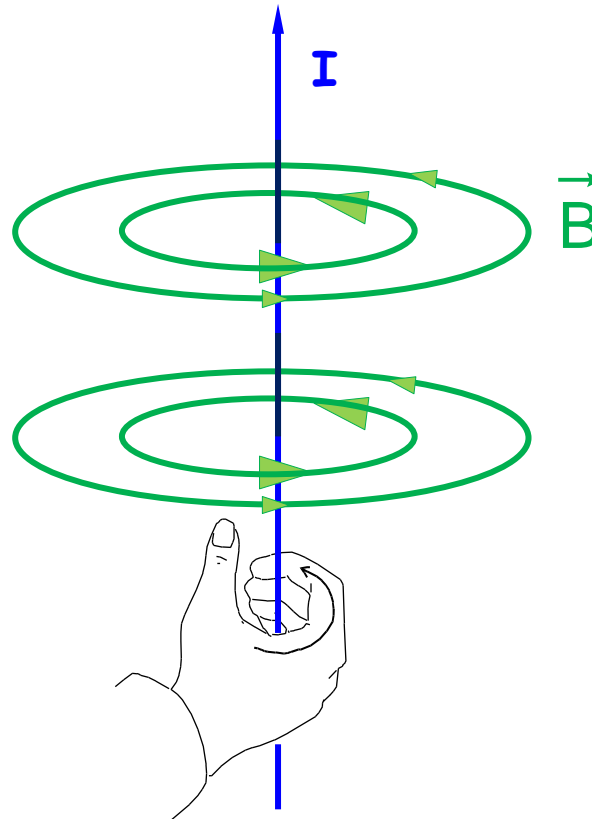
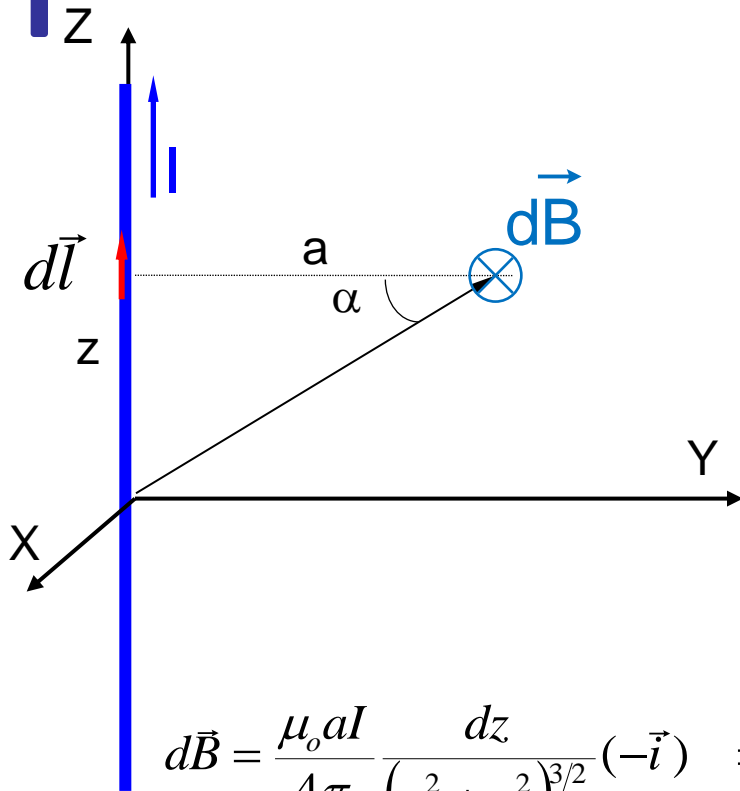


Fuentes del campo magnético

Ejemplos: Calcule el campo magnético creado por una corriente rectilínea I muy larga, a una distancia a de la corriente (aplicando la ley de Biot-Savart).



Fuentes del campo magnético



Aplicamos la ley de Biot-Savart:

$$d\vec{B} = \frac{\mu_o I}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^3}$$

$$\left. \begin{aligned} d\vec{l} &= dz\vec{k} \\ \vec{r} &= a\vec{j} - z\vec{k} \end{aligned} \right\} \Rightarrow d\vec{l} \times \vec{r} = dz\vec{k} \times (a\vec{j} - z\vec{k}) = -adz\vec{i}$$

$$r = (a^2 + z^2)^{1/2} \Rightarrow r^3 = (a^2 + z^2)^{3/2}$$

$$d\vec{B} = \frac{\mu_o a I}{4\pi} \frac{dz}{(a^2 + z^2)^{3/2}} (-\vec{i}) \Rightarrow \vec{B}(\vec{r}) = \frac{\mu_o a I}{4\pi} (-\vec{i}) \int_{-\infty}^{\infty} \frac{dz}{(a^2 + z^2)^{3/2}} = \frac{\mu_o a I}{4\pi} (-\vec{i}) \int_{-\infty}^{\infty} \frac{dz}{r^3}$$

$$\left. \begin{aligned} a = r \cos \alpha &\Rightarrow r^3 = \frac{a^3}{\cos^3 \alpha} \\ z = a \tan \alpha &\Rightarrow dz = a \frac{d\alpha}{\cos^2 \alpha} \end{aligned} \right\} \vec{B}(\vec{r}) = \frac{\mu_o a I}{4\pi} (-\vec{i}) \int_{-\pi/2}^{\pi/2} \frac{a/\cos^2 \alpha}{a^3/\cos^3 \alpha} d\alpha = \frac{\mu_o a I}{4\pi} (-\vec{i}) \int_{-\pi/2}^{\pi/2} \frac{\cos \alpha}{a^2} d\alpha = \frac{\mu_o I}{2\pi a} (-\vec{i})$$