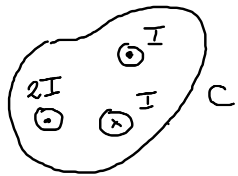
Th Ampere

$$\oint_C \underline{B} \cdot d\underline{l} = \mu_0 I_{conc}$$

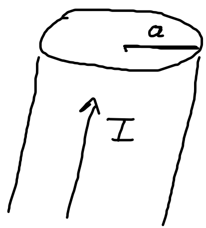
C : generico circuito geometrico

$d\underline{l}$: elemento infinitesimo lungo il circuito C



$I_{conc} = 2I + \cancel{I} - \cancel{I} = 2I$

Filo percorso da corrente

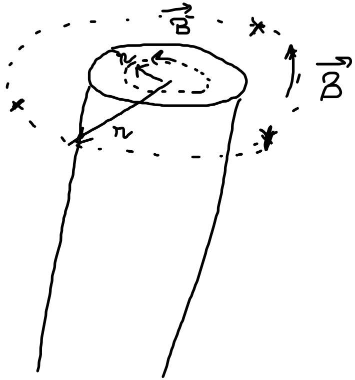


I uniforme

$\underline{B}$ = ? dentro e fuori dal filo

Linee di campo sono circonferenze centrate sull'asse del filo

$\Rightarrow$ scelgo C della stessa "forma"



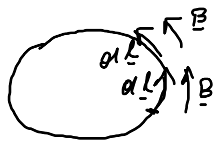
lungh. della circonf.

$$\oint_C \underline{B}\cdot d\underline{l} = \oint_C B\,dl = B\oint_C dl = 2\pi r B$$

vero per punti sia dentro il filo, sia fuori

$r < a$ (dentro il filo), $r > a$ (fuori)

$\underline{B} \parallel d\underline{l}$: $\underline{B}\cdot d\underline{l} = B\,dl$



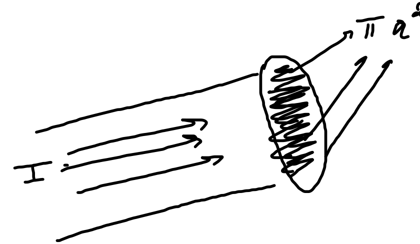
Se $r > a$: $I_{conc} = I$

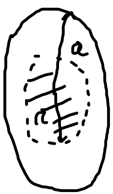
$$2\pi r B = \mu_0 I; \quad B(r) = \frac{\mu_0}{2\pi} \frac{I}{r}$$

Se $\underline{r < a}$:

j è uniforme $\qquad j = \frac{I}{\pi a^2}$

(dens. sup. corrente)

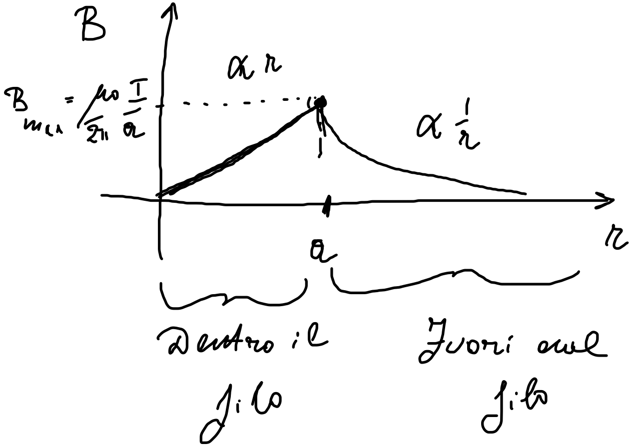




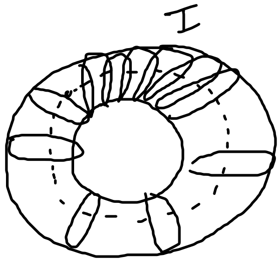
$$a_{circuito} = \pi r^2$$

$$I_{conc} = j \cdot \pi r^2 = \frac{I}{\pi a^2} \pi r^2 = \frac{I}{a^2} r^2$$

$$2\pi r B = \mu_0 \cdot \frac{I r^2}{a^2}; \quad B = \frac{\mu_0}{2\pi} \frac{I}{a^2} r.$$

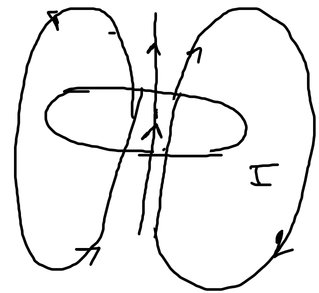


<u>Toroide</u>



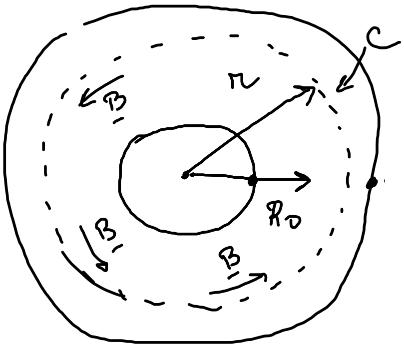
Spira circolare percorsa da I

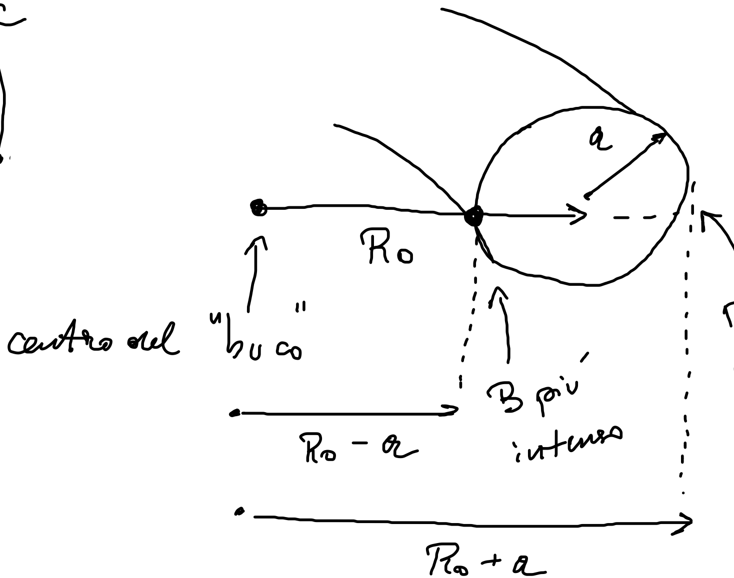
Linee di campo lungo circonferenze



Scelgo come C: circonferenza di raggio r

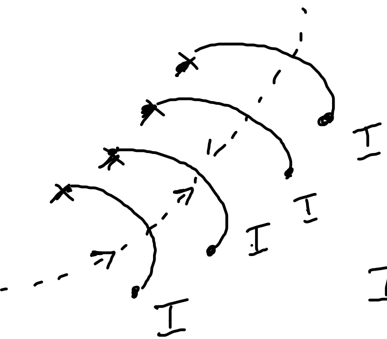
$$R_0 - a < r < R_0 + a$$





$$\oint_C \underline{B} \cdot d\underline{l} = 2\pi r B$$

come per il filo



$I_{conc} = I \cdot N$ N: # di spire nell'avvolgimento

$$2\pi r B = \mu_0 N I;$$

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

B_{max} è per $r = R_0 - a$: $B_{max} = \frac{\mu_0}{2\pi}\frac{NI}{R_0 - a}$

B_{min} è per $r = R_0 + a$: $B_{min} = \frac{\mu_0}{2\pi}\frac{NI}{R_0 + a}$

$$\frac{B_{min}}{B_{max}} = \frac{\mu_0}{2\pi}\frac{NI}{R_0 + a}\cdot\frac{2\pi}{\mu_0}\frac{R_0 - a}{NI} = \frac{R_0 - a}{R_0 + a} = \frac{R_0\left(1 - \frac{a}{R_0}\right)}{R_0\left(1 + \frac{a}{R_0}\right)} = \frac{1 - \frac{a}{R_0}}{1 + \frac{a}{R_0}}$$

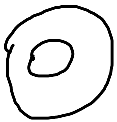
Campo magn. uniforme: $\frac{B_{min}}{B_{max}} = 1$

$$\frac{B_{min}}{B_{max}} = \frac{1-\frac{a}{R_0}}{1+\frac{a}{R_0}}$$

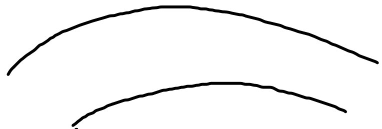
Vorrei: $\frac{B_{min}}{B_{max}} = 1$: $\frac{a}{R_0} = 0$; $a = 0$.

↳ Se $\frac{a}{R_0} \ll 1$ $\quad \frac{a}{R_0} \to 0$

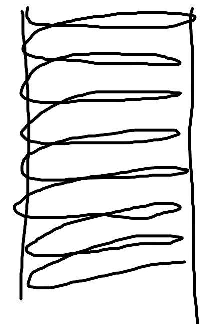
Se $R_0 \to +\infty$



R_0 "piccolo"

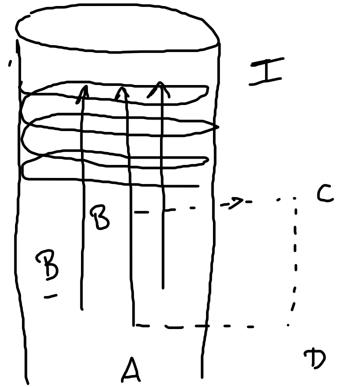


R_0 "grande"



Solenoide

Campo magnetico del solenoide



$$\oint_C \underline{B}\cdot d\underline{l} = \mu_0 I_{conc}$$

C : rettangolo ABCD

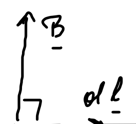
$$\oint_C \underline{B}\cdot d\underline{l} = \int_{AB} + \int_{BC} + \int_{CD} + \int_{DA}$$

$B = 0$ fuori dal solenoide

Lati ⊥ :

"pezzetto fuori" : $B = 0$

"pezzetto dentro" :

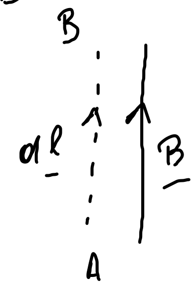


$$\underline{B}\cdot d\underline{l} = 0$$

perché $\underline{B} \perp d\underline{l}$

$$\int_{AB} \underline{B} \cdot d\underline{l} = \int_{AB} B\,dl = $$

$$= B \cdot \int_{AB} dl = B \cdot \overline{AB}$$

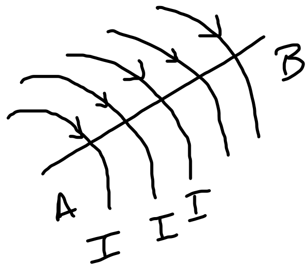


Lungo AB:

$\underline{B} \parallel d\underline{l}$

$$\underline{B} \cdot d\underline{l} = B\,dl$$

$$I_{conc} = I \cdot N_{\text{spire lungo } \overline{AB}}$$



Th Ampere

$$B \cdot \overline{AB} = \mu_0 I N_{\text{spire lungo } \overline{AB}}$$

$$\boxed{B = \mu_0 I \cdot n}$$

n: $\dfrac{\#\text{ spire}}{m}$

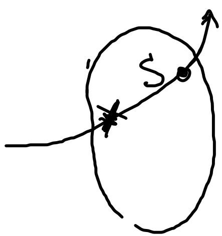
Campo elettrostatico:

$$\int_S \underline{E} \cdot d\underline{S} = \frac{q^{int}}{\varepsilon_0}$$

$$\oint_C \underline{E} \cdot d\underline{l} = 0$$

Campo magnetostatico:

$$\oint_C \underline{B} \cdot d\underline{l} = \mu_0 I^{conc}$$



$$\int_S \underline{B} \cdot d\underline{S} = 0$$