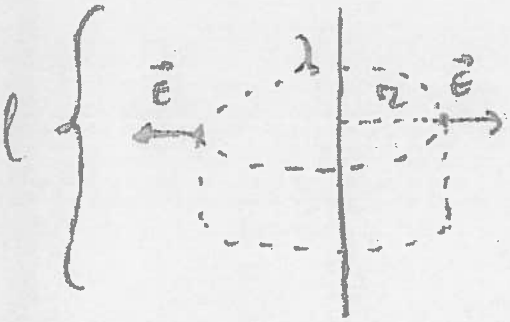
15/02/2017

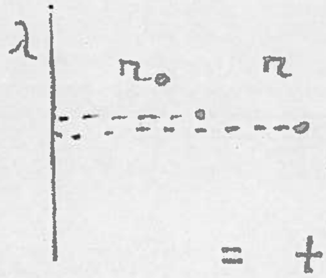
(1) CAMPO PRODOTTO DA UN FILO



$$\oint(\vec{E}) = E(r)2\pi r\, l = \frac{\lambda l}{\varepsilon_0}$$

$$E(r) = \frac{\lambda}{2\pi\varepsilon r}$$

POTENZIALE GENERATO DA UN FILO

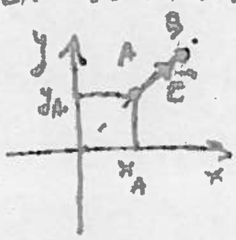


$$V(r) - \underbrace{V(r_0)}_{\text{RIFERIMENTO}} = -\int_{r_0}^{r} E(r')\,dr' =$$

$$= +\int_{r}^{r_0} E(r')\,dr' = \frac{\lambda}{2\pi\varepsilon}\int_{r}^{r_0}\frac{dr'}{r'} = \frac{\lambda}{2\pi\varepsilon}\Big|_{r}^{r_0} =$$

$$= \frac{\lambda}{2\pi\varepsilon}\ln\frac{r_0}{r} = -\frac{\lambda}{2\pi\varepsilon}\ln\frac{r}{r_0}$$

USO LA SOVRAPPOSIZIONE DEGLI EFFETTI



$$x_A = y_A = \frac{d}{\sqrt{2}} \qquad x_B = y_B = \frac{2d}{\sqrt{2}}$$

$$\boxed{\text{SCELGO } x_{RIF} = y_{RIF}}$$

$$\boxed{\text{CON } x_{RIF} = 1\,(m)}$$

$$\vec{E}(A) = \hat{x}E_x(x_A) + \hat{y}E_y(y_A) =$$

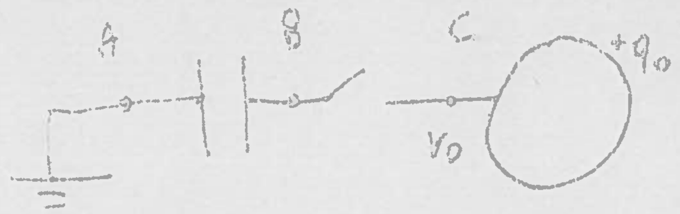
$$= \hat{x}\frac{\lambda\sqrt{2}}{2\pi\varepsilon_0 d} + \hat{y}\frac{\lambda\sqrt{2}}{2\pi\varepsilon d}$$

$$|\vec{E}(A)| = \sqrt{2\left(\frac{\lambda\sqrt{2}}{2\pi\varepsilon d}\right)^2} = \sqrt{\frac{\cancel{2}\cdot\lambda^2\cdot\cancel{2}}{\cancel{4}\pi^2\varepsilon^2 d^2}} = \frac{\lambda}{\pi\varepsilon d} \qquad \theta = \operatorname{arctg}\frac{E_y}{E_x} = 45^\circ$$

$$V(A) - V(RIF) = -\frac{\lambda}{2\pi\varepsilon}\ln\left(\frac{x_A}{x_{RIF}}\right) - \frac{\lambda}{2\pi\varepsilon}\ln\left(\frac{y_A}{y_{RIF}}\right) = -\frac{2\lambda}{2\pi\varepsilon}\ln\left(\frac{d}{\sqrt{2}}\right)$$

$$V(B) - V(RIF) = -\frac{2\lambda}{2\pi\varepsilon}\ln\left(\frac{2d}{\sqrt{2}}\right) \quad ; \quad V(B) - V(A) = -\frac{\lambda}{\pi\varepsilon}\ln\left(\frac{2d}{d}\right) = -\frac{\lambda}{\pi\varepsilon}\ln 2$$

(2)



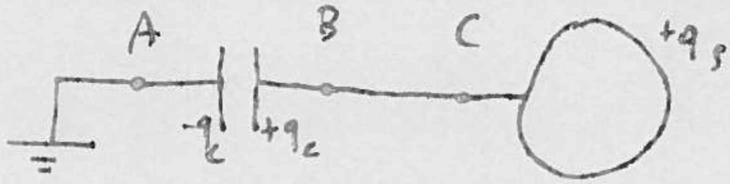
INIZIALE

$$V_A = 0 \qquad V_{cond} = V_B - V_A = 0 \rightarrow V_B = 0 \qquad V_C = V_0$$

$$V_0 = \frac{q_0}{4\pi\varepsilon_0 R} \rightarrow q_0 = 4\pi\varepsilon R\, V_0$$

FINALE

la carica q_0 si distribuisce tra sfera (q_s) e placchetta B del condensatore (q_c)
inoltre con il contatto risulta $V_B = V_C$



$$V_A = 0 \qquad V_{COND} = V_B - V_A = V_B = V_C$$

$$\begin{cases} V_C = \dfrac{q_s}{4\pi\varepsilon R} = V_B = V_{cond} = \dfrac{q_c}{C} \\ q_0 = q_s + q_c \end{cases}$$

$$\frac{q_0 - q_c}{4\pi\varepsilon R} = \frac{q_c}{C} \rightarrow q_c\left(\frac{1}{C} + \frac{1}{4\pi\varepsilon R}\right) = \frac{q_0}{4\pi\varepsilon R}$$

$$q_c = q_0 \frac{C}{C + 4\pi\varepsilon R} \qquad V_{cond} = \frac{q_c}{C} = \frac{q_0}{4\pi\varepsilon R + C} = \frac{V_0\, 4\pi\varepsilon R}{C + 4\pi\varepsilon R}$$

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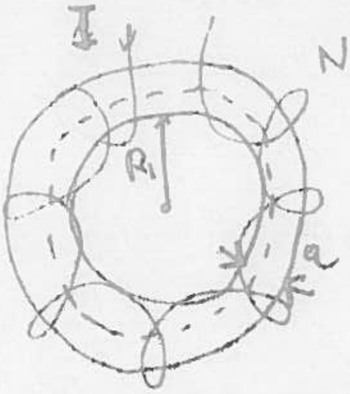
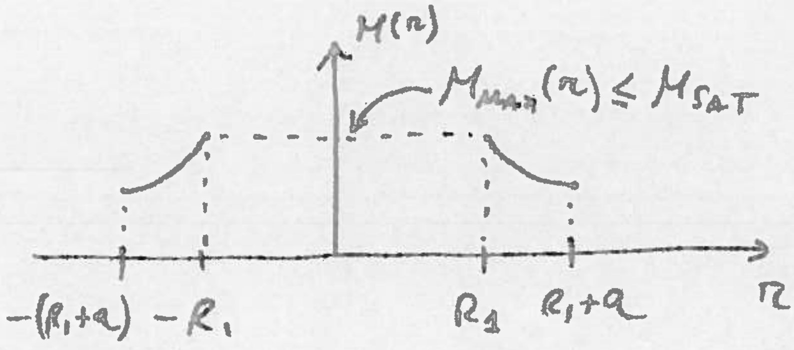


da AMPERE

$$\oint \vec{H}(r) \cdot d\ell = i_{conc} = \begin{cases} 0 & r < R_1 \\ N I & R_1 < r < R_1 + a \\ 0 & r > R_1 + a \end{cases}$$

$$H(r) = \frac{N I}{2\pi r}$$

$$M(r) = (\mu_r - 1) H(r) = \frac{N I}{2\pi r}(\mu_r - 1)$$



$$M(R_1) = M_{MAX} = \frac{N I}{2\pi R_1}(\mu_r - 1) \leq M_{SAT}$$

$$I \leq \frac{M_{SAT} \cdot 2\pi R_1}{N(\mu_r - 1)}$$

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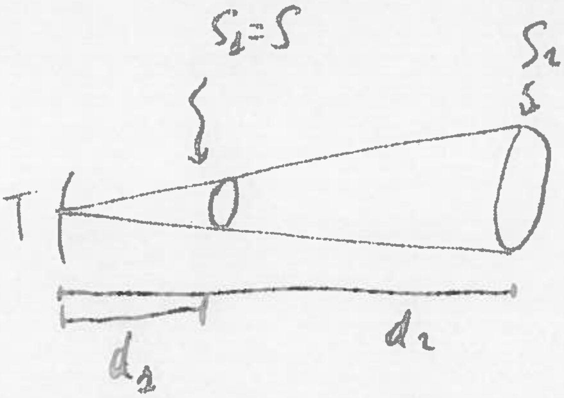

$$\frac{S_2}{d_2^2} = \frac{S_1}{d_1^2}$$

$$B_{1eff} = \frac{E_{1eff}}{c} \qquad E_{1eff} = \frac{E_{01}}{\sqrt{2}}$$

$$P = \int I \, dS = I S \qquad I_1 = \frac{1}{2} \varepsilon c E_{01}^2 = \varepsilon c E_{1eff}^2$$

$$P = I_1 S_1 = \varepsilon_0 c E_{1eff}^2 S_1$$

$$\|$$

$$P = I_2 S_2 = \varepsilon c E_{2eff}^2 S_2$$

$$E_{2eff}^2 = E_{1eff}^2 \frac{S_1}{S_2} = E_{1eff}^2 \frac{d_1^2}{d_2^2}$$

$$E_{2eff} = E_{1eff} \frac{d_1}{d_2}$$