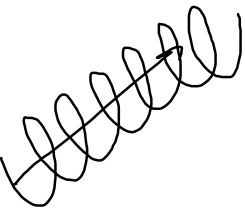
$\underline{B}$ uniforme

- $\parallel$ alla linea di campo: $\underline{v}_{\parallel}$ rimane invariato.
- $\perp$ " " " " : $\underline{v}_{\perp}$ " " in modulo

moto circolare uniforme

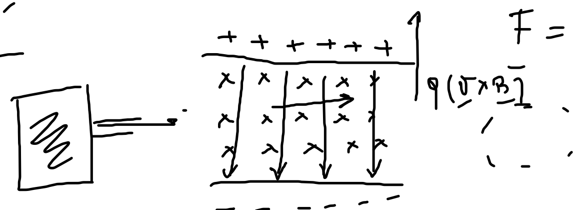
$$r_L = \frac{m v_\perp}{qB} \qquad \omega_L = \frac{qB}{m}$$



moto a "elica"

$$\underline{F} = q\underline{E} + q(\underline{v} \times \underline{B})$$

Selettore di velocità



Sorgente
di part. cariche

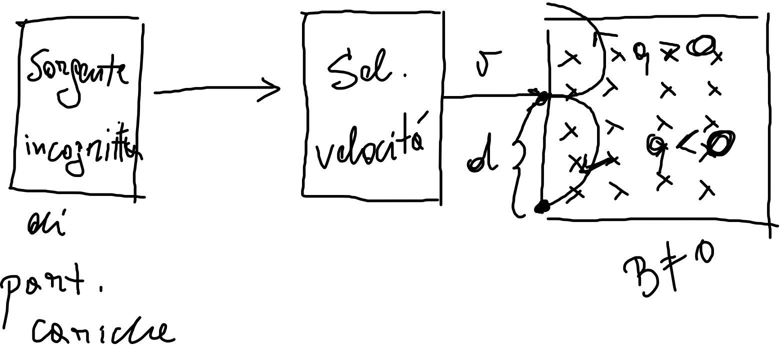
$$\underline{F} = q\underline{E} + q(\underline{v} \times \underline{B}) = 0$$

$\downarrow$ no deflessione

$\underline{v} \perp \underline{B}$

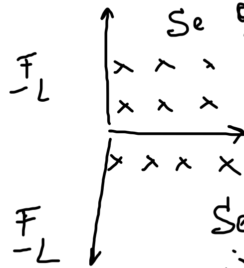
$$\|q\underline{E}\| = qE \qquad \|q(\underline{v} \times \underline{B})\| = qvB$$

$\Sigma \underline{F} = 0$ se $\cancel{q}E = \cancel{q}vB$; $v = \frac{E}{B}$



$\underline{F} = q(\underline{v} \times \underline{B})$

Moto circolare uniforme



misurata

$$d = 2r_L = \frac{2\, m\, v_\perp}{q\, B}$$

v → noto (è selezionata)

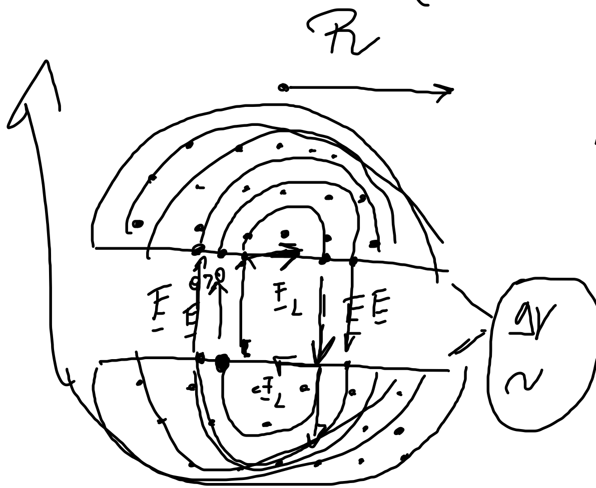
qB → noto

$$\frac{m}{q} = \frac{dB}{2v}$$

Ciclotrone

T_L è indip. da v

$(v \ll c)$



part. è acc. nell'intercapedine tra le 2 D

Seconda semicirconf. ha raggio > della prima

T_L è lo stesso

$$\frac{1}{2} m v_{max}^2 = \frac{1}{2} \cancel{m} \frac{q^2 B^2 R^2}{m^{\cancel{2}}}$$

$$\frac{m v_{max}}{qB} = R \; ; \quad v_{max} = \frac{qBR}{m}$$

$$E_{max} = \frac{q^2 B^2 R^2}{2m}$$

$q = 1.6 \cdot 10^{-19}$ C

$m = 1.67 \cdot 10^{-27}$ kg

Protone

$B = 1$ T $\quad R \sim 1$ m

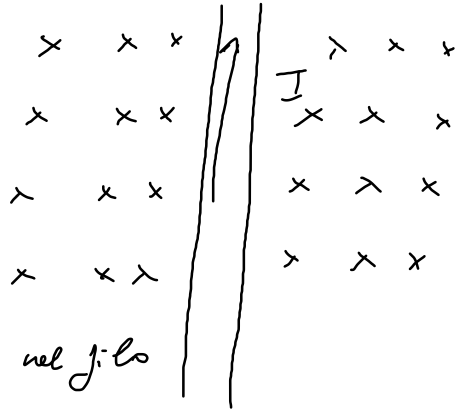
T_L ~~rimanere~~ deve invariante con v

$E_{max} \sim 40$ MeV

$mc^2 \sim 1$ GeV

$$T_L = \frac{2\pi}{\omega} = \frac{2\pi m}{qB}$$

Forza su un filo indefinito percorso da corrente in $\underline{B}$



$j = n\, q\, v_d$ → $\dfrac{\#\ \text{cariche}}{\text{volume}}$

Su ogni carica in movimento

$$\underline{F}_q = q\,(\underline{v}_d \times \underline{B})$$

N : # cariche in movimento nel filo

$$\underline{F}_{filo} = \sum \underline{F}_q = N\, q\,(\underline{v}_d \times \underline{B})$$

$$= (\underbrace{n\, q\, \underline{v}_d}_{\underline{j}} \times \underline{B})\, A\, L$$

$N = n \cdot (\text{Volume filo}) = n \cdot A \cdot L$

A: sezione del filo

L: lungh. del filo

$$\underline{F}_{filo} = AL\,(\underline{j} \times \underline{B})$$

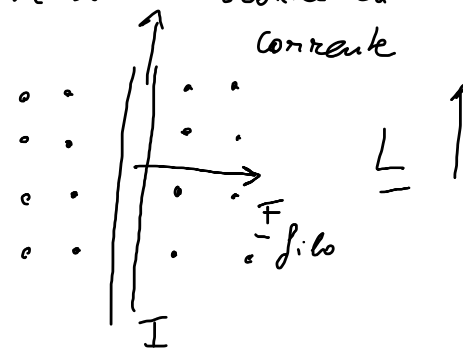
$$\underbrace{I}_{\text{corrente}} = \underbrace{j}_{\text{dens. corr.}} \cdot \underbrace{A}_{\text{sezione}}$$

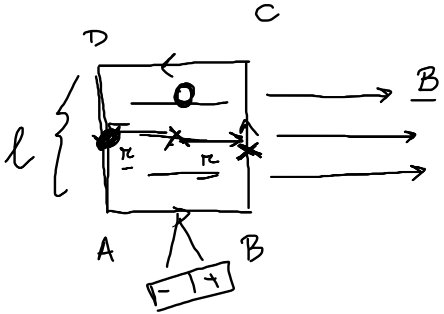
Vettore lunghezza del filo: $\underline{L}$

- modulo: L
- direzione e verso: quelli in cui scorre la corrente

$$\underline{F}_{filo} = \overbrace{Aj}^{I}\,(\underline{L} \times \underline{B})$$

$$\underline{F}_{filo} = I\,(\underline{L} \times \underline{B})$$





$$\underline{F}_{TOT} = \sum \underline{F}_{lati} \qquad \underline{F} = \underline{I}(\underline{L} \times \underline{B})$$

$$\underline{F}_{AB} = I(\overrightarrow{AB} \times \underline{B}) = 0$$

$$\underline{F}_{BC} = I(\overrightarrow{BC} \times \underline{B}) \qquad |\underline{F}_{BC}| = I l B$$

$$\underline{F}_{CD} = I(\overrightarrow{CD} \times \underline{B}) = 0$$

$\underline{F}_{BC}$ entrante nel piano

$$\underline{F}_{DA} = I(\overrightarrow{DA} \times \underline{B}) \qquad |\underline{F}_{DA}| = I l B$$

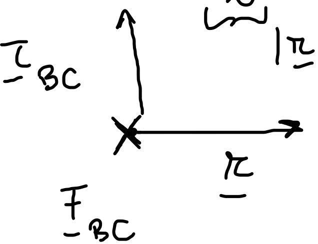
$\underline{F}_{DA}$ uscente dal piano

$$\sum \underline{F} = \underline{0}$$

Momento torcente $\quad \underline{\tau}_O = \underline{r} \times \underline{F}$

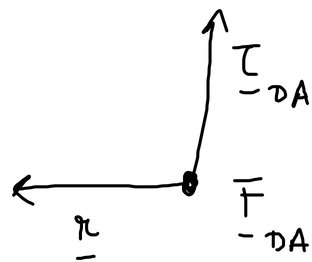
Lato BC:

$$|\underline{\tau}_{BC}| = \underbrace{\frac{l}{2}}_{|\underline{r}|} \cdot F_{BC} = \frac{l}{2} I l B = \frac{l^2}{2} I B$$



Lato DA:

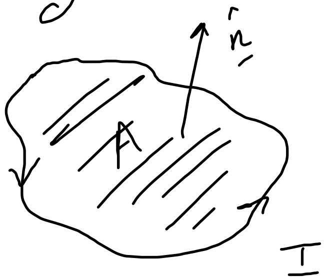
$$|\underline{\tau}_{DA}| = \underbrace{\frac{l}{2}}_{|\underline{r}|} \cdot F_{DA} = \frac{l^2}{2} I B$$



$$|\underline{\tau}| = |\underline{\tau}_{BC} + \underline{\tau}_{DA}| = \cancel{2} \cdot \frac{l^2}{\cancel{2}} I B = \underbrace{l^2}_{area} I B$$

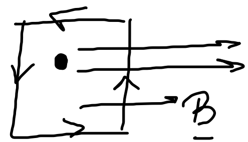
$$\tau = area\ I B$$

Caso generale



Def momento magn. della spira

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

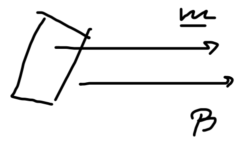


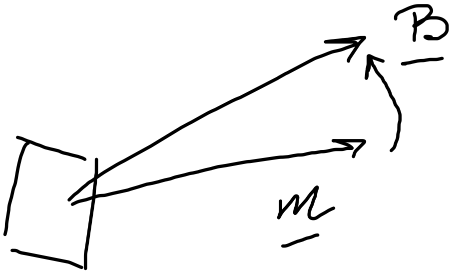
$\boldsymbol{\tau}$ è massimo se $\mathbf{m} \perp \mathbf{B}$

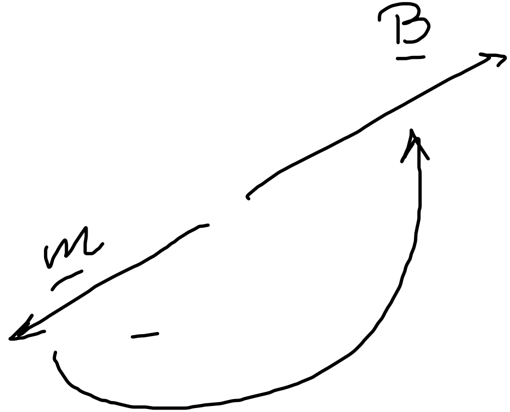
$|\boldsymbol{\tau}| = mB \operatorname{sen}\theta$

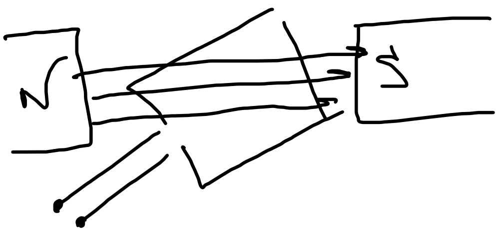
max se $\theta = 90° \Rightarrow \mathbf{m} \perp \mathbf{B}$

$|\boldsymbol{\tau}| = 0$ se $\theta = 0$




B
m


B
m


N
S