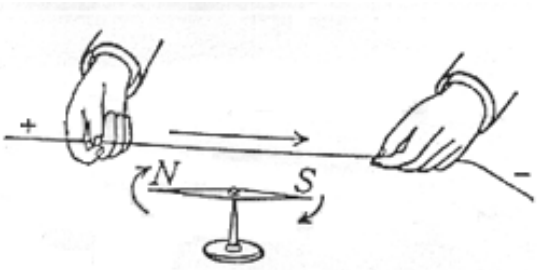
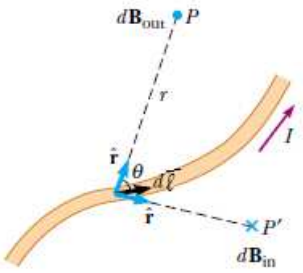
Oersted (1820)

Hans Christian Ørsted
(1777-1851)



Campo magnético generado por un conductor: Ley de Biot-Savart

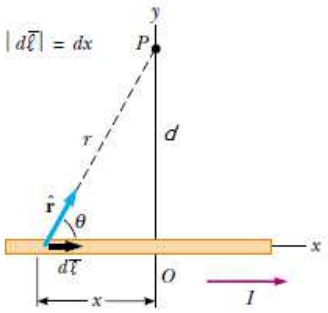


$$d\vec{B}(\vec{r}) = \frac{\mu_0}{4\pi} \frac{Id\vec{l} \times (\vec{r} - \vec{r}')}{(\vec{r} - \vec{r}')^3}$$

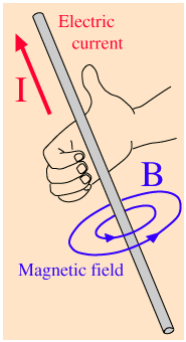
$\mu_0 = 4\pi 10^{-7}\ N/A^2$

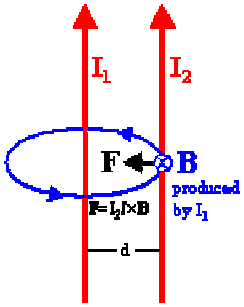
Permeabilidad magnética del vacío

Campo magnético generado por un conductor lineal infinito

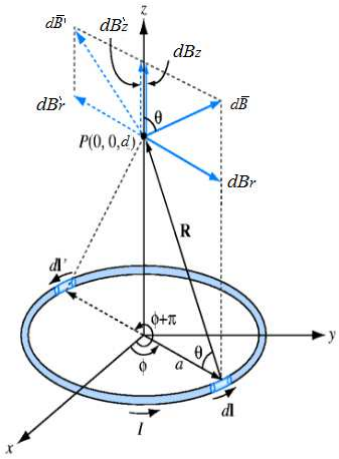


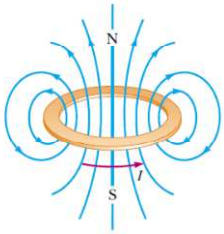
$$B = \frac{\mu_0 I}{2\pi d}$$



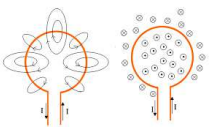


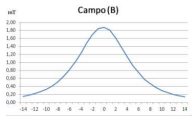
Aplicaciones de Biot-Savart: espira con corriente



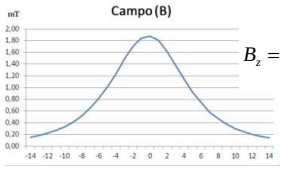


$$B_z = \frac{\mu_0 I 2\pi a^2}{4\pi (d^2 + a^2)^{3/2}}$$

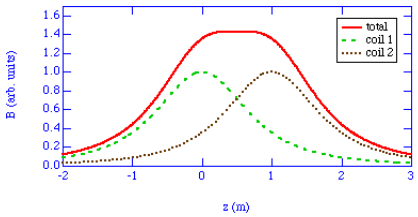


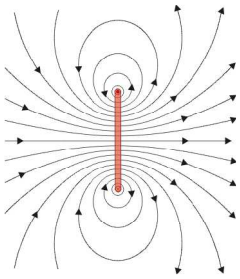


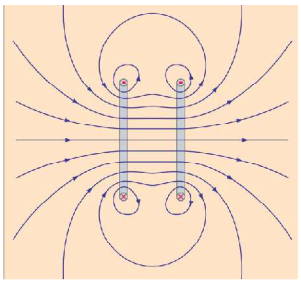
Bobinas de Helmholtz



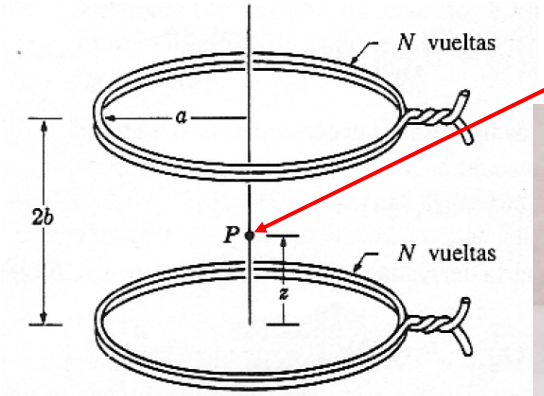
$$B_z = \frac{\mu_0 I 2\pi a^2}{4\pi (d^2 + a^2)^{3/2}}$$







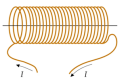
Bobina de Helmholtz

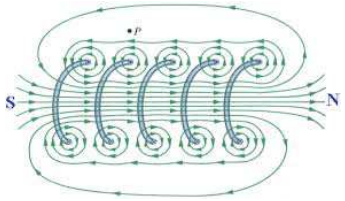


$$B_z = \frac{\mu_0 N I}{a} \frac{8}{5^{3/2}}$$

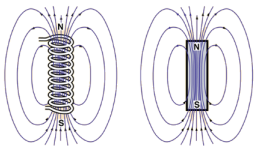
$$B_z(z) = \frac{N\mu_0 I a^2}{2} \left\{ \frac{1}{(z^2 + a^2)^{3/2}} + \frac{1}{[(2b - z)^2 + a^2]^{3/2}} \right\}$$

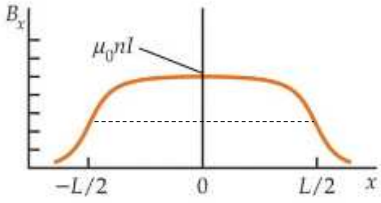
Campo Magnético de un solenoide





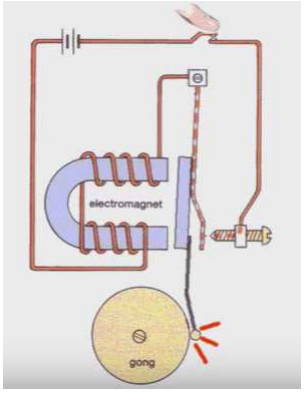
$$B_z(z_0) \cong \frac{\mu_0 NI}{L}$$

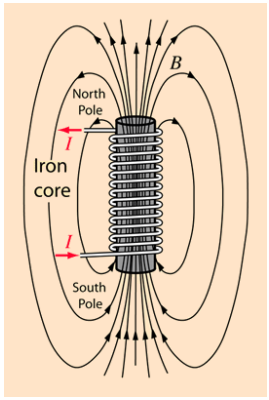




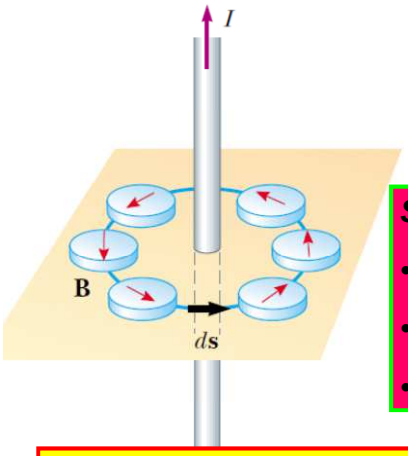
El sentido del B depende de la I y del bobinado

Aplicaciones





Ley de Circuitos de Ampere



$$\oint \vec{B}, \vec{dl} = \mu_0 I$$

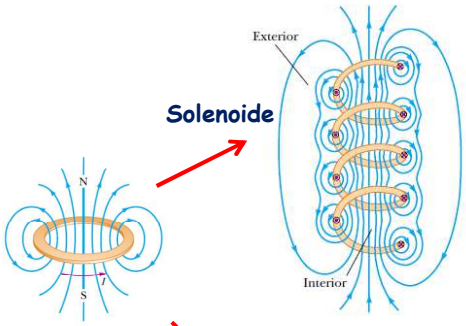
Simetrías para la Ley de Ampere:

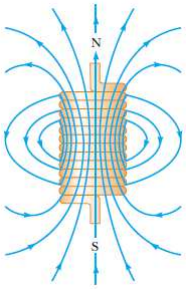
- ***Hilo infinito con corriente***
- ***Solenoide infinito***
- ***Plano infinito con corriente***

La ley de Ampere es análoga a la Ley de Gauss en electrostática: permite obtener B debido a distribuciones de corriente de gran simetría.

Aplicaciones de la Ley de Ampere

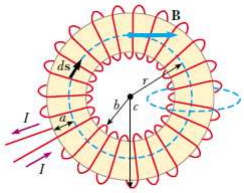
Solenoide





$$B_z(z_0) \cong \frac{\mu_0 NI}{L}$$

Toroide



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