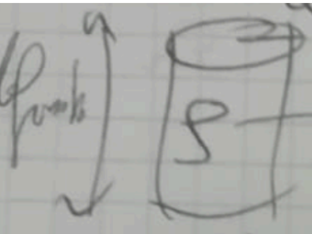
51) indefinito  ρ → densità di carica di volume

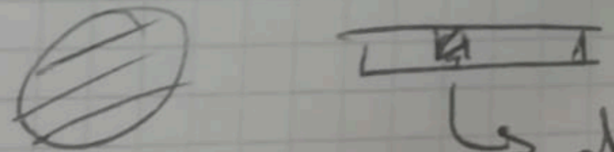
λ, ℓ → bacchetta con carica lineare λ. (lunga ℓ)

$d > a$

$$\Phi(E) = \int_{\Sigma_{cil}} \vec{E}\cdot\hat{n}\, d\Sigma = E\, 2\pi r h = \frac{Q_{INT}}{\varepsilon_0} = \frac{\rho}{\varepsilon_0}\pi a^2 h$$

$$E(r) = \frac{a^2\rho}{2\varepsilon_0 r} \Rightarrow \vec{E} = E(r)\,\hat{r} = \frac{a^2\rho}{2\varepsilon_0 r}\hat{r}$$

La bacchetta è immersa in tale campo variabile con r

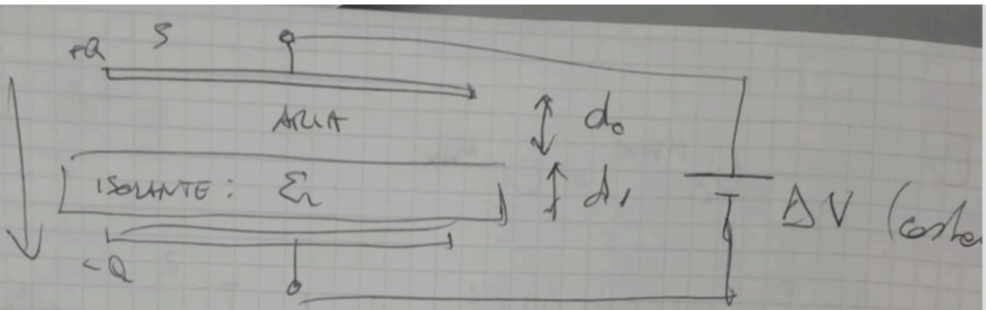
 λ

↳ $dq = \lambda\, dr$

$$\Rightarrow F = \int_d^{\ell+d} \frac{\lambda a^2 \rho}{2\varepsilon_0 r}\, dr = \frac{\lambda a^2 \rho}{2\varepsilon_0} \ln\left(\frac{\ell+d}{d}\right)$$

$$d\vec{F} = dq\,\vec{E} \parallel \hat{r} \qquad dF = \lambda E(r)\, dr$$

ES 2)



Momento di dipolo elettrico dell'isolante?

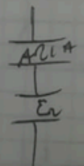
$$\vec{p} = \int_{\text{VOLUME DIEL}} \vec{P}\, d\tau = \vec{P}\,\tau \qquad \vec{P}, \vec{p} \,/\!/\, \hat{E}$$

$$|\vec{P}| = \varepsilon_0(\varepsilon_r - 1)E \Rightarrow p = \varepsilon_0(\varepsilon_r - 1)E\tau =$$

$$= \varepsilon_0(\varepsilon_r - 1)ESd_1$$

$$E = \frac{\sigma}{\varepsilon_0\varepsilon_r} \Rightarrow p = \varepsilon_0(\varepsilon_r - 1)\frac{\sigma}{\varepsilon_0\varepsilon_r}Sd_1 \qquad \text{MA: } Q = \sigma S$$

$$\Rightarrow p = \frac{\varepsilon_0(\varepsilon_r - 1)}{\varepsilon_0\varepsilon_r}Qd_1 = \frac{\varepsilon_r - 1}{\varepsilon_r}Qd_1 = \frac{\varepsilon_r - 1}{\varepsilon_r}C\Delta V d_1$$



SERIE TRA 2 CAPACITÀ:

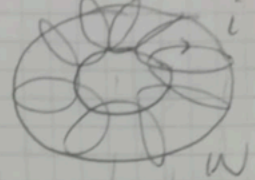
$$\frac{1}{C} = \frac{d_0}{\varepsilon_0 S} + \frac{d_1}{\varepsilon_0\varepsilon_r S} \Rightarrow C = \frac{\varepsilon_r\varepsilon_0 S}{d_1 + d_0\varepsilon_r} \Rightarrow$$

$$\Rightarrow \cancel{p = \varepsilon_1 \varepsilon_1} \Rightarrow \boxed{p = \frac{(\varepsilon_r - 1)\varepsilon_0 \Delta V S d_1}{d_1 + d_0\varepsilon_r}}$$

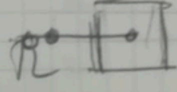
Esercizio 3 (21/07/2021 IC1 e 135)

...ircuitazione di Ampere per H : $\oint \vec{H} \cdot d\vec{l} = H\, 2\pi r = Ni$

$\mu H = \mu_0 \mu_r H = \mu_0 \mu_r \frac{Ni}{2\pi r} \simeq$

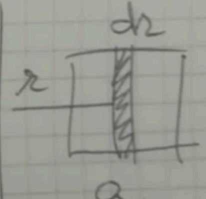


$\simeq \mu_0 \frac{Ni}{2\pi r}$



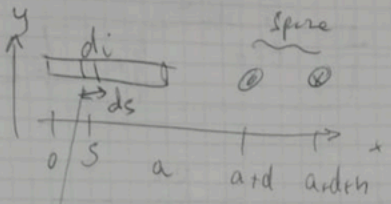
$R - \frac{a}{2} < r < R + a/2$

$= L \cdot i = N \int \vec{B} \cdot \hat{n}_m \, dS =$ $\quad dS = a \cdot dr$



$$= N \int_{R-a/2}^{R+a/2} \frac{\mu_0 N i}{2\pi r} \, a \, dr = \frac{\mu_0 N^2 i}{2\pi} a \cdot \ln \frac{R + a/2}{R - a/2} \Rightarrow \boxed{L = \frac{\mu_0 N^2 a}{2\pi} \ln \left(\frac{R + a/2}{R - a/2} \right)}$$

Es a



ogni elemento di genera il campo di un filo percorso da una corrente:

$$di = \frac{i}{a}\, ds$$

SULLA SPIRA: ⊗

$d\vec{B} \parallel \hat{y}$ $\qquad dB = \dfrac{\mu_0\, di}{2\pi(x-s)}$ $\qquad B(x) = \displaystyle\int_{\text{strato}} dB = \frac{\mu_0 i}{2\pi a}\int_0$

$$\vec{B} = \frac{\mu_0 i}{2\pi a} \ln\left(\frac{x}{x-a}\right)\hat{y}$$

$B(x)_{\text{LATO VICINO SPIRA}} = B(a+d)$

$B(x)$ " LONTANO " $= B(a+d+h)$

La forza tra la striscia e i 2 lati in a e a+d della spira (per gli altri 2 forze

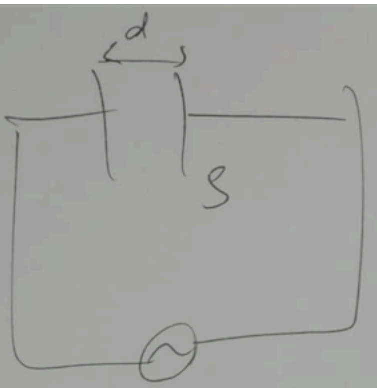
è:

$$\vec{F}_a = -\frac{\mu_0\, i_1 i_2 h}{2\pi a} \ln\left(\frac{a+d}{d}\right)\hat{x}$$

$$\vec{F}_h = \frac{\mu_0\, i_1 i_2 h}{2\pi a} \ln\left(\frac{a+d+h}{d+h}\right)\hat{x}$$

$$\vec{F}_{Tot} = -\frac{\mu_0\, i_1 i_2 h}{2\pi a}\left\{ \ln\left(\frac{a+d}{d}\right) - \ln\left(\frac{a+d+h}{d+h}\right)\right.$$

5)



Corrente spostamento

I_{SPOST} ?

$S = 50\ cm^2$

$d = 1\ mm$

$B = 10^5\ V/s$

$V(t) = A + Bt$

$$i_{SPOST} = \int_{S_{COND}} \vec{J} \cdot \hat{n}\, dS =$$

$$= \int_{S_{COND}} \varepsilon_0 \frac{\partial \vec{E}}{\partial t} \cdot \hat{n}\, ds = S_{COND}\, \varepsilon_0 \frac{\partial E}{\partial t} =$$

$$= S_{COND}\, \varepsilon_0 \frac{\partial \overbrace{(V/d)}^{E}}{\partial t} = \frac{S \varepsilon_0 B}{d} = 4.4\ \mu A$$