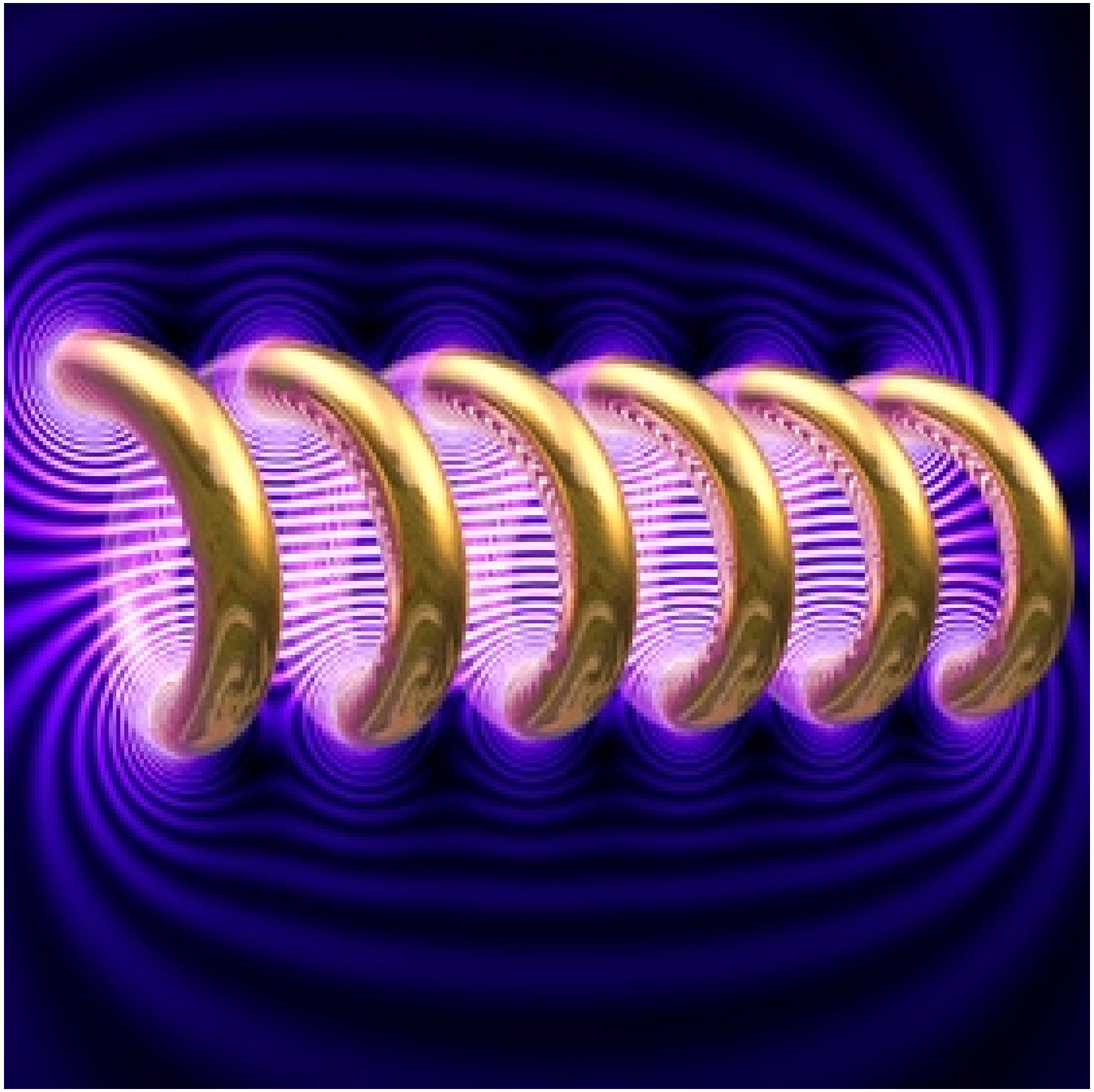
Magnetismo

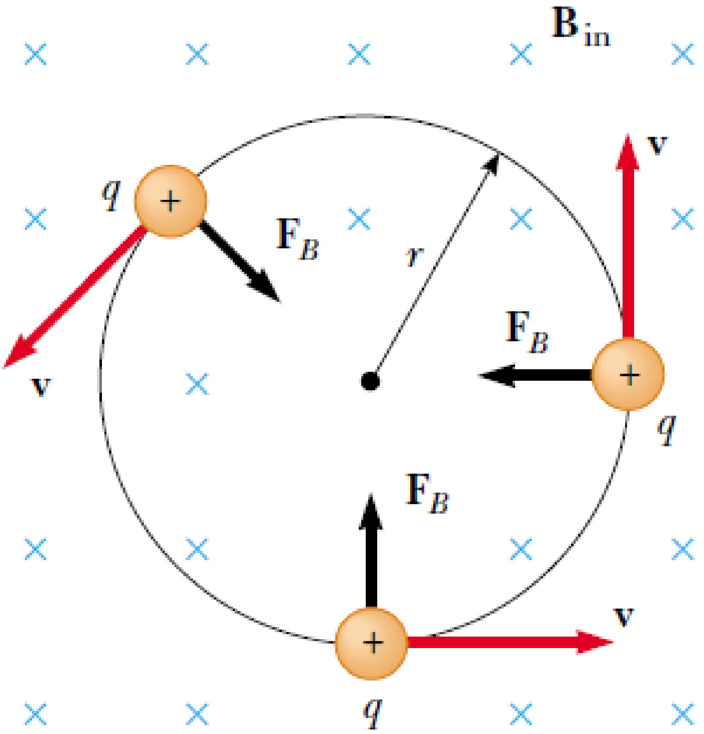


Repaso

$$\boxed{\mathbf{F}_B = q\mathbf{v} \times \mathbf{B}}$$

$$1\ \mathrm{T} = 1\ \frac{\mathrm{N}}{\mathrm{A \cdot m}}$$

$$\boxed{\omega = \frac{v}{r} = \frac{qB}{m}}$$



Fuerza magnética sobre un conductor con corriente

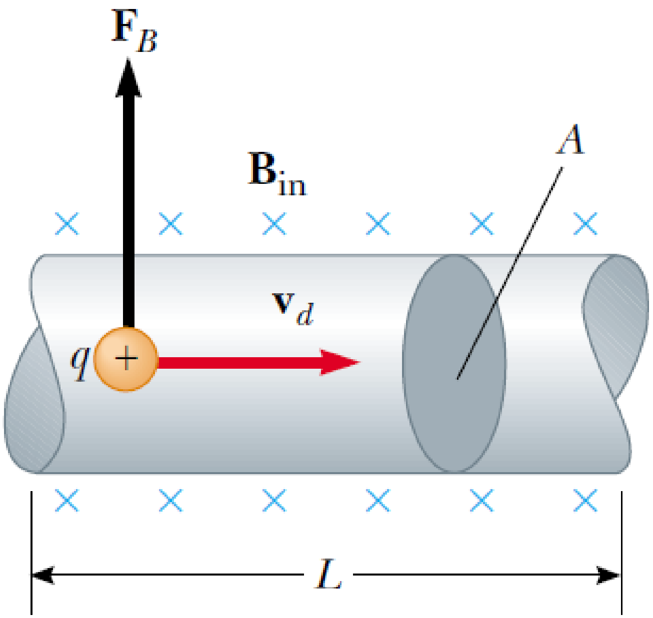
$$d\mathbf{F} = Nq\,|\mathbf{v}|\,A\,d\mathbf{l} \times \mathbf{B}$$

I

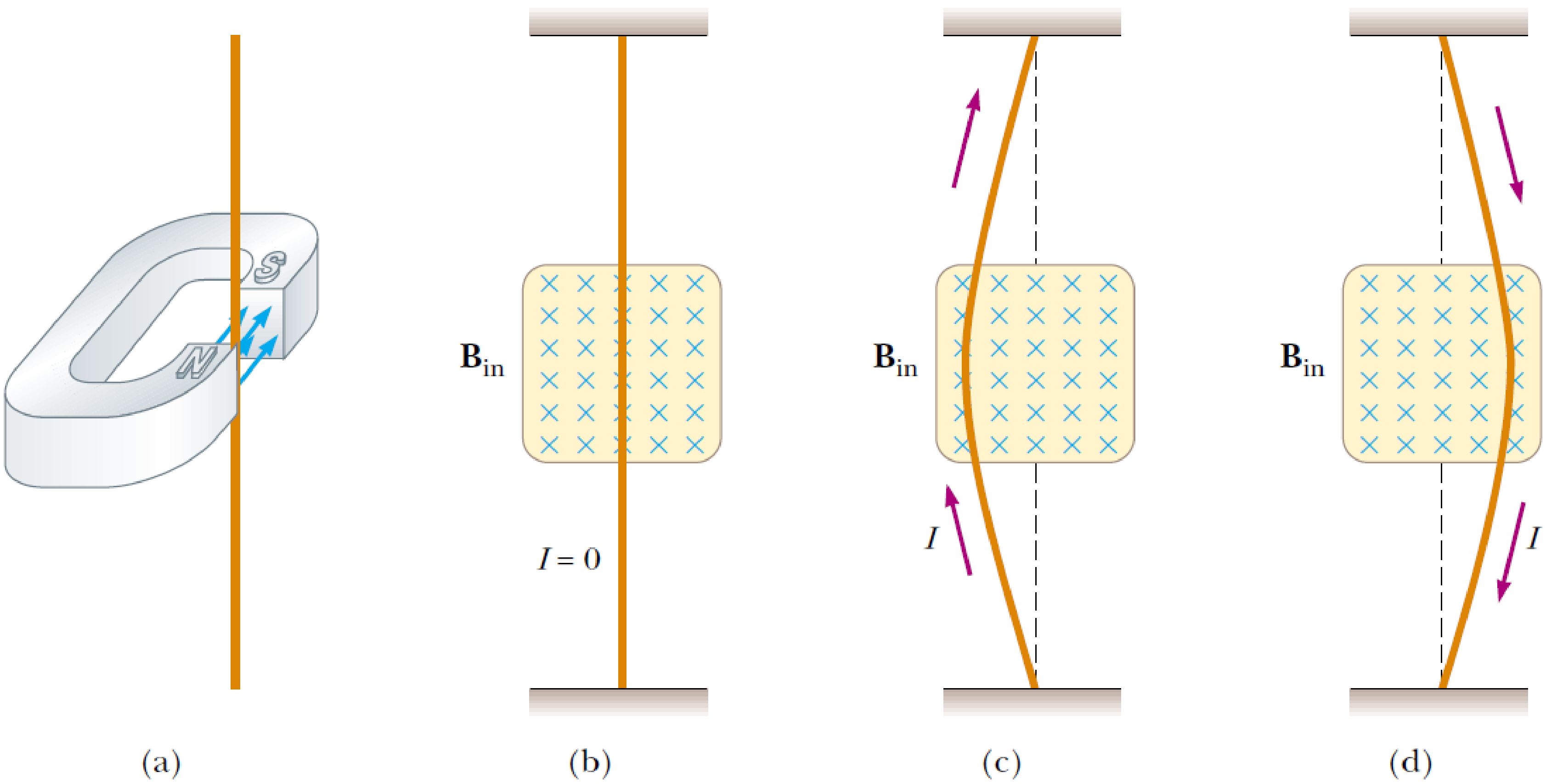
$$d\mathbf{F} = I\,d\mathbf{l} \times \mathbf{B}$$

$$\mathbf{F} = \oint_C I\,d\mathbf{l} \times \mathbf{B}$$

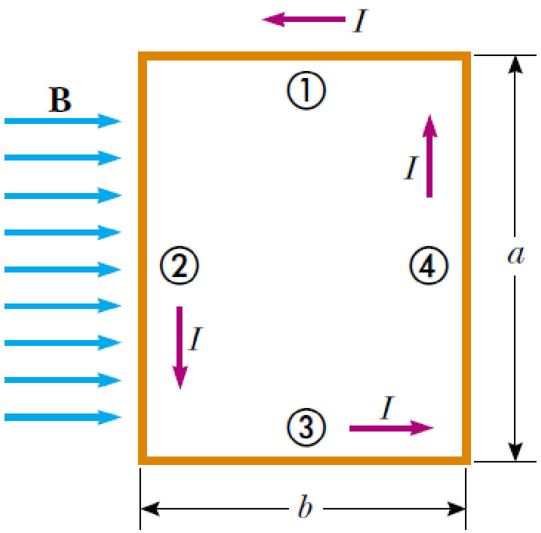
$$\mathbf{F} = \oint_C I\,d\mathbf{l} \times \mathbf{B} = 0 \qquad (\mathbf{B}\ \text{uniforme})$$



Fuerza magnética sobre un conductor con corriente



Torque sobre un circuito con corriente en un **B** uniforme

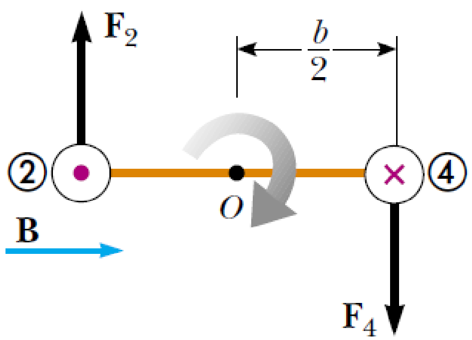


(a)

$$d\boldsymbol{\tau} = \mathbf{r} \times d\mathbf{F} = I\mathbf{r} \times (d\mathbf{l} \times \mathbf{B})$$

$$\boxed{\boldsymbol{\tau} = I\oint_C \mathbf{r} \times (d\mathbf{l} \times \mathbf{B})}$$

$$\boldsymbol{\mu} = I\mathbf{A}$$



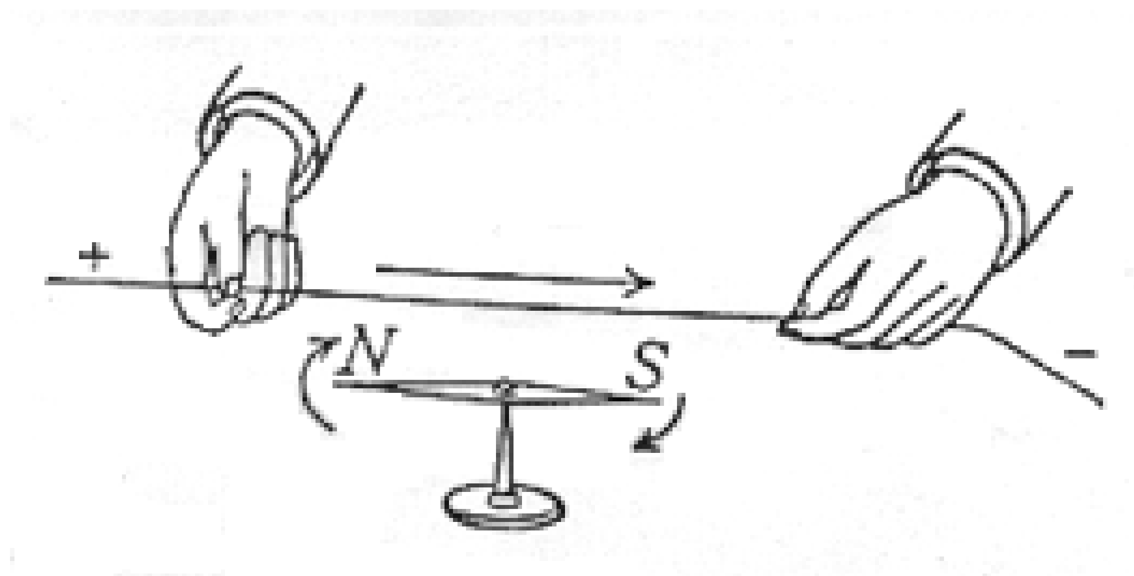
(b)

$$\boldsymbol{\tau} = I\mathbf{A} \times \mathbf{B}$$

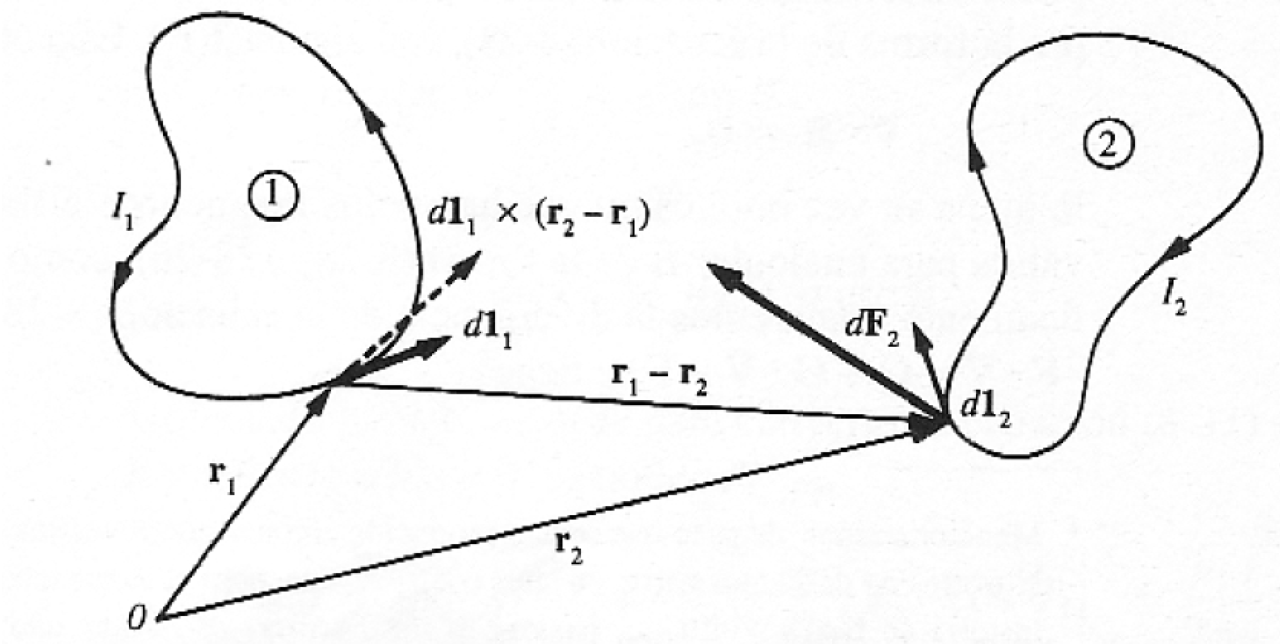
$$\boxed{\boldsymbol{\tau} = \boldsymbol{\mu} \times \mathbf{B}}$$

Oersted (1820)

Hans Christian Ørsted
(1777-1851)



Ley de Biot-Savart



$$\boxed{\mathbf{F}_2 = \frac{\mu_0}{4\pi} I_1 I_2 \oint_1 \oint_2 \frac{d\mathbf{l}_2 \times [d\mathbf{l}_1 \times (\mathbf{r}_2 - \mathbf{r}_1)]}{|\mathbf{r}_2 - \mathbf{r}_1|^3}}$$

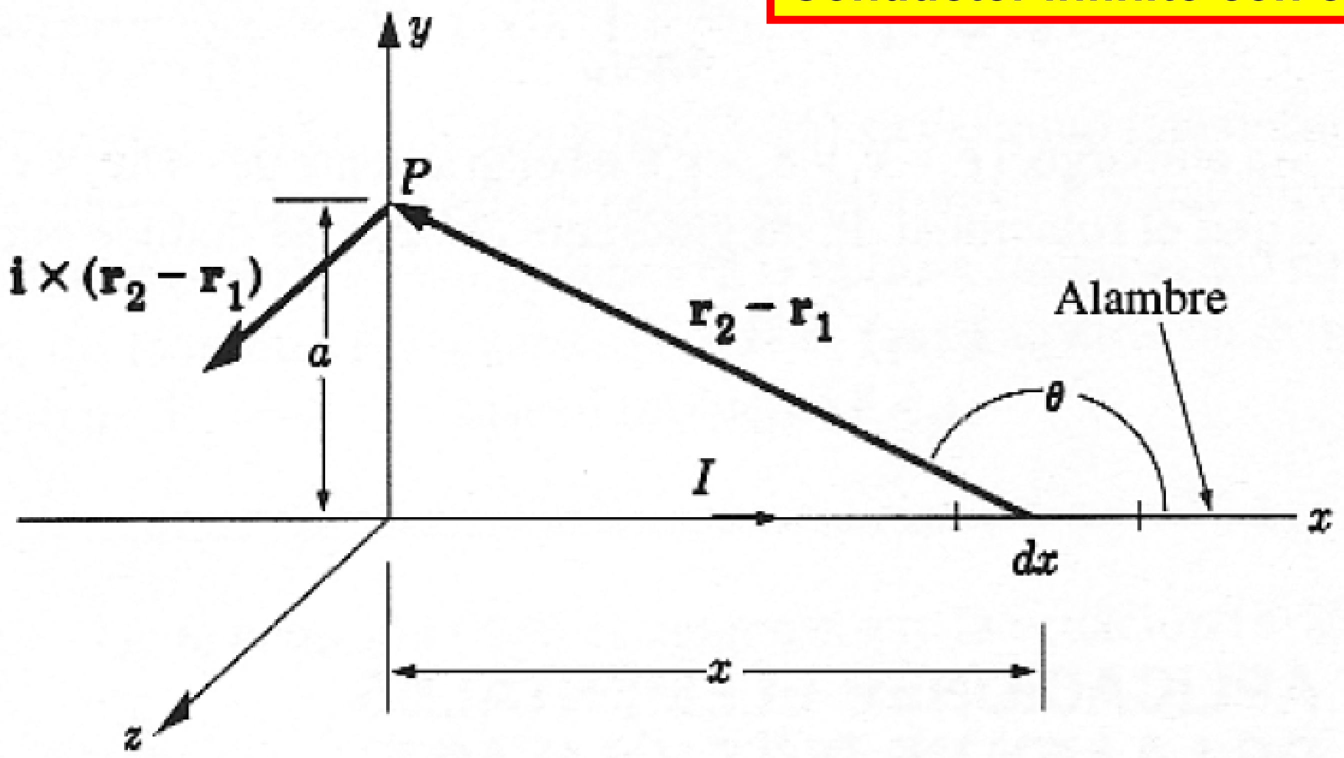
$$\frac{\mu_0}{4\pi} = 10^{-7}\,\mathrm{N/A^2}$$

$$\boxed{\mathbf{B}(\mathbf{r}_2) = \frac{\mu_0}{4\pi} I_1 \oint_1 \frac{d\mathbf{l}_1 \times (\mathbf{r}_2 - \mathbf{r}_1)}{|\mathbf{r}_2 - \mathbf{r}_1|^3}}$$

Ley de Biot-Savart

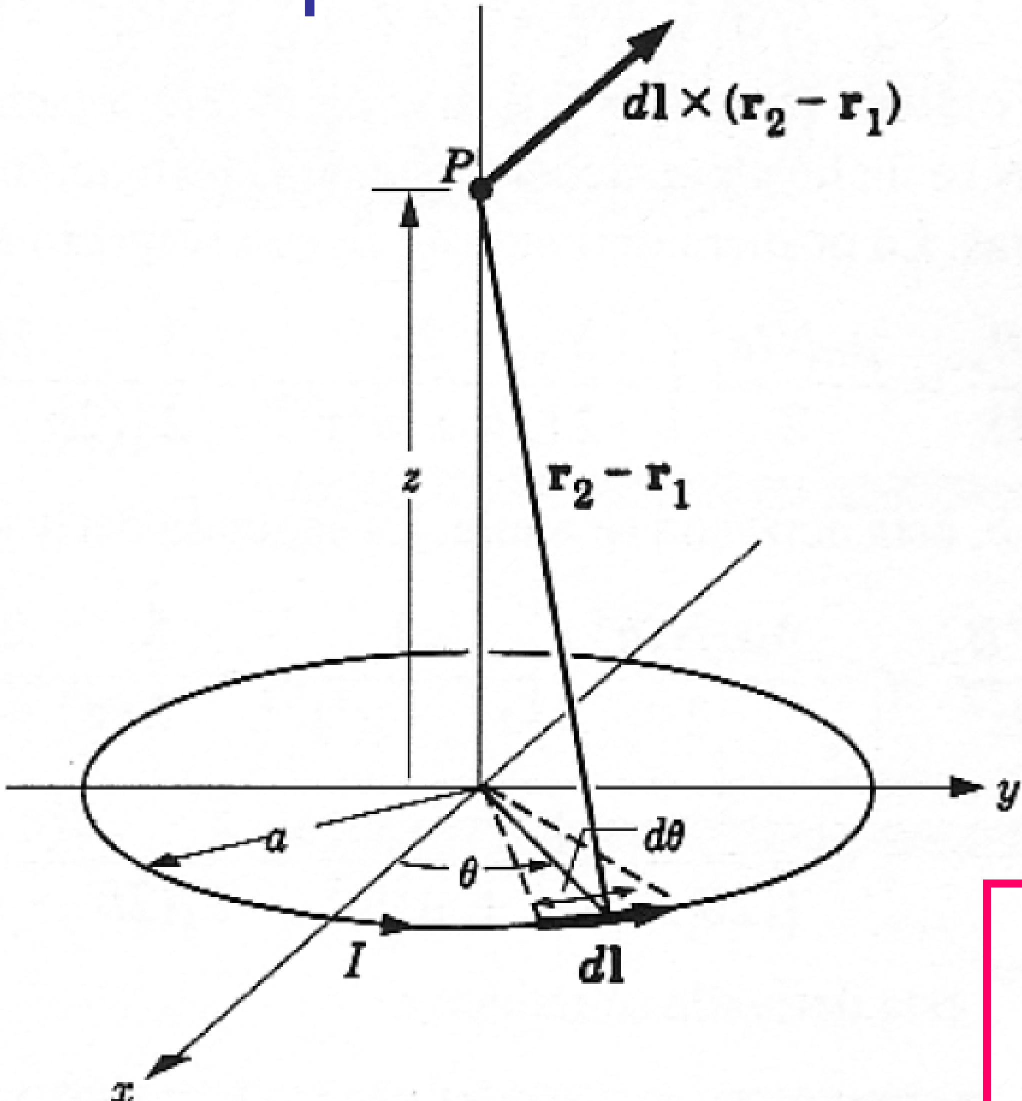
Aplicaciones de Biot-Savart

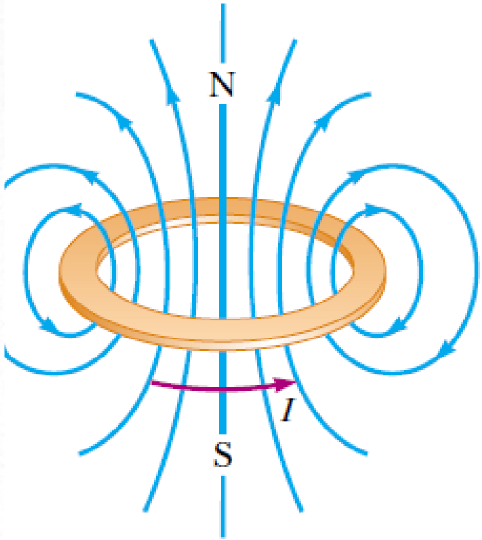
Conductor infinito con corriente



$$\mathbf{B}(\mathbf{r}_2) = \frac{\mu_0 I}{2\pi a}\mathbf{k}$$

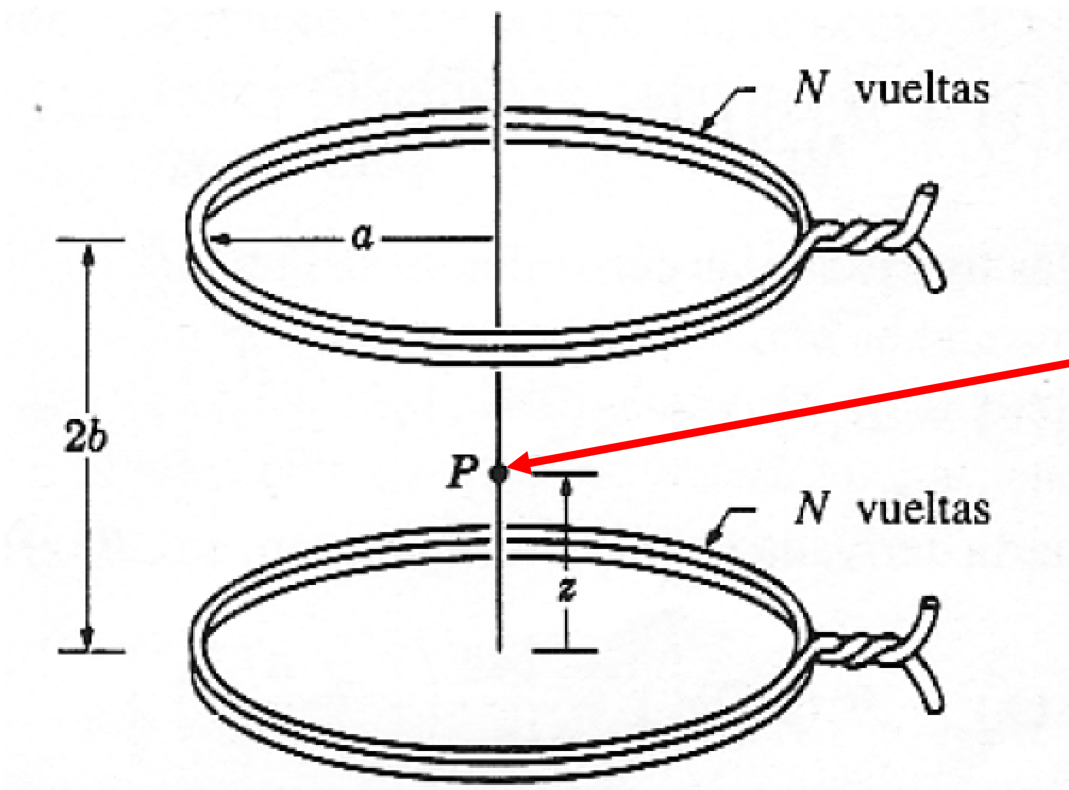
Aplicaciones de Biot-Savart





$$\mathbf{B}(z) = \frac{\mu_0 I}{2}\frac{a^2}{(z^2+a^2)^{3/2}}\mathbf{k}$$

Bobina de Helmholtz



$$B_z = \frac{\mu_0 N I}{a} \frac{8}{5^{3/2}}$$

$$B_z(z) = \frac{N\mu_0 I a^2}{2} \left\{ \frac{1}{(z^2 + a^2)^{3/2}} + \frac{1}{[(2b - z)^2 + a^2]^{3/2}} \right\}$$

Bobina de Helmholtz