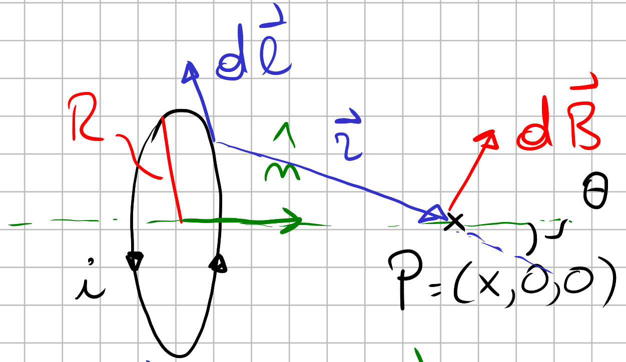
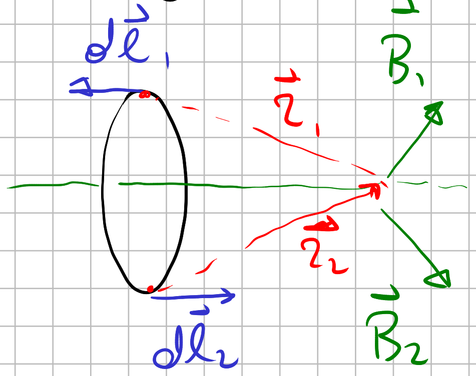
CAMPO GENERATO DA UNA SPIRA



$$\vec{B}(P) = ? \quad , \quad d\vec{B} = \frac{\mu_0 i}{4\pi} \frac{d\vec{\ell} \times \hat{r}}{r^2}$$

$$d\vec{\ell} \perp \hat{r}$$



$$\vec{B}(P) = (B_x, 0, 0) \quad \text{per simmetria}$$

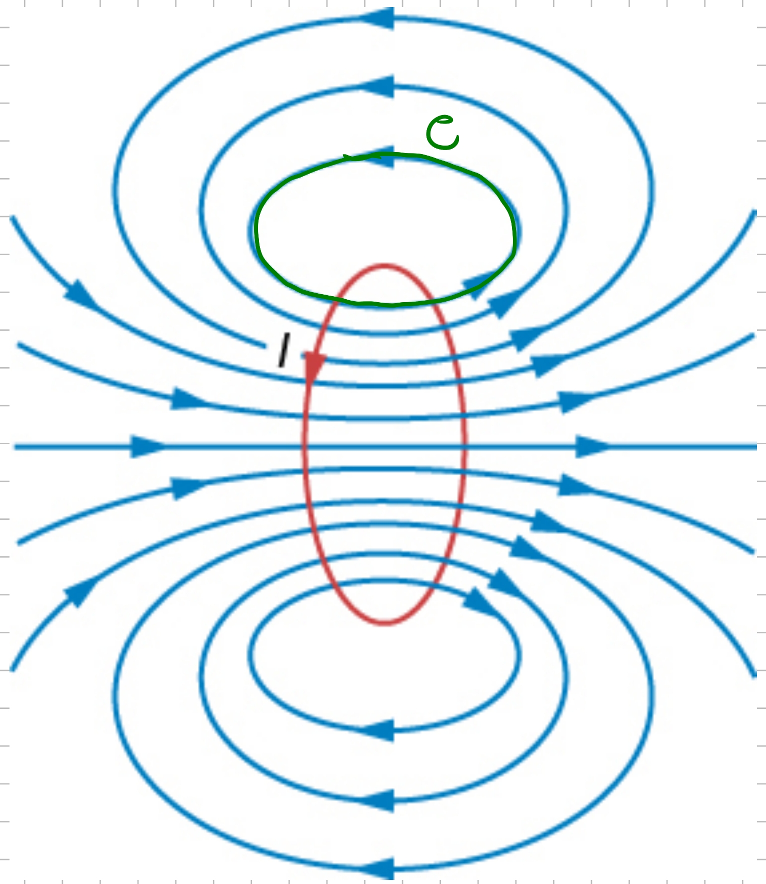
$$dB_x = dB\cos\theta = dB\,\frac{R}{r} = \frac{\mu_0 i}{4\pi}\frac{d\ell}{r^2}\frac{R}{r} = \frac{\mu_0 i}{4\pi}\frac{R}{r^3}\,d\ell$$

$$B_x = \int_{\text{SPIRA}} dB_x = \int_0^{2\pi R} \frac{\mu_0 i}{4\pi}\frac{R}{r^3}\,d\ell = \boxed{\frac{\mu_0 i}{4\pi}\frac{2\pi R^2}{r^3} = B_x = B} \Rightarrow$$

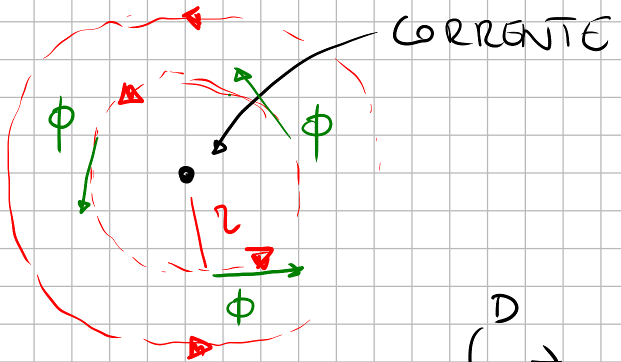
$$\vec{B} = B\hat{n} = \frac{\mu_0 i}{4\pi}\frac{2\pi R^2 \hat{n}}{r^3}, \quad \text{sapendo che } \vec{m} = i\Sigma\hat{n},$$

$$\vec{B} = \frac{\mu_0}{4\pi}\frac{2\vec{m}}{r^3} \longleftrightarrow \vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{2\vec{p}}{r^3}$$

LINEE DI CAMPO

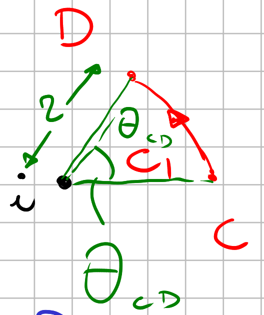


$$\int_c \vec{B}\cdot d\vec{s} > 0 \neq 0 \rightarrow \vec{B} \text{ non è conservativo!}$$

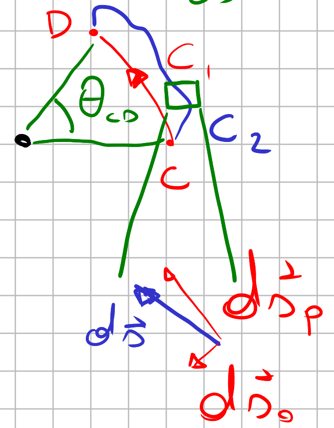


TEOREMA DI AMPÉRE

$$\vec{B} = \frac{\mu_0 i}{2\pi r}\,\hat{\phi}$$



$$\int_C^D \vec{B}\cdot d\vec{s} = \int_C^D B\,ds = \int_C^D \frac{\mu_0 i}{2\pi r}\,ds = \int_C^D \frac{\mu_0 i}{2\pi \cancel{r}}\,\cancel{r}\,d\theta = \int_C^D \frac{\mu_0 i}{2\pi}\,d\theta = \frac{\mu_0 i\,\theta_{CD}}{2\pi}$$

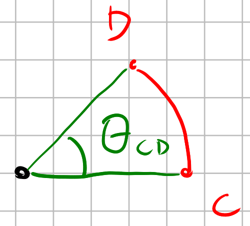


il $d\vec{s}$ di C_2 si può scomporre, $d\vec{s} = d\vec{s}_p + d\vec{s}_o$,

$$\vec{B}\cdot d\vec{s} = \vec{B}\cdot(d\vec{s}_p + d\vec{s}_o) = B\,ds_p + \cancel{0}$$

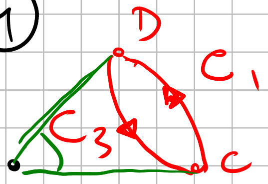
$$\int_{C_2} \vec{B}\cdot d\vec{s} = \frac{\mu_0 i\,\theta_{CD}}{2\pi}$$ COME PER C_1

TEOREMA DI AMPERE



$$\int_C^D \vec{B}\cdot d\vec{s} = \frac{\mu_0 i}{2\pi}\,\theta_{CD}\ ,$$ chiudiamo la circuitazione

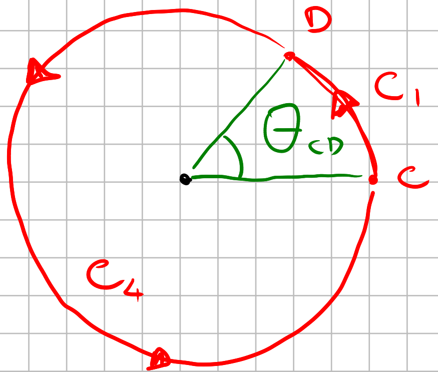
(1)



$$\oint_{C_1+C_3} \vec{B}\cdot d\vec{s} = \int_{C_1} \vec{B}\cdot d\vec{s} + \int_{C_3} \vec{B}\cdot d\vec{s} = \frac{\mu_0 i}{2\pi}\left(\theta_{CD} + \theta_{DC}\right) = 0$$

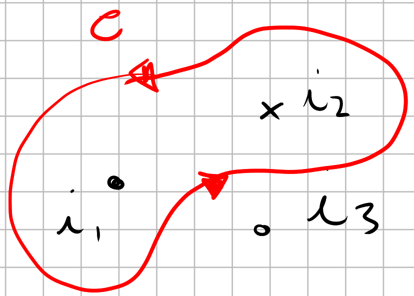
perché $\theta_{CD} = -\theta_{DC}$

(2)



$$\oint_{C_1+C_4} \vec{B}\cdot d\vec{s} = \int_{C_1} \vec{B}\cdot d\vec{s} + \int_{C_4} \vec{B}\cdot d\vec{s} = \frac{\mu_0 i}{2\pi}\left(\cancel{\theta_{CD}} + 2\pi - \cancel{\theta_{CD}}\right) = \mu_0 i$$

se il percorso chiuso concatena una corrente i $\Rightarrow$ abbiamo $\pm\mu_0 i$ come contributo all'integrale.



GENERALIZZAZIONE

$$\oint_C \vec{B} \cdot d\vec{s} = \mu_0 \sum_k i_k = \mu_0 (i_1 - i_2)$$

$\hookrightarrow$ CORRENTI CONCATENATE