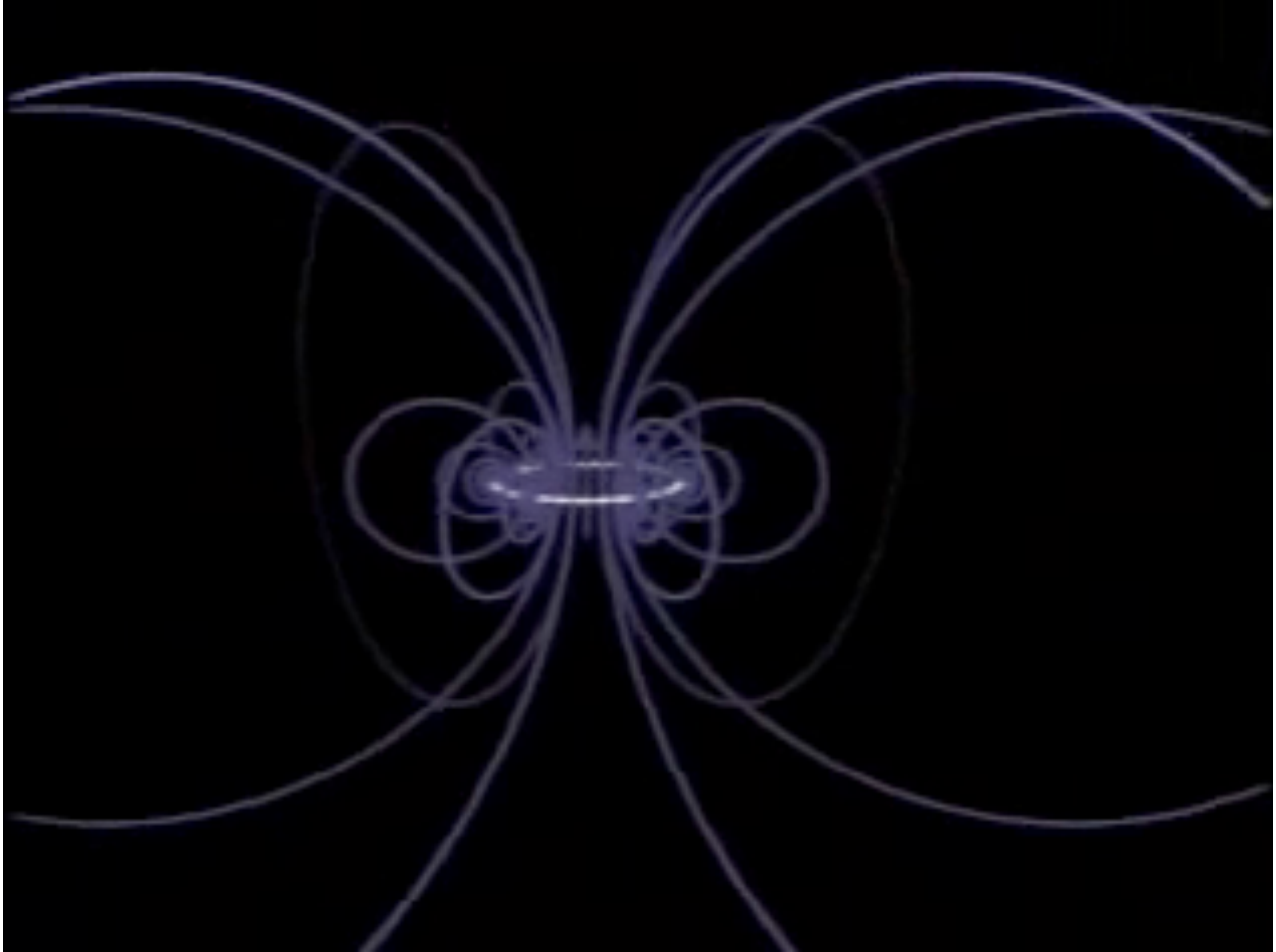
Toroides
Campo magnético

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

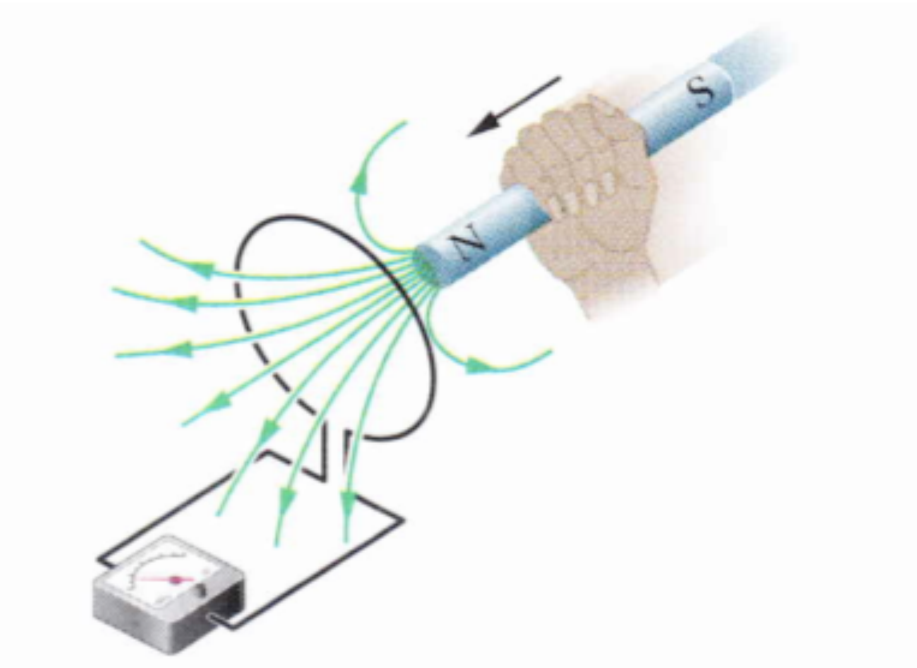
$$(B)(2\pi r) = \mu_0 i N,$$

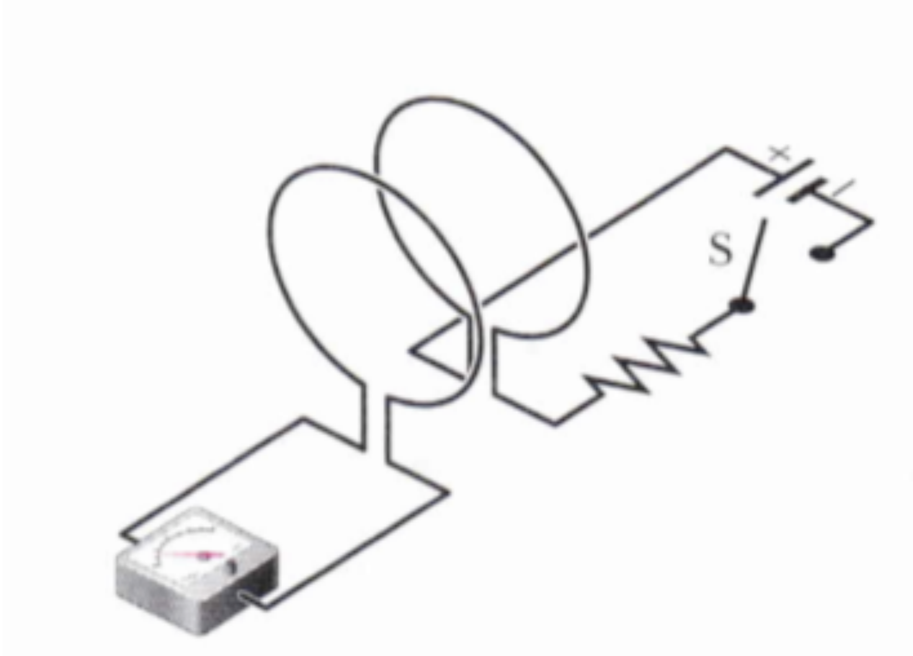
$$B = \frac{\mu_0 i N}{2\pi} \frac{1}{r}$$





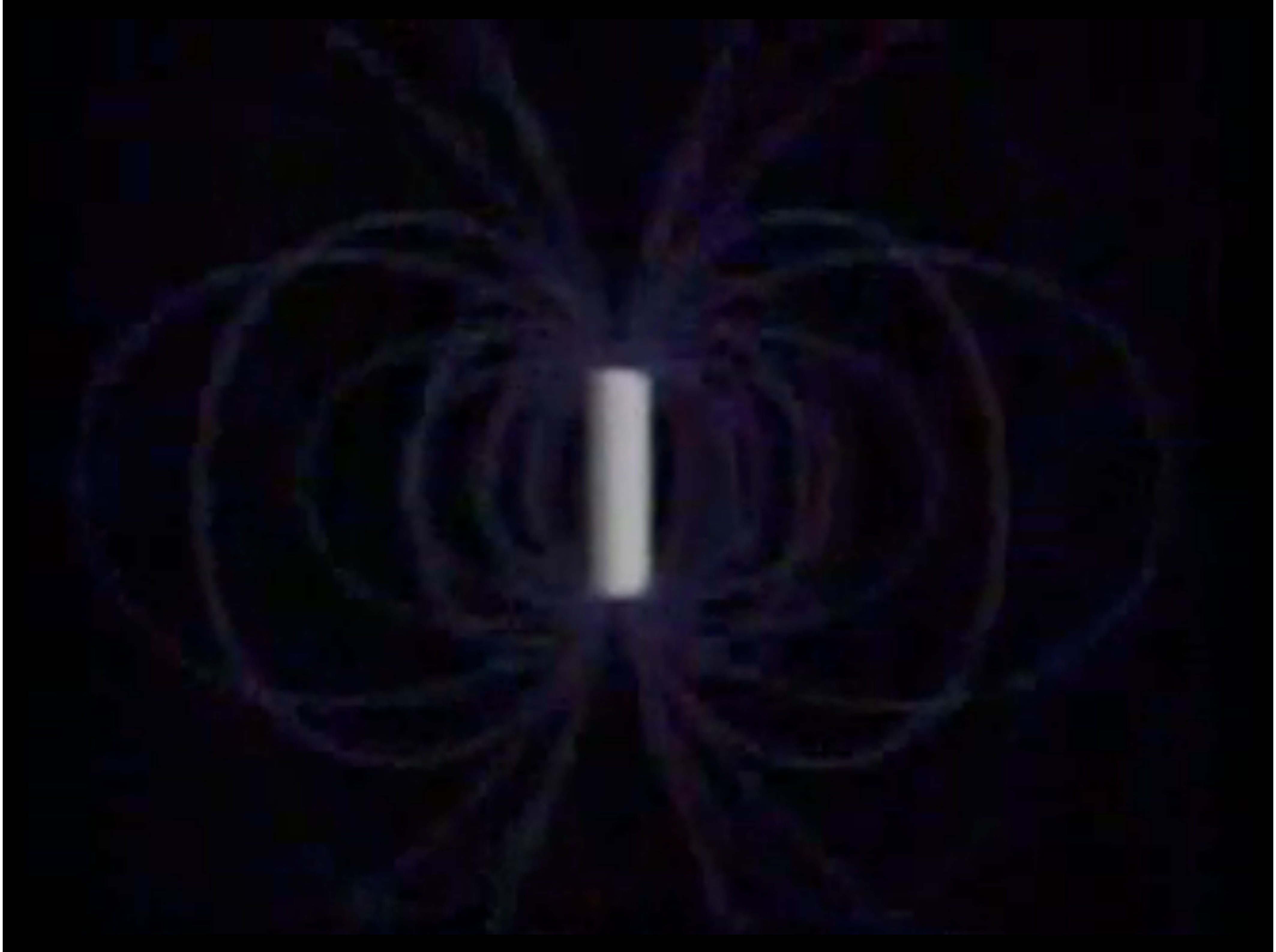
Inducción e Inductancia





$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\Phi_B = BA \qquad (\vec{B} \perp \text{area } A, \vec{B} \text{ uniform}).$$



Ley de Faraday

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

Flujo magnético

$$1 \text{ weber} = 1 \text{ Wb} = 1 \text{ T} \cdot \text{m}^2.$$

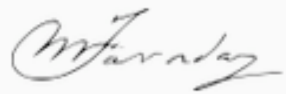
$$\mathcal{E} = -N\frac{d\Phi_B}{dt}$$

Michael Faraday

Michael Faraday

Nacimiento	22 de septiembre de 1791 Newington
Fallecimiento	25 de agosto de 1867 (75 años)
Residencia	Reino Unido
Nacionalidad	británico
Campo	electromagnetismo, electroquímica
Instituciones	Royal Institution
Conocido por	Descubrimiento del benceno y de la inducción electromagnética (motor eléctrico)

Firma



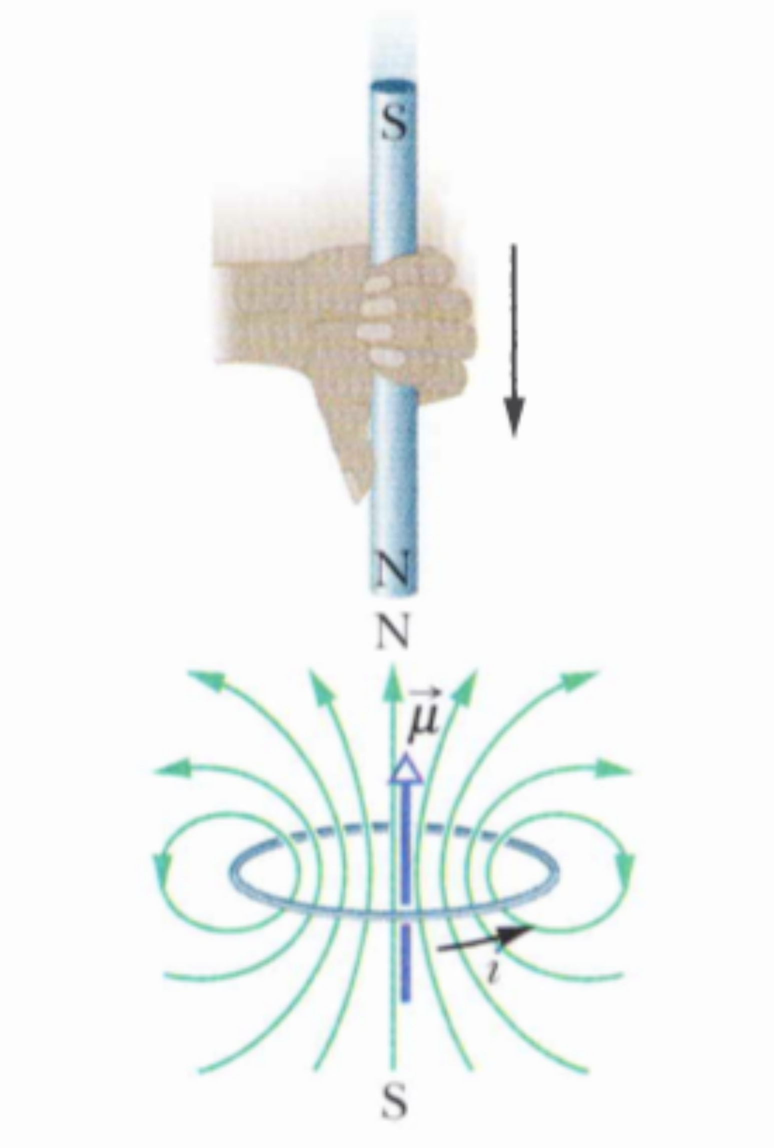
Para cambiar el flujo

Cambio de B en magnitud

Cambio de A

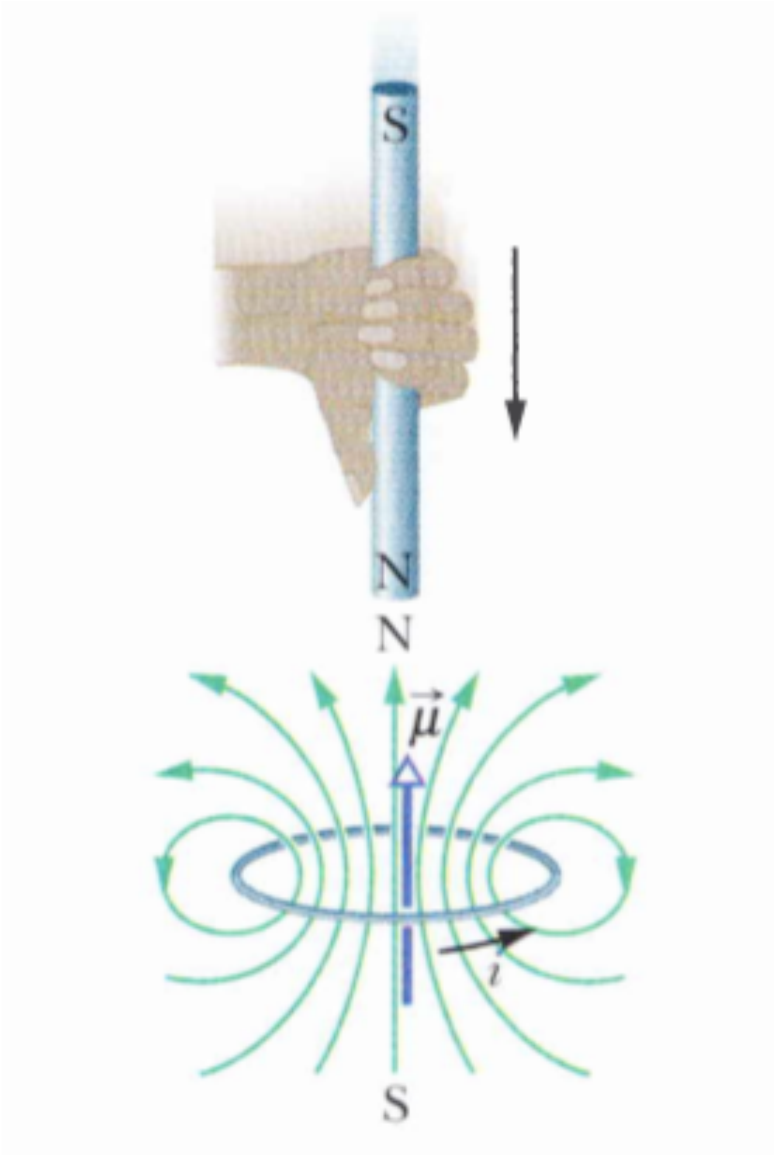
Cambio del ángulo entre B y A

Ley de Lenz



Una corriente inducida tiene una dirección tal que el campo magnético debido a la corriente inducida se opone al cambio de flujo magnético que induce la corriente

Ley de Lenz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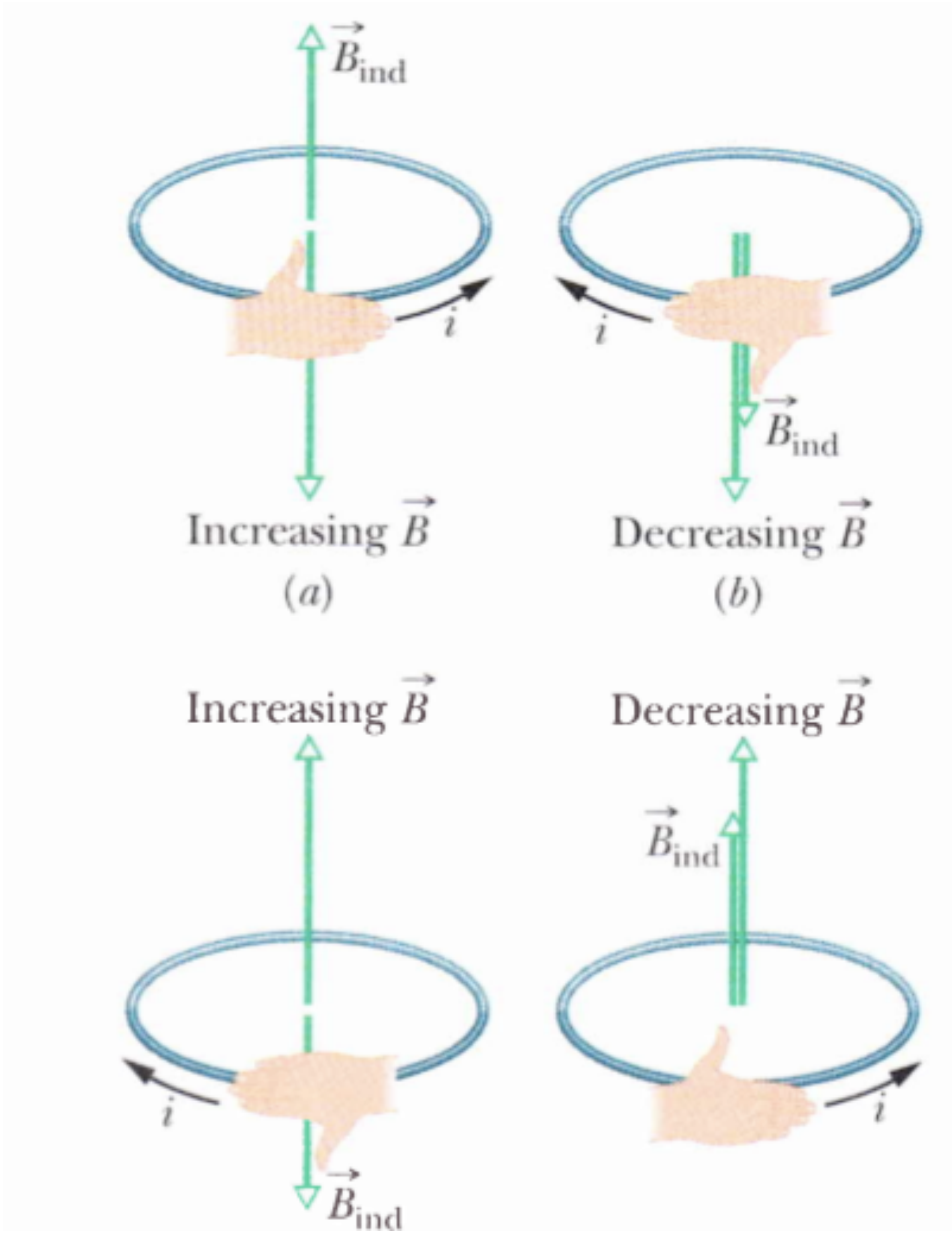
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Increasing $\vec{B}$
Decreasing $\vec{B}$
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Increasing $\vec{B}$
Decreasing $\vec{B}$
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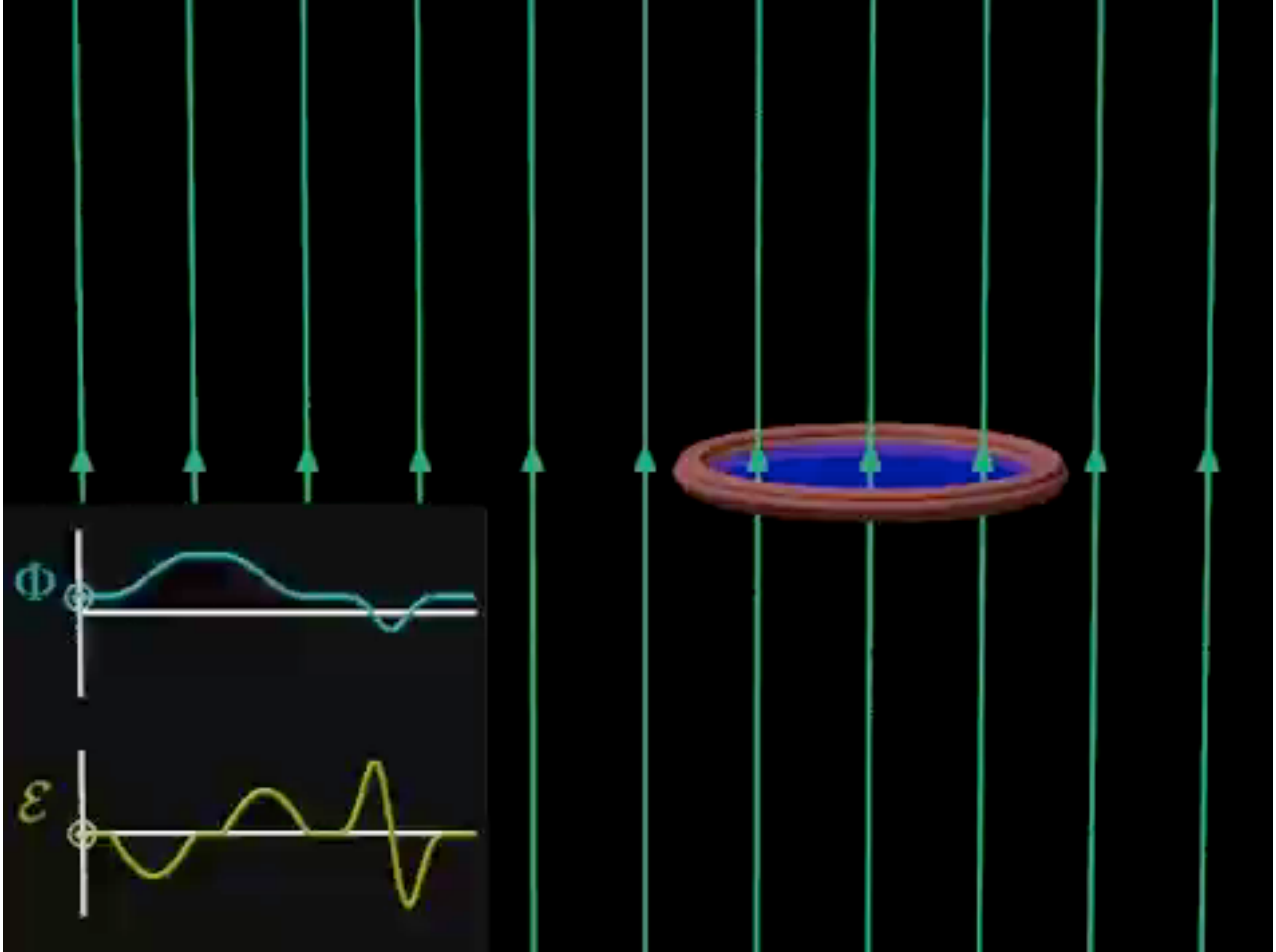
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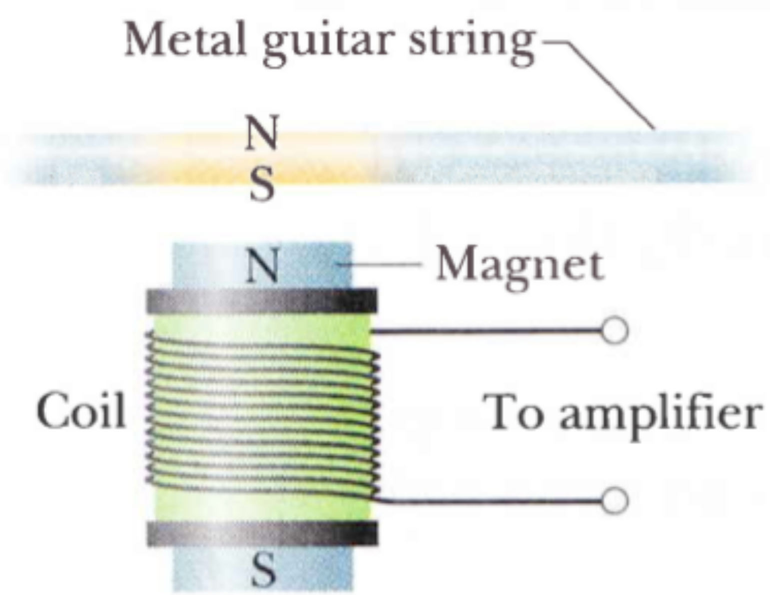

Metal guitar string
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To amplifier
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Y
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Escrita por: Carl Sagan
Organiza: Grupo de Astronomía
Departamento de Física
Universidad de los Andes