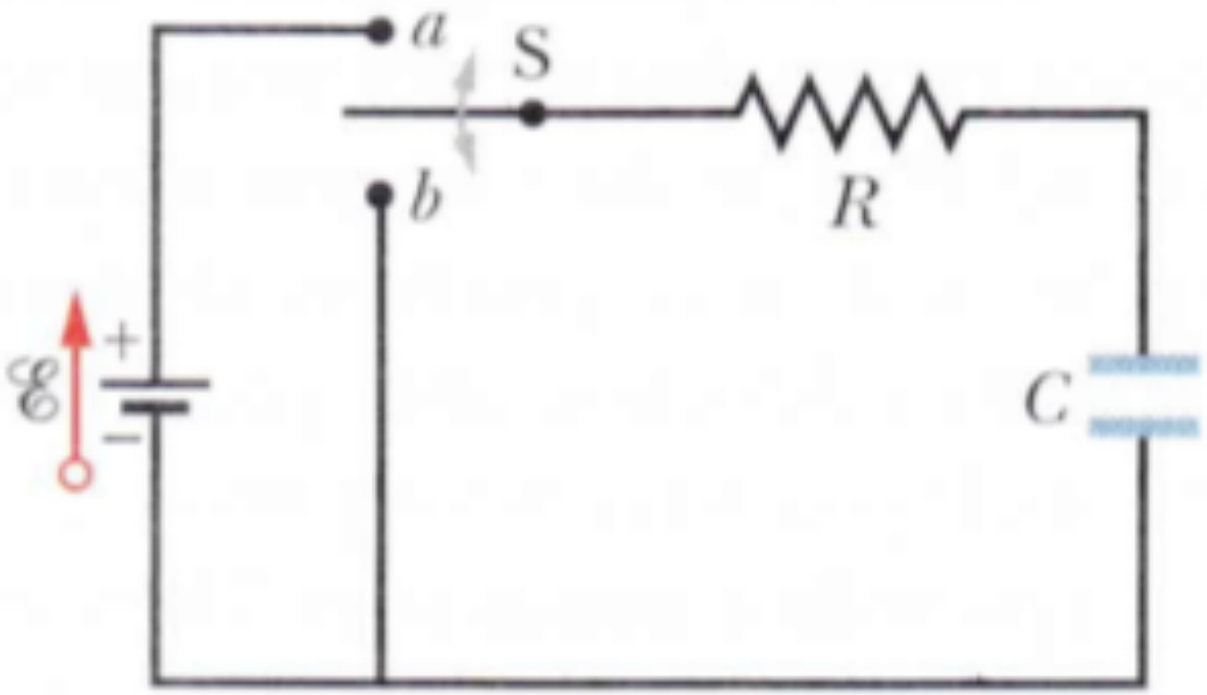
Clase 21

11/04/2013

Lecturas 28.1 - 28.7

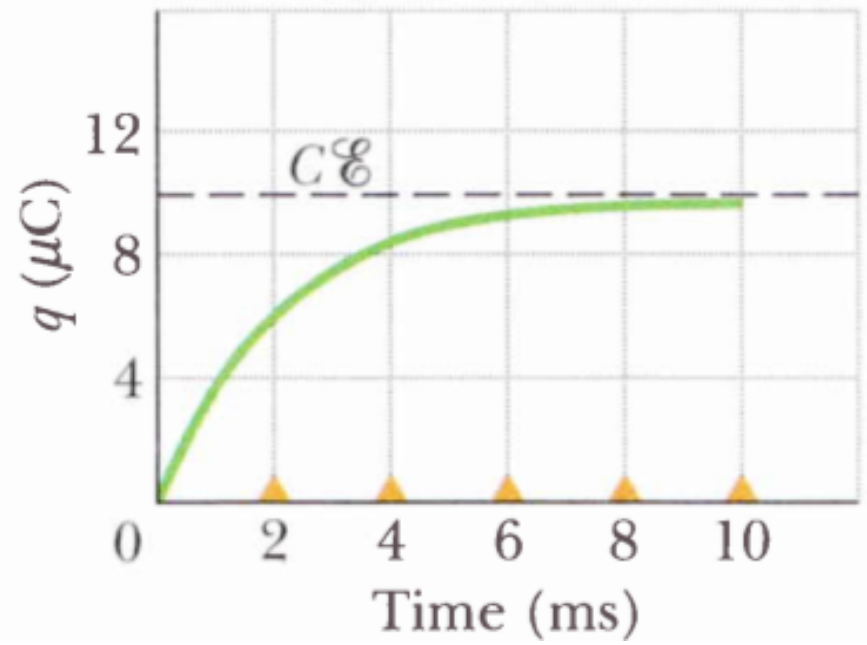
HEMOS VISTO ...

Carga de un condensador

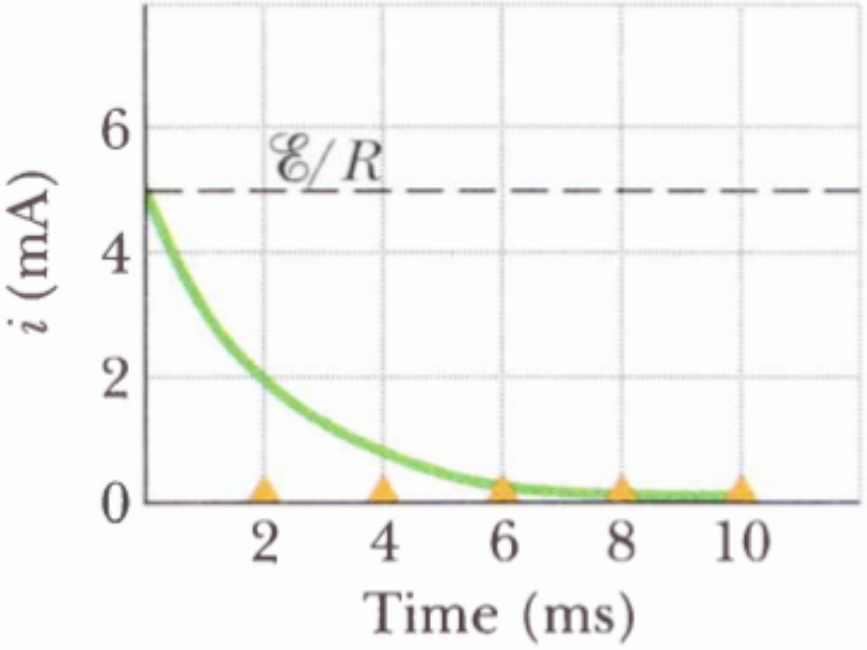


Ecuación de carga $$R\frac{dq}{dt} + \frac{q}{C} = \mathcal{E}$$

Solución $$q = C\mathcal{E}(1 - e^{-t/RC})$$

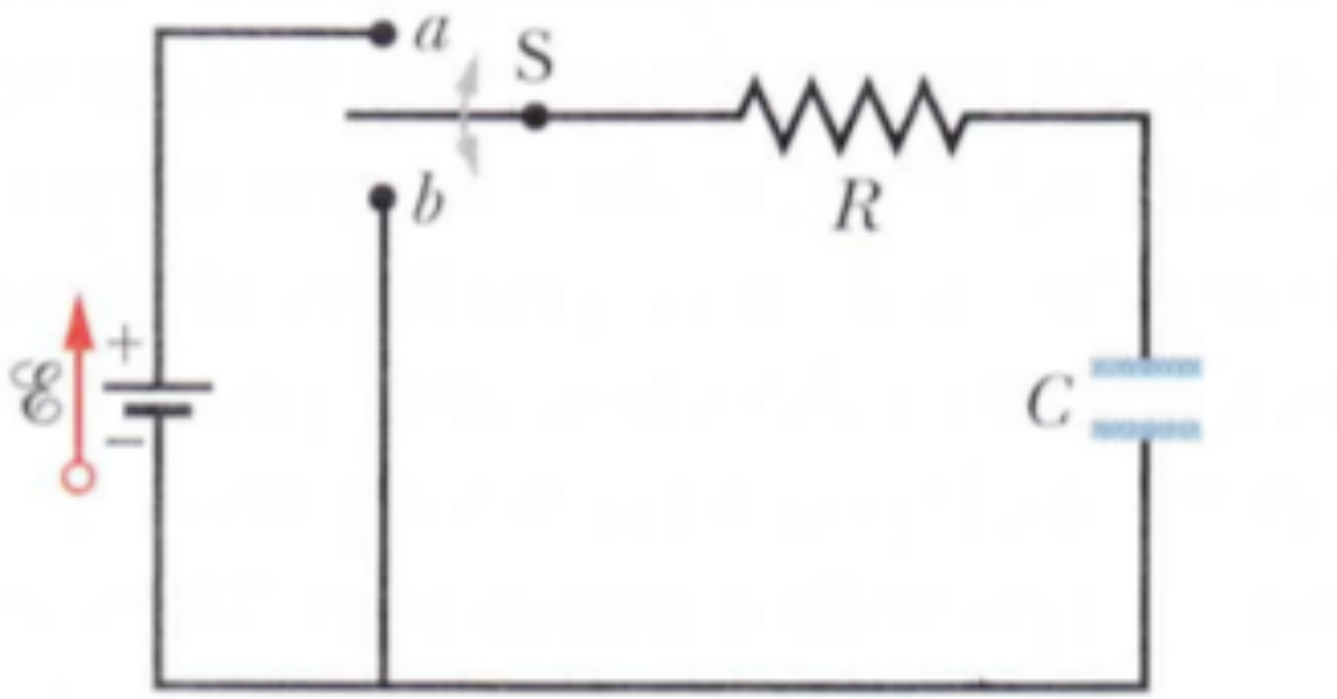


$$q = C\mathscr{E}(1 - e^{-t/RC})$$



$$i = \frac{dq}{dt} = \left(\frac{\mathscr{E}}{R}\right)e^{-t/RC}$$

Descarga de un condensador



Ecuación de descarga

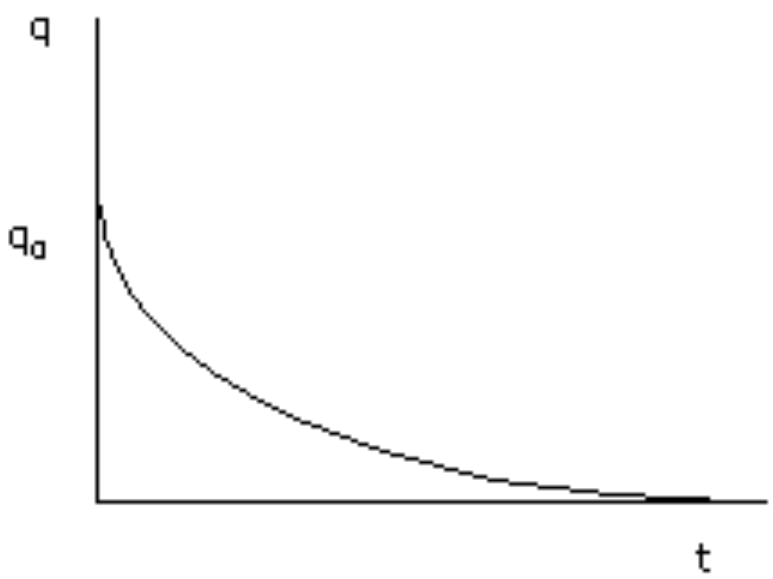
$$R\frac{dq}{dt} + \frac{q}{C} = 0$$

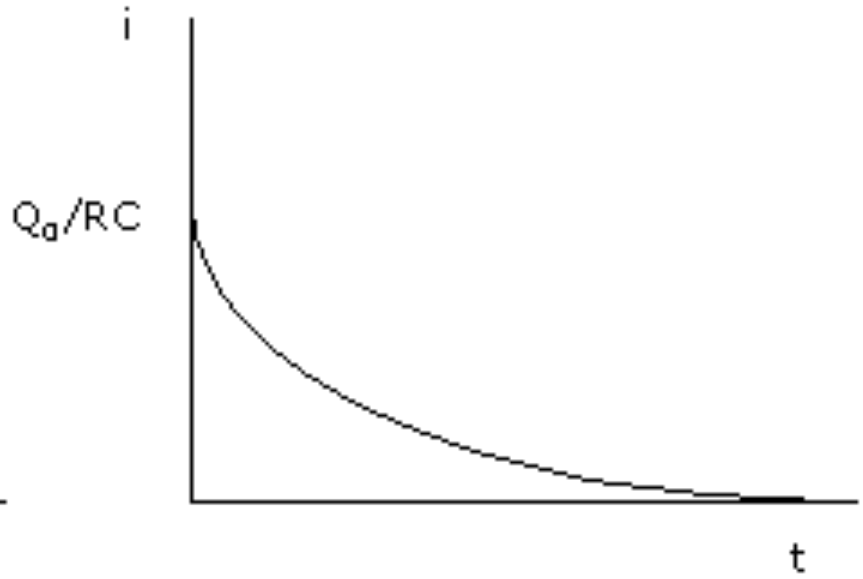
Solución

$$q = q_0 e^{-t/RC}$$

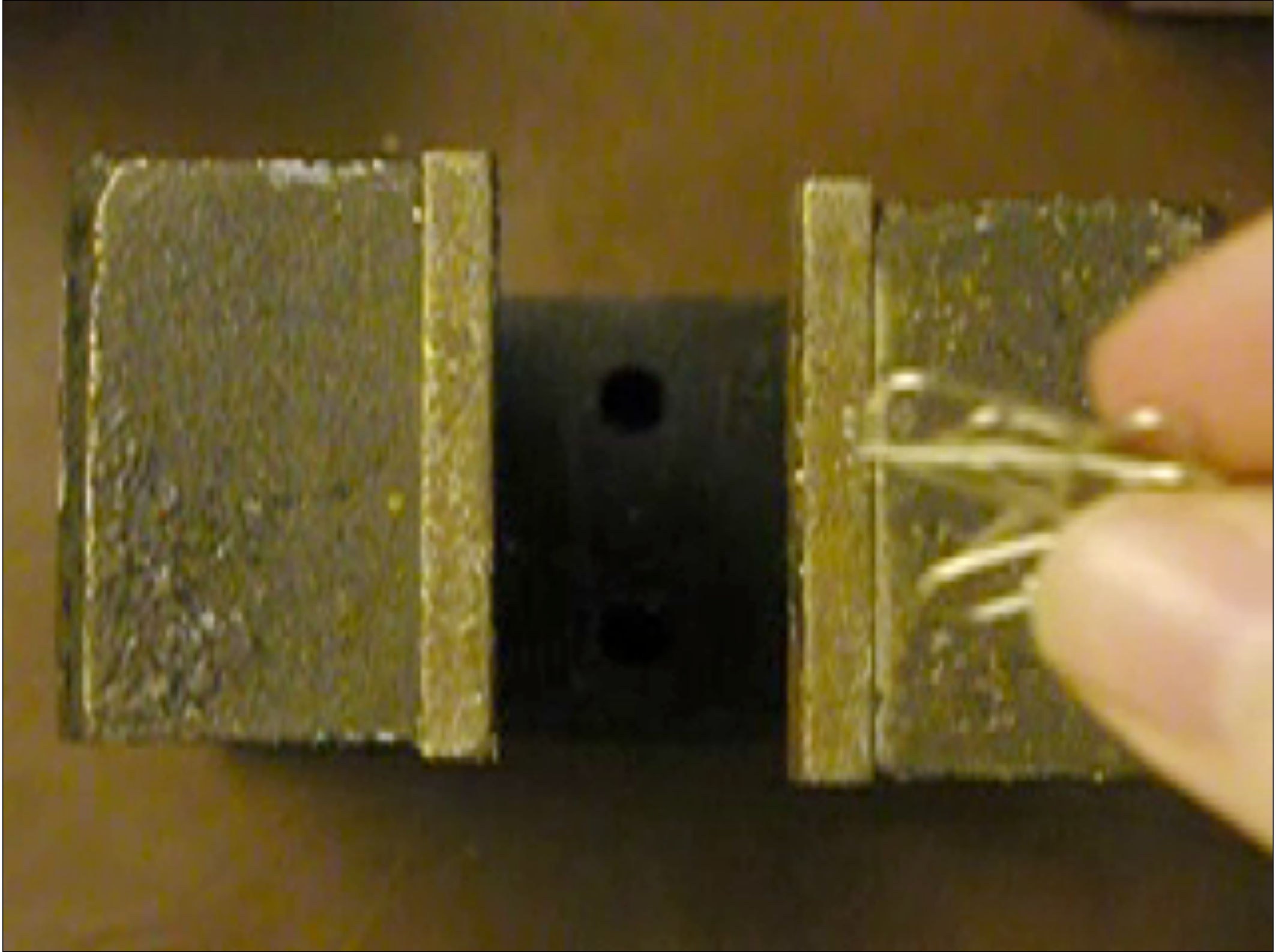
$$q = q_0 e^{-t/RC}$$

$$i = \frac{dq}{dt} = -\left(\frac{q_0}{RC}\right) e^{-t/RC}$$





Campos magnéticos

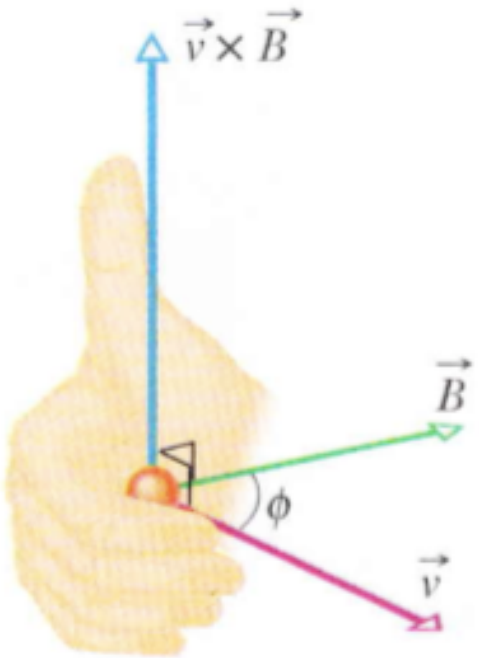


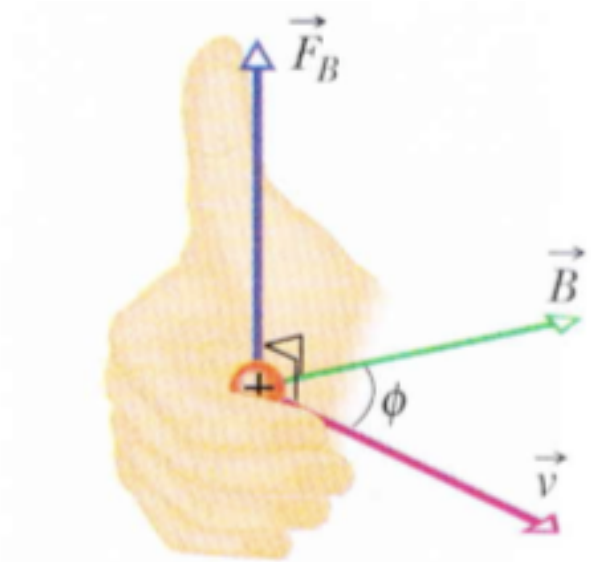
$$\vec{E} = \frac{\vec{F}_E}{q}.$$

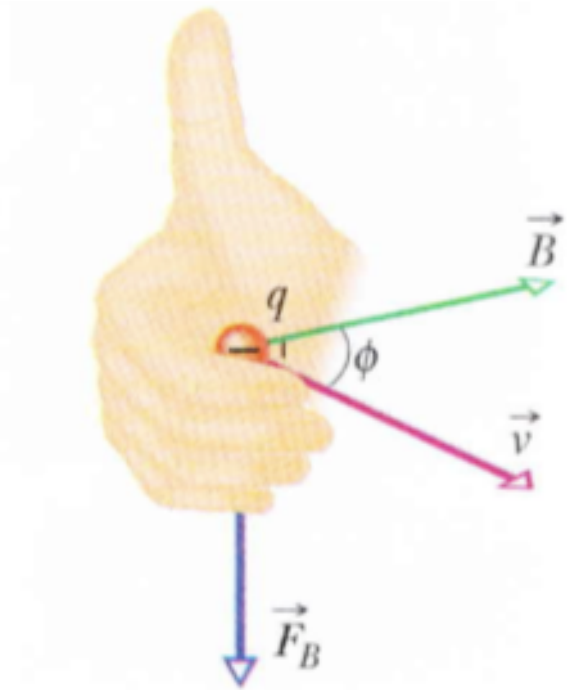
$$B = \frac{F_B}{|q|v},$$

$$\vec{F}_B = q\vec{v} \times \vec{B};$$

$$F_B = |q|vB \sin \phi,$$







Some Approximate Magnetic Fields

At surface of neutron star	10^8 T
Near big electromagnet	1.5 T
Near small bar magnet	10^{-2} T
At Earth's surface	10^{-4} T
In interstellar space	10^{-10} T
Smallest value in magnetically shielded room	10^{-14} T

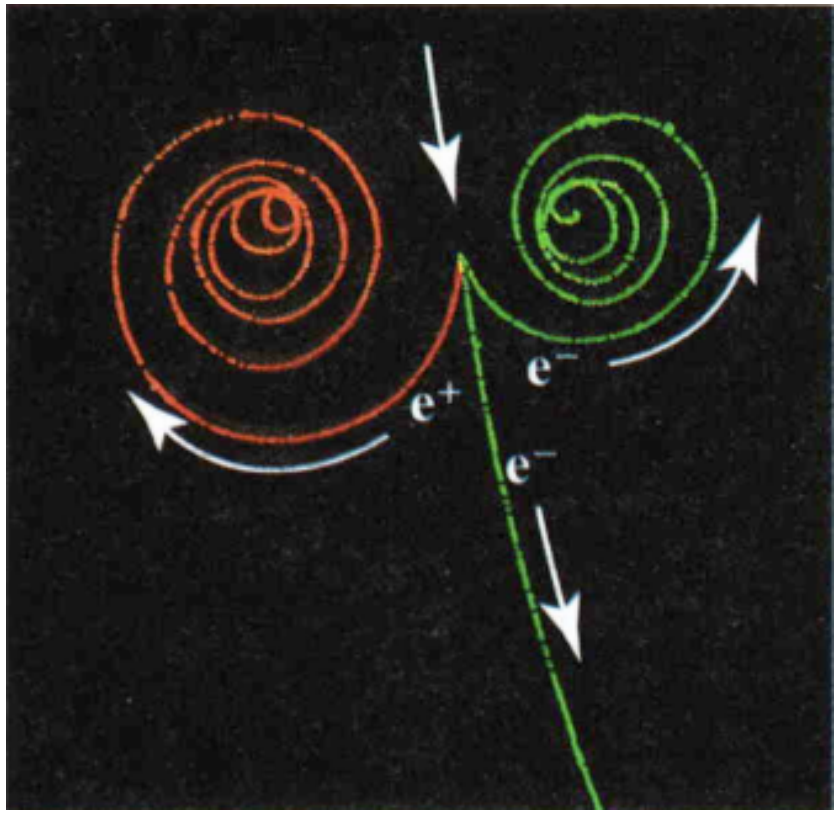
$$1 \text{ tesla} = 1 \text{ T} = 1 \frac{\text{newton}}{(\text{coulomb})(\text{meter/second})}.$$

$$1 \text{ T} = 1 \frac{\text{newton}}{(\text{coulomb/second})(\text{meter})} = 1 \frac{\text{N}}{\text{A} \cdot \text{m}}.$$

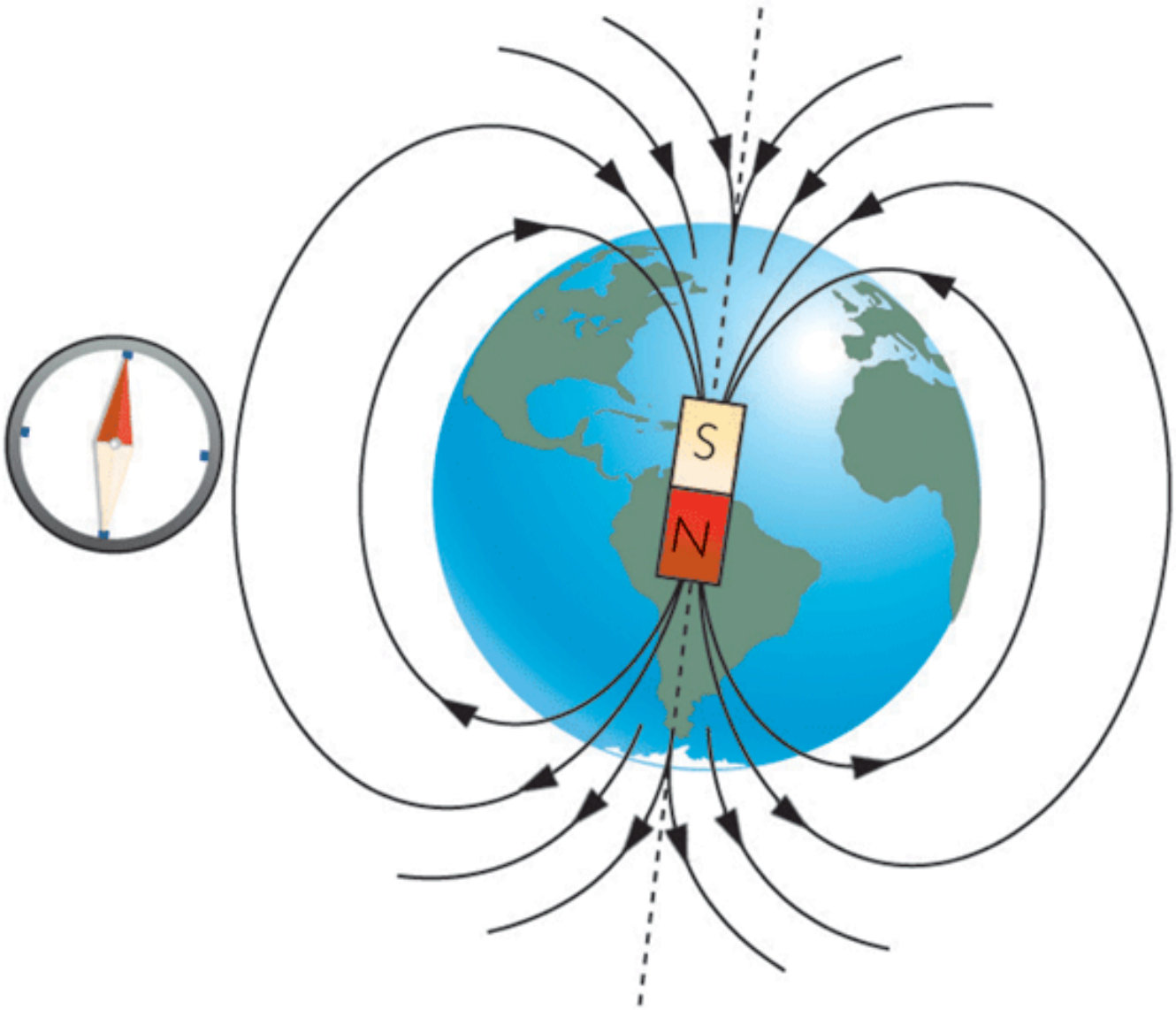
$$1 \text{ tesla} = 10^4 \text{ gauss}.$$

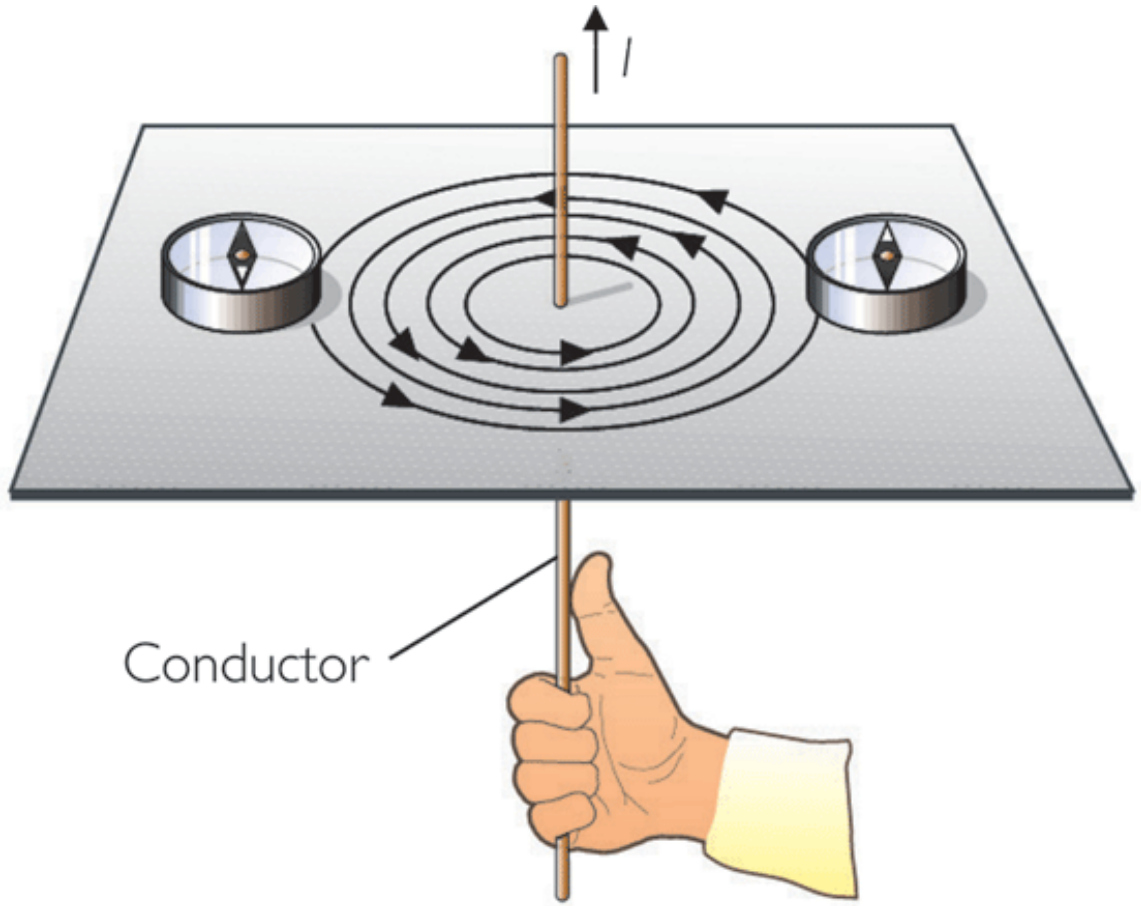
Fuerza magnética sobre una partícula

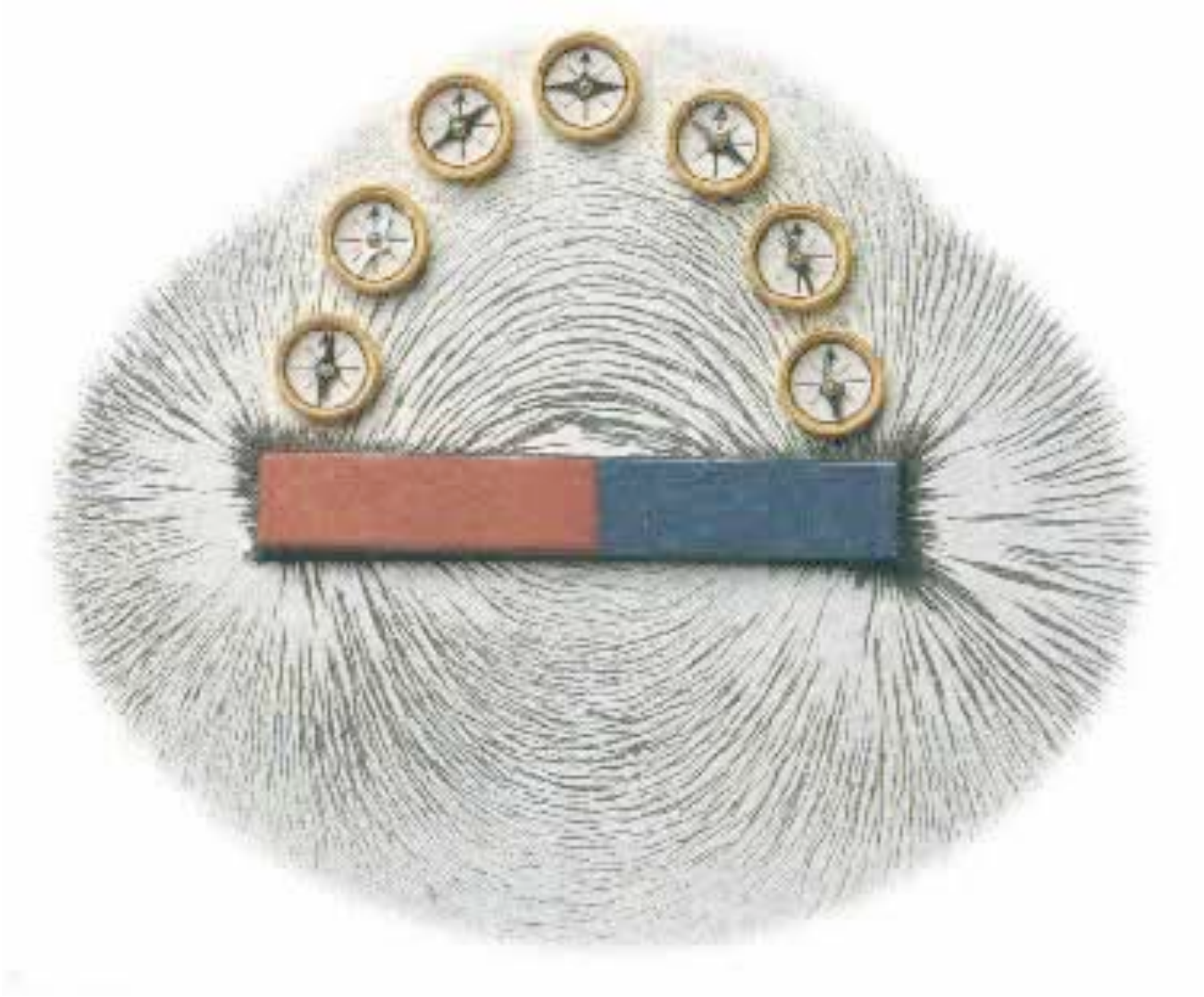
La fuerza que actúa sobre una partícula cargada que se mueve con velocidad v en un campo magnético B es siempre perpendicular a v y B

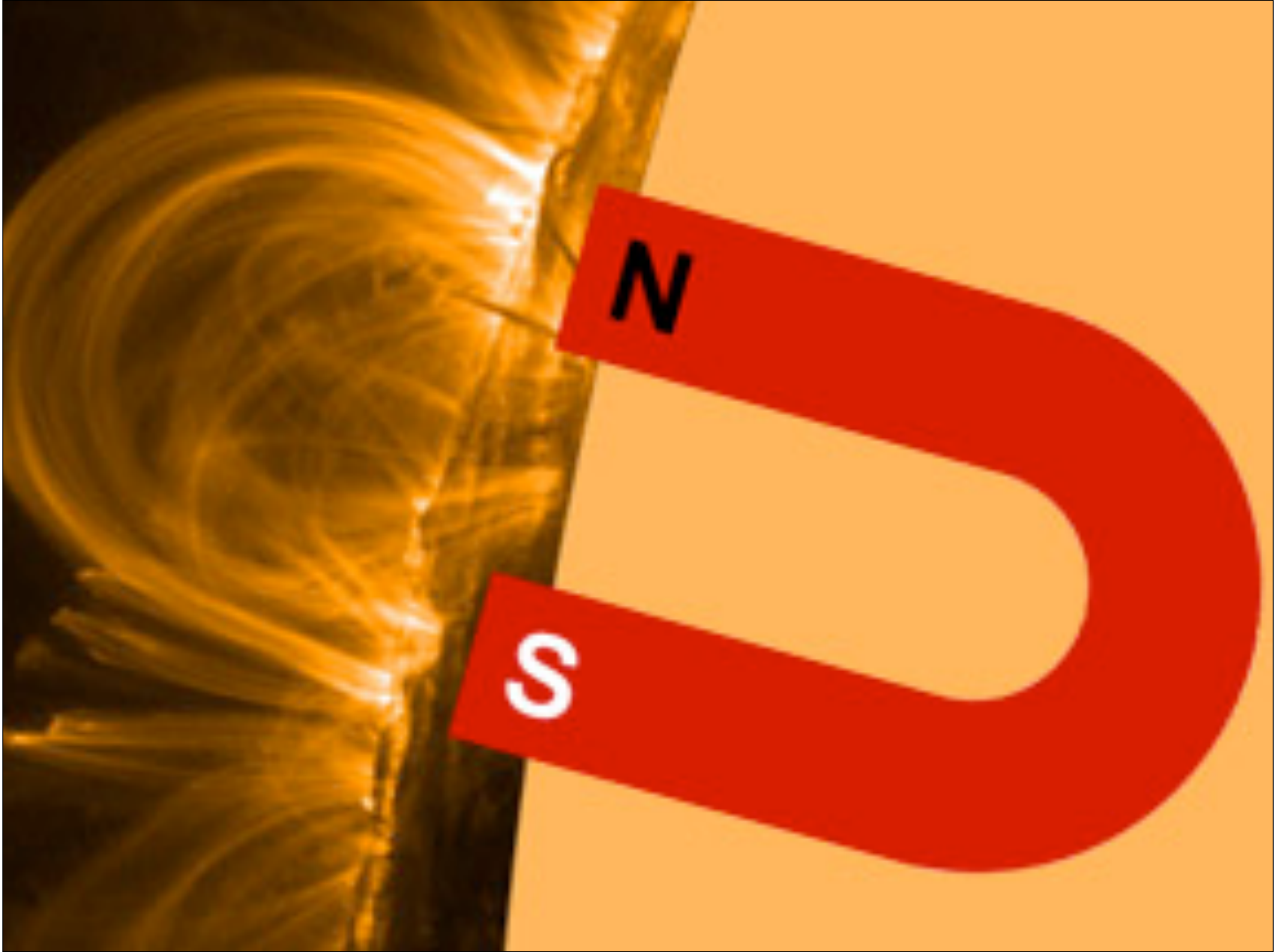


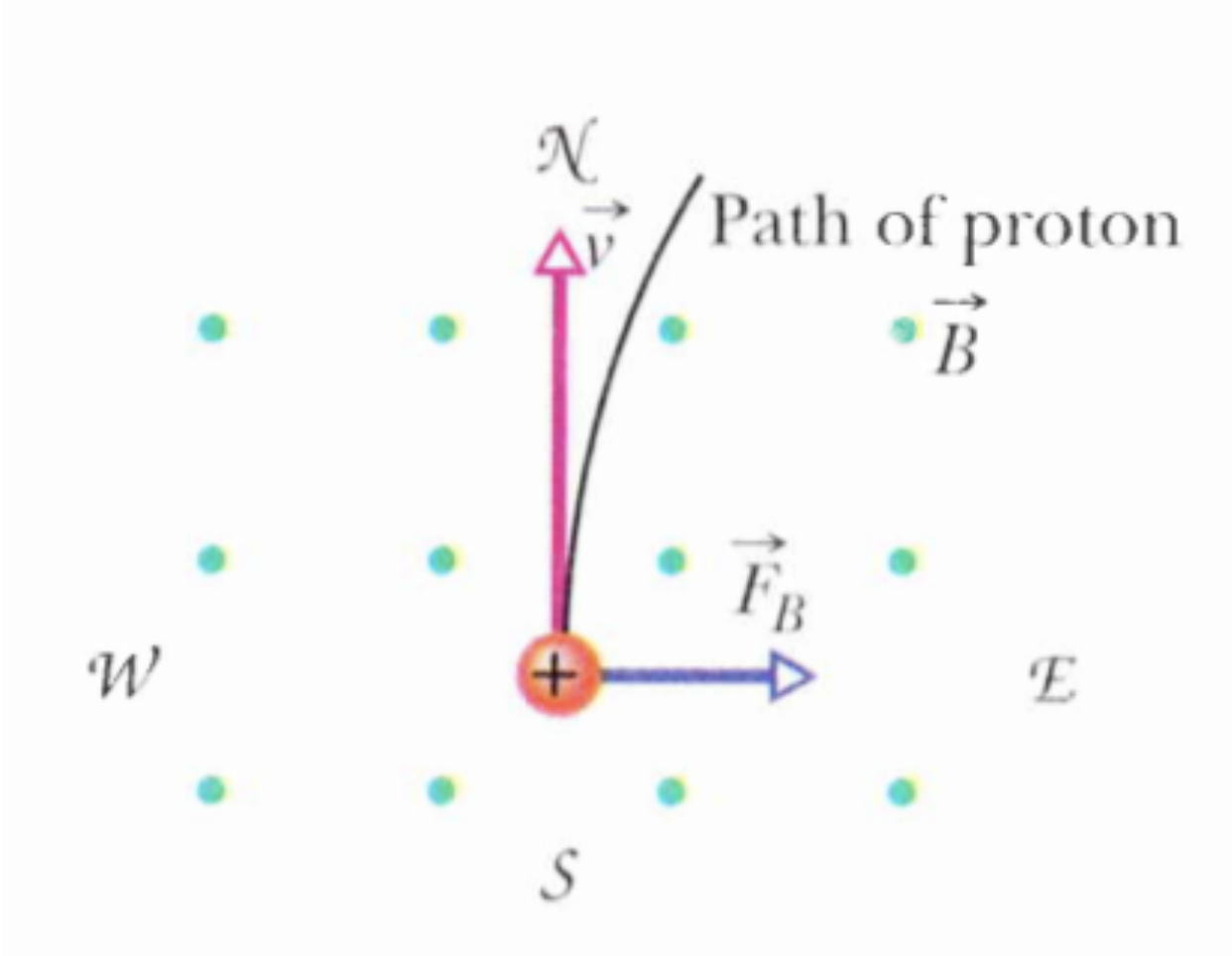
Líneas de campo magnético




I
Conductor

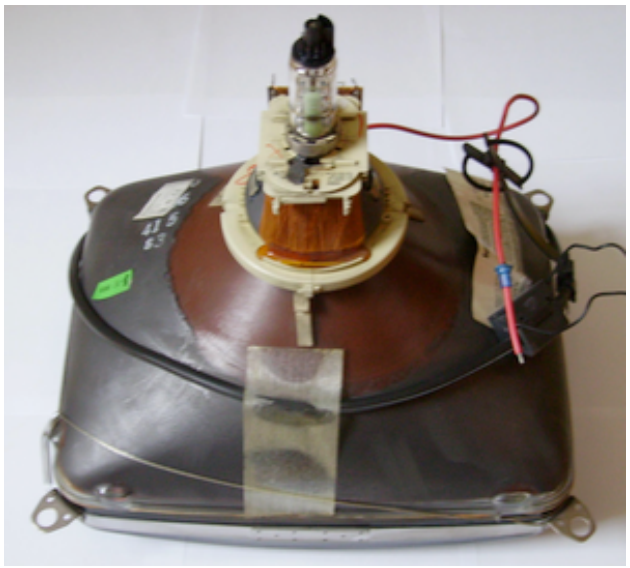



N
S


N
$\vec{v}$
Path of proton
$\vec{B}$
$\vec{F}_B$
W
+
E
S

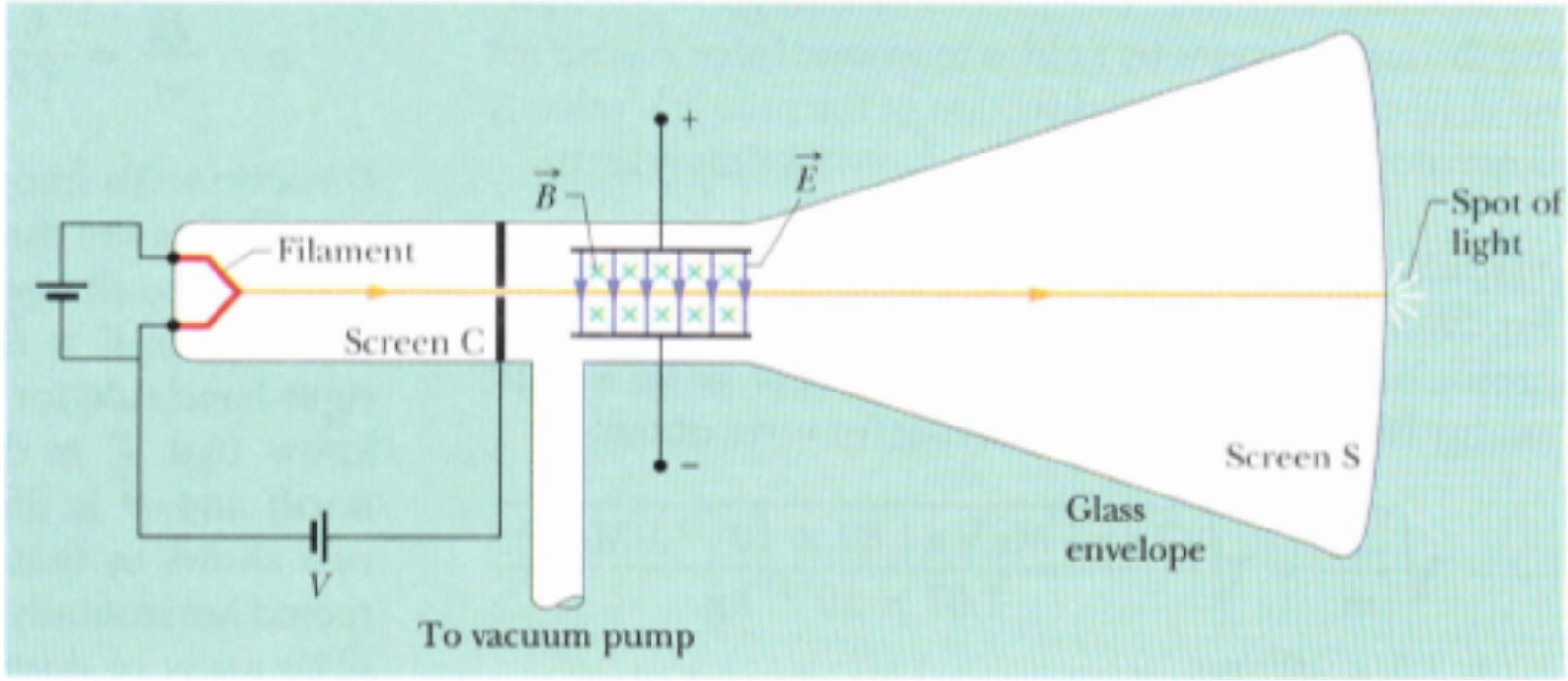
Campos cruzados: descubrimiento del electrón

Tubo de rayos catódicos



Joseph John Thomson

Nacimiento	18 de diciembre de 1856 Cheetham Hill, Reino Unido
Fallecimiento	30 de agosto de 1940 Cambridge, Reino Unido
Nacionalidad	británico
Campo	Física
Instituciones	Trinity College
Conocido por	Realizar importantes contribuciones para la comprensión de la estructura del átomo.
Premios destacados	Premio Nobel de Física en 1906.
Cónyuge	Rose Elizabeth Paget



Desviación en el extremo de la placa

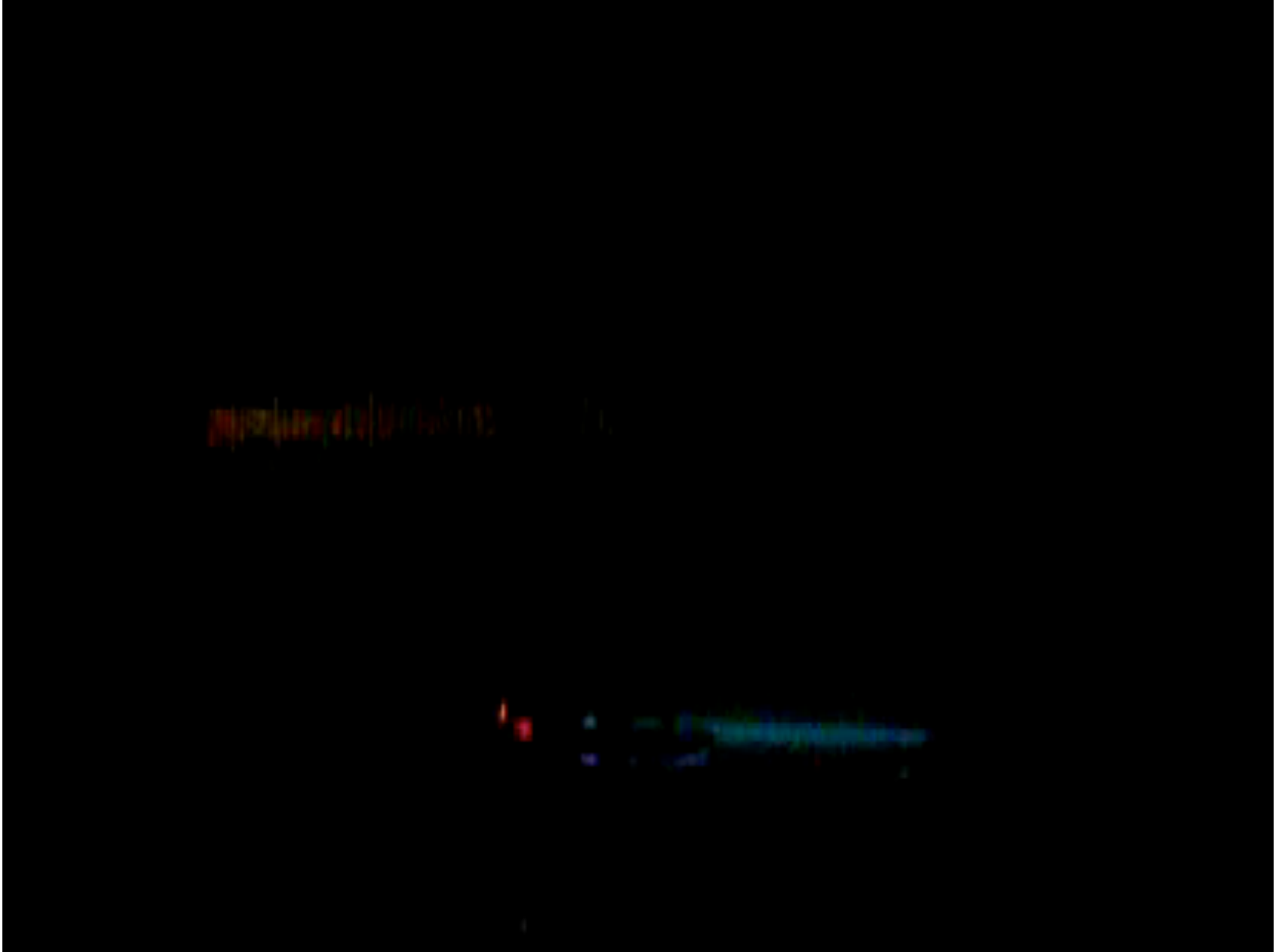
$$y = \frac{|q|EL^2}{2mv^2},$$

Haz sin desviación

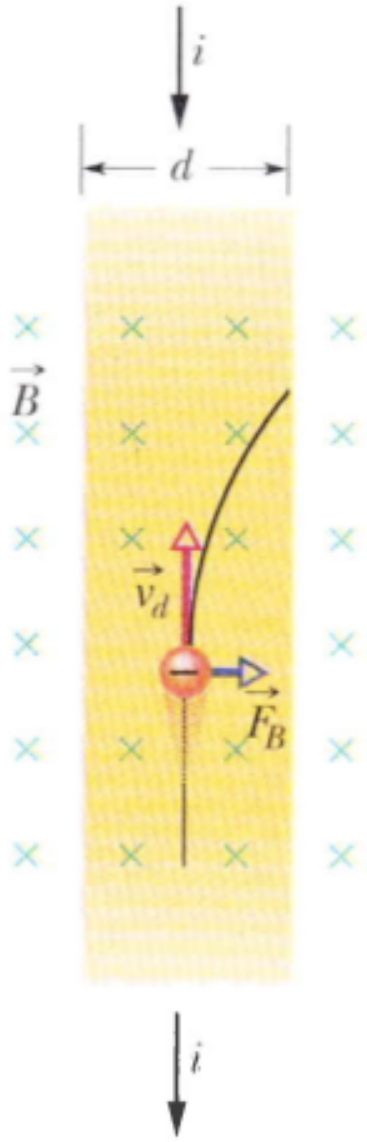
$$|q|E = |q|vB\sin(90°) = |q|vB$$

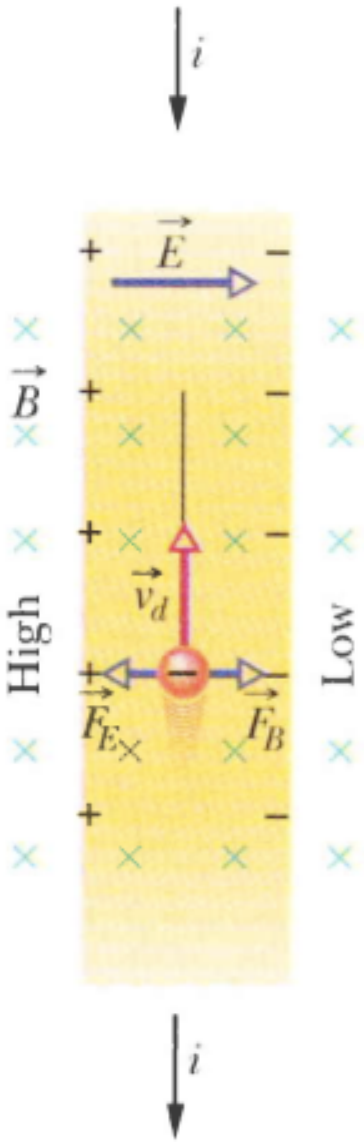
$$v = \frac{E}{B}.$$

$$\frac{m}{|q|} = \frac{B^2L^2}{2yE},$$



Campos cruzados: el Efecto Hall





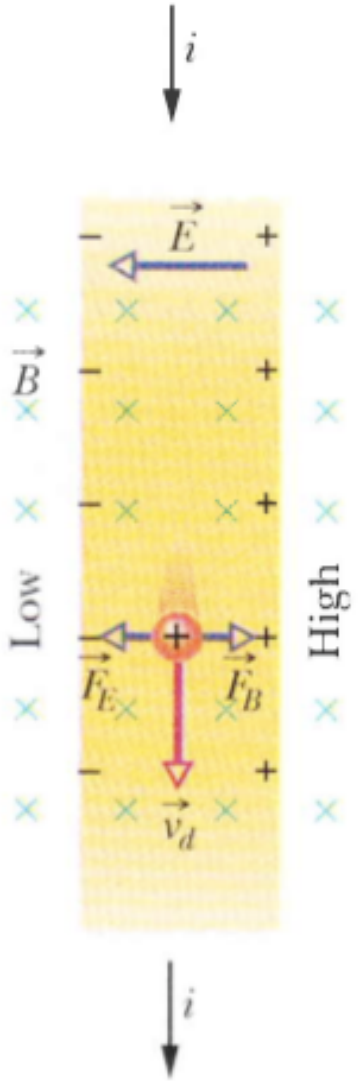
$$V = Ed.$$

Fuerzas en equilibrio

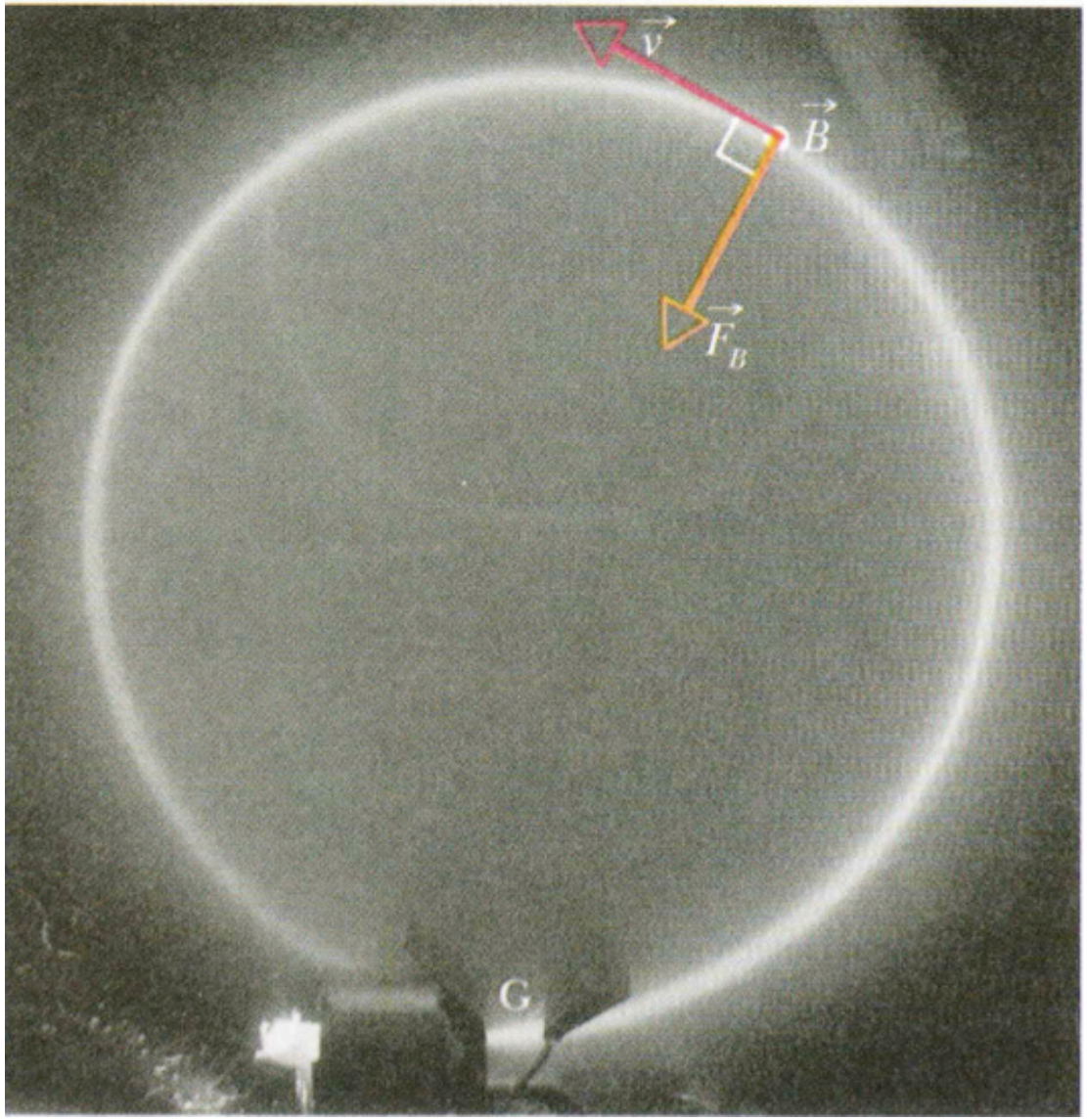
$$eE = ev_dB.$$

$$v_d = \frac{J}{ne} = \frac{i}{neA},$$

$$n = \frac{Bi}{Vle},$$



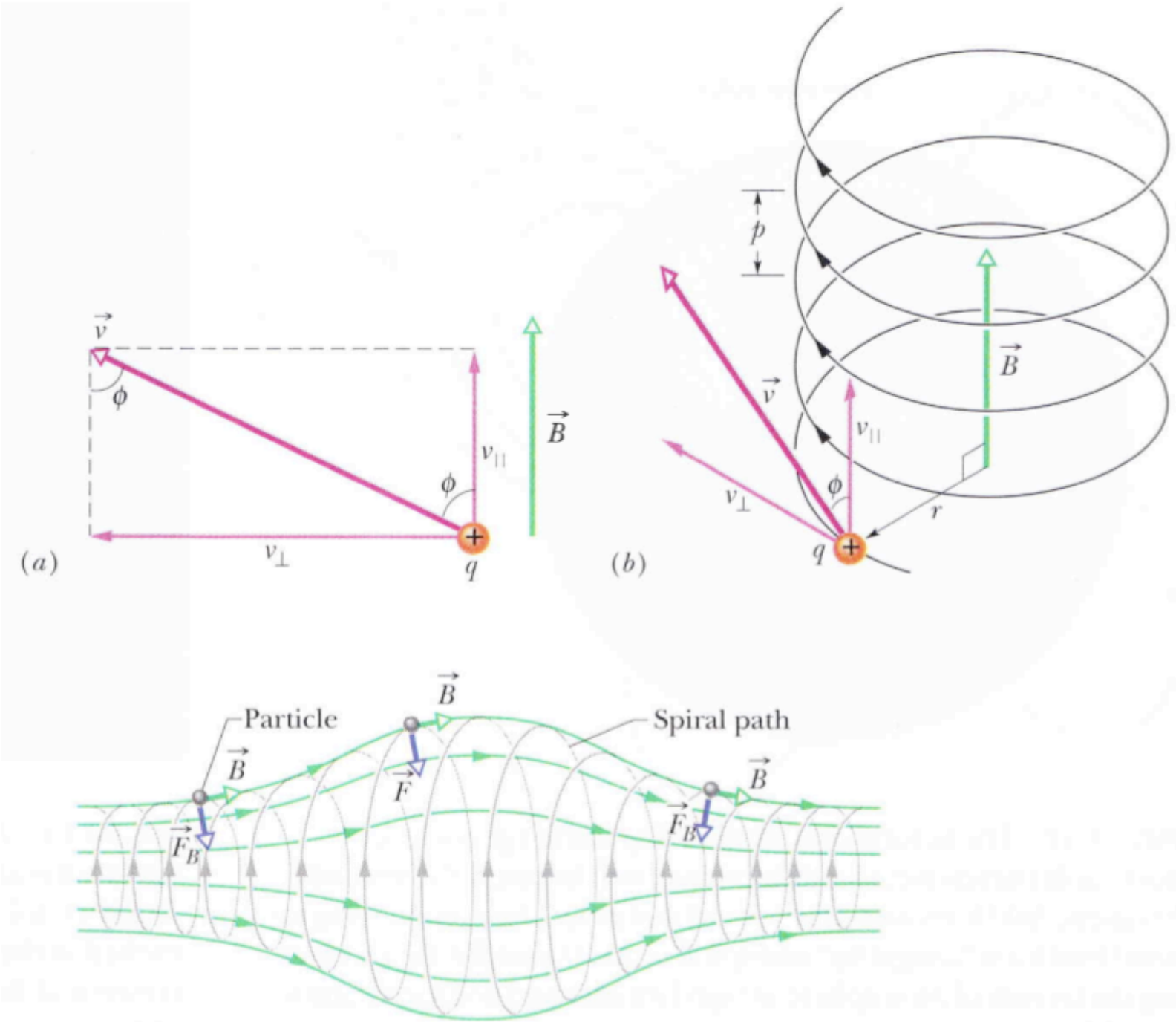
Una partícula cargada en circulación



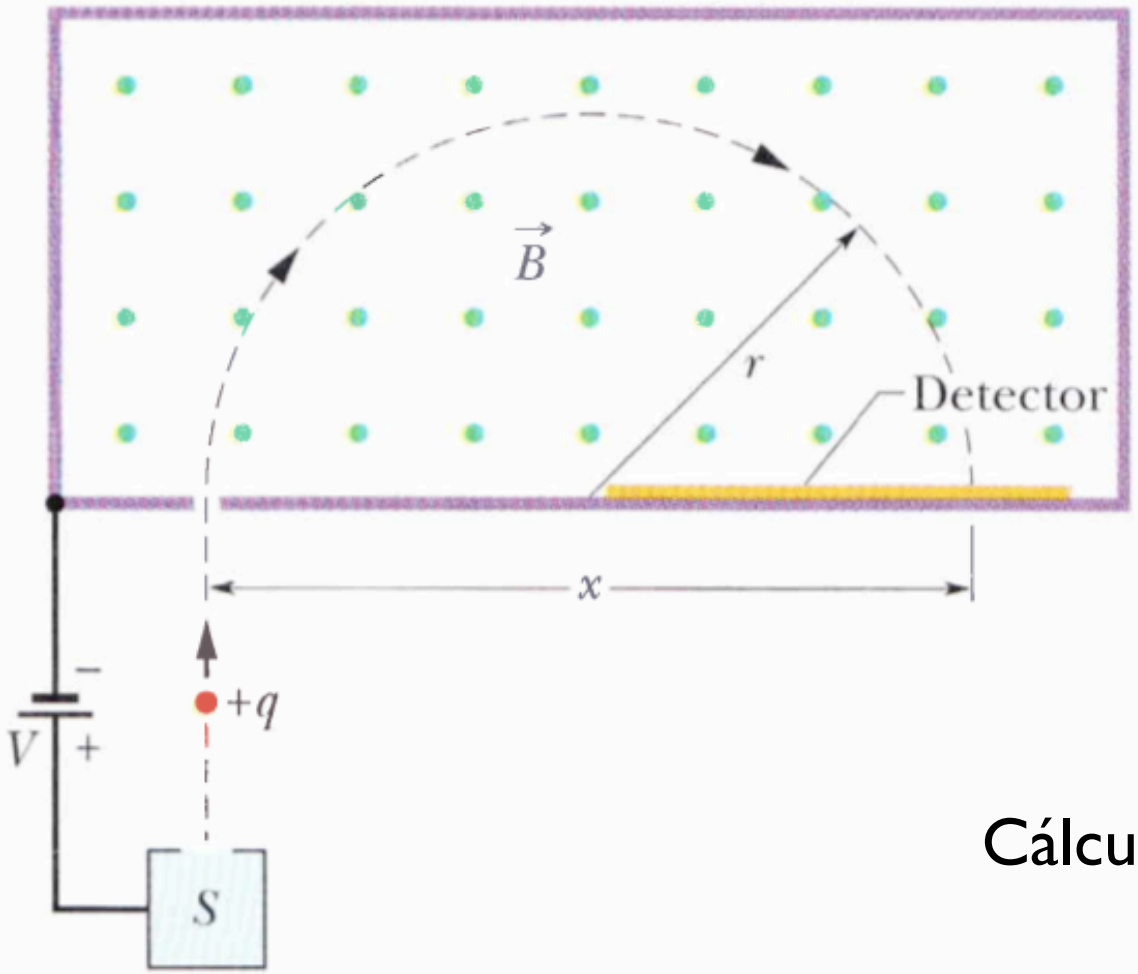
$$r = \frac{mv}{|q|B}$$

$$T = \frac{2\pi r}{v} = \frac{2\pi}{v}\,\frac{mv}{|q|B} = \frac{2\pi m}{|q|B}$$

$$f = \frac{1}{T} = \frac{|q|B}{2\pi m}$$


$\vec{v}$
ϕ
$v_{||}$
$\vec{B}$
$v_\perp$
q
(a)
p
$\vec{B}$
$\vec{v}$
$v_{||}$
$v_\perp$
ϕ
r
q
(b)
Particle
$\vec{B}$
Spiral path
$\vec{F}$
$\vec{F}_B$

Ejercicio



$B = 80.000\ \text{mT},$

$V = 1000.0\ \text{V},$

$q = +1.6022 \times 10^{-19}\ \text{C}$

$x = 1.6254\ \text{m}.$

Cálcular la masa m de los iones

Espectrómetro de masas

$$\Delta K + \Delta U = 0,$$

$$\tfrac{1}{2}mv^2 - qV = 0$$

$$v = \sqrt{\frac{2qV}{m}}.$$

$$r = \frac{mv}{qB} = \frac{m}{qB}\sqrt{\frac{2qV}{m}} = \frac{1}{B}\sqrt{\frac{2mV}{q}}.$$

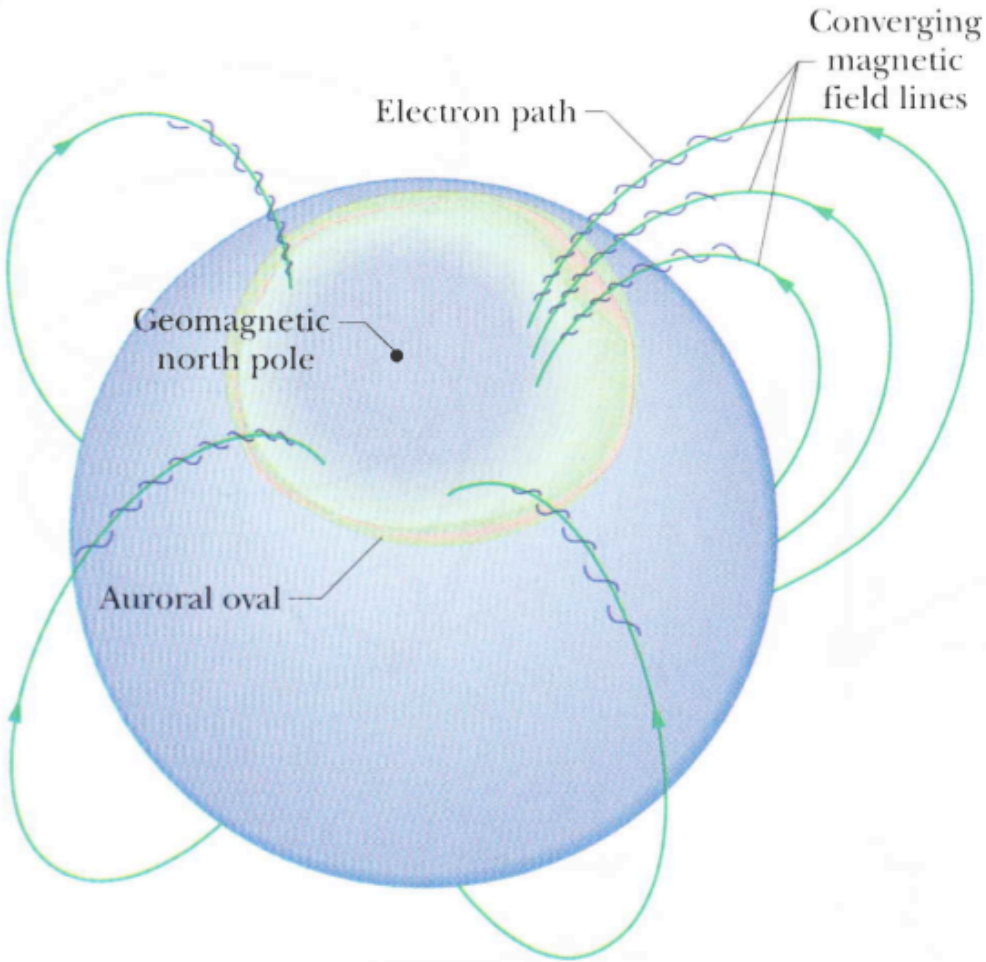
$$x = 2r = \frac{2}{B}\sqrt{\frac{2mV}{q}}.$$

$$m = \frac{B^2qx^2}{8V}$$

$$= \frac{(0.080000\ \text{T})^2(1.6022 \times 10^{-19}\ \text{C})(1.6254\ \text{m})^2}{8(1000.0\ \text{V})}$$

$$= 3.3863 \times 10^{-25}\ \text{kg} = 203.93\ \text{u}. \qquad \text{(Answer)}$$

Trayectorias helicoidales



Ciclotrones y sincrotrones