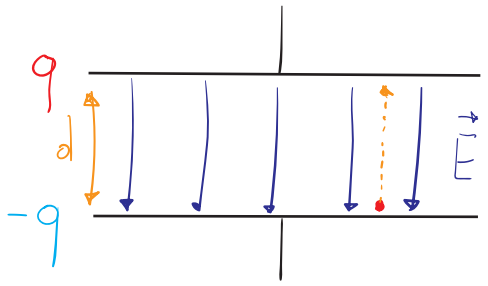
Università
degli Studi
di Padova

Fisica 1

Lezione 49: Capacità III

Prof. Giubilato

Condensatori



$$C = \frac{q}{V} = \frac{A}{d}\varepsilon_0 \qquad W = \int \vec{F}\cdot d\vec{s} = \int E q\, ds$$

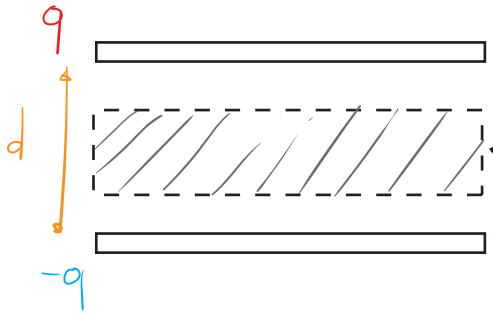
$$V \simeq -Ed \qquad = Vq$$

$$U_E = \frac{1}{2}CV^2 = \frac{1}{2}E^2 d A \varepsilon_0 = \frac{1}{2}\varepsilon_0 E^2 \underbrace{\text{Volume}}_{A\cdot d}$$

densità di energia

$$u_E = \frac{1}{2}\varepsilon_0 E^2 \quad \left[J/m^3\right]$$

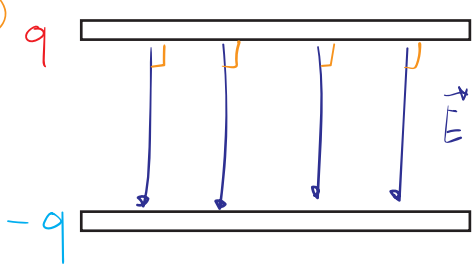
$$\left[\frac{F}{m}\frac{V^2}{m^2}\right] = \left[\frac{C}{V}\frac{V}{m^3}\right] = \left[J/m^3\right]$$

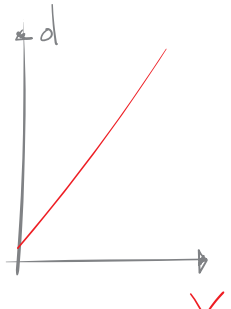


$q = cost$

$$U_E = \frac{1}{2}CV^2 = \frac{1}{2}\frac{q^2}{C}$$

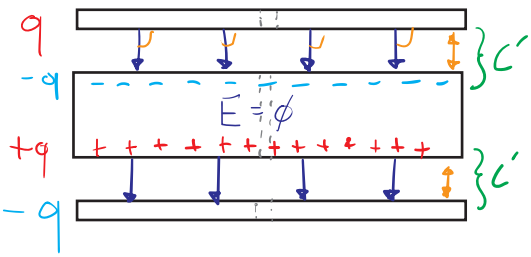
(ϕ)

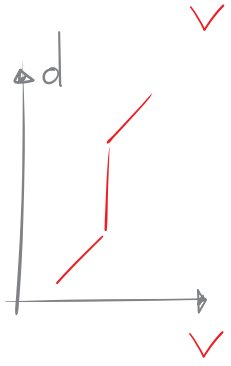




$$U_1 = \frac{1}{2}C_1 V_1^2 = \frac{1}{2}\frac{A}{d}\varepsilon_0 V_1^2$$

(1)





$$C' = 4\frac{A}{d}\varepsilon_0 = 4C_1$$

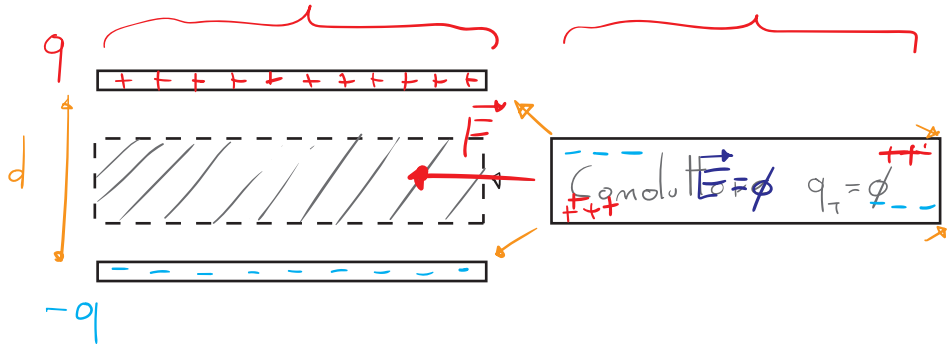
$$U_2 = \frac{1}{2}C_2 V_2^2 = \frac{1}{2}\left[\frac{C'C'}{C'+C'}\right]V_2^2 = \frac{1}{2}\left[2C_1\right]V_2^2 = C_1 V_2^2$$

$$\begin{cases} U_1 = \frac{1}{2}\frac{q^2}{C_1} \\ U_2 = \frac{1}{2}\frac{q^2}{C_2} \end{cases} \qquad C_2 = 2C_1 \Rightarrow U_2 = \frac{1}{2}U_1$$

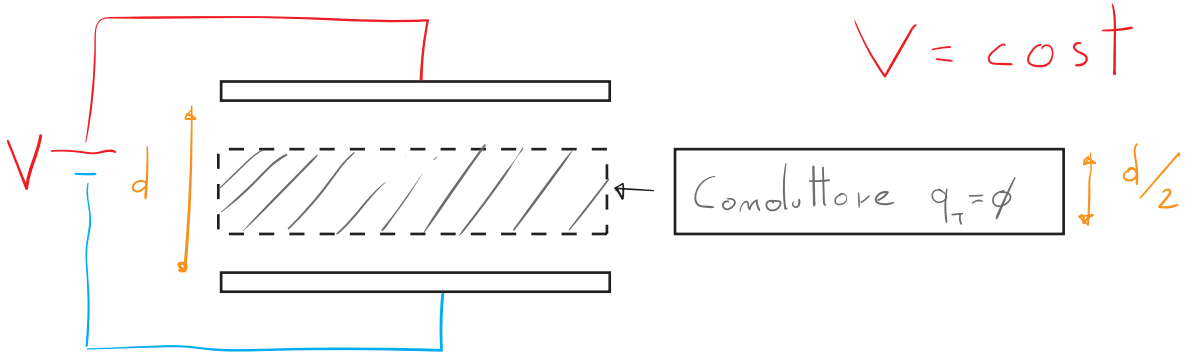
$$U_1 = \underbrace{\frac{1}{2}C_1V_1^2}_{U_1} = 2\underbrace{\left[\frac{1}{2}C_2V_2^2\right]}_{U_2}$$

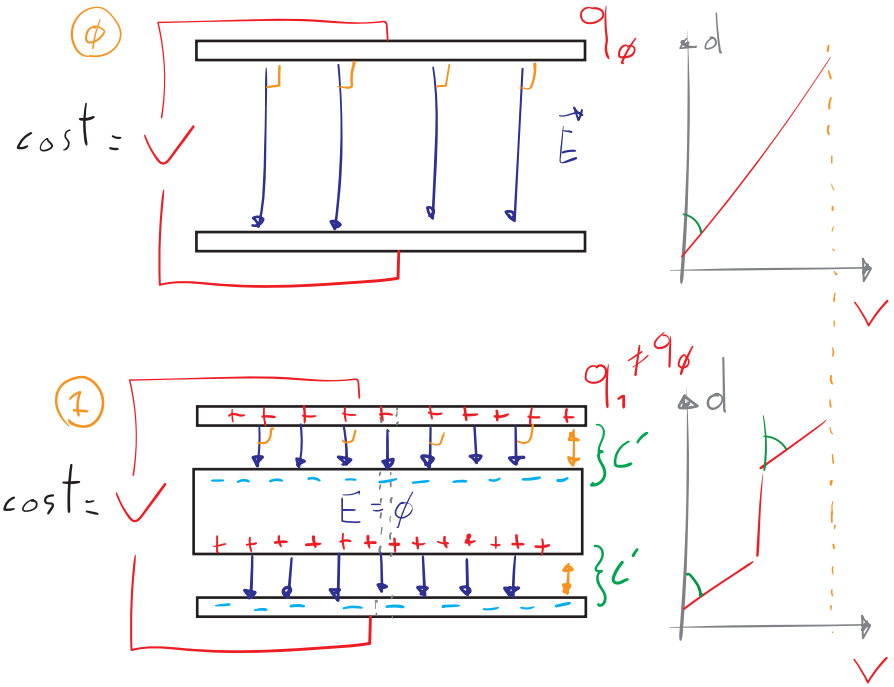
$$C_1V_1^2 = 2C_2V_2^2$$
$$C_1V_1^2 = 4C_1V_2^2$$
$$V_1 = 2V_2$$

$U_2 < U_1$



$V = cost$



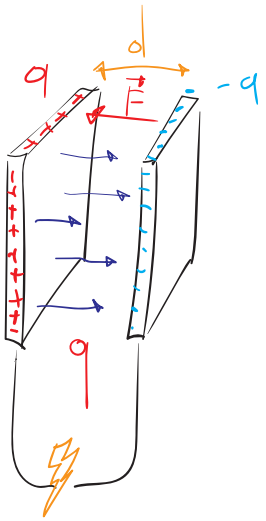


$$U_1 = \frac{1}{2}C_1V^2$$

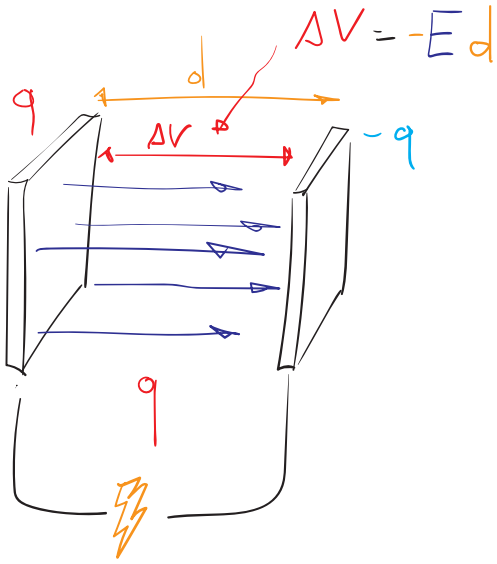
$$U_2 = \frac{1}{2}C_2V^2 = 2U_1$$

$2C_1$

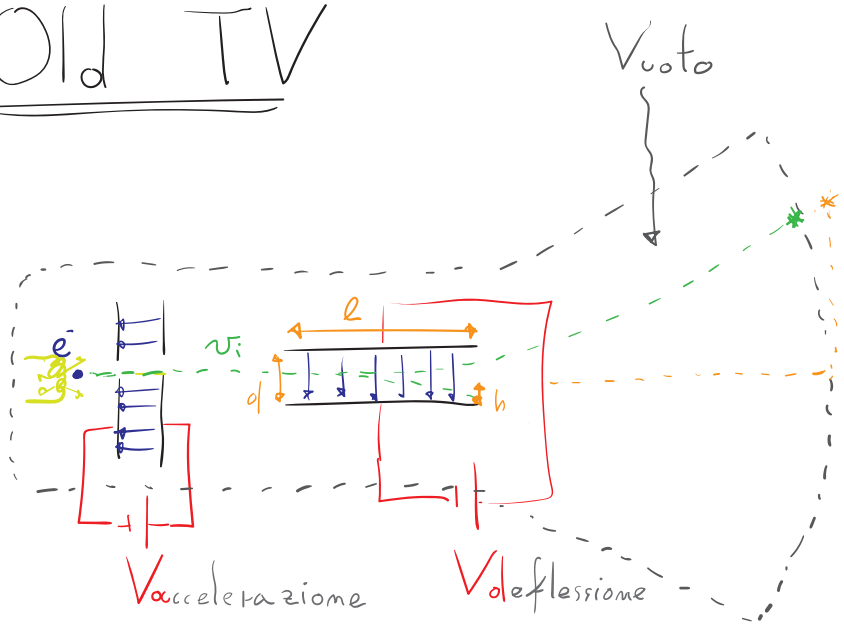
Applicazioni



$$E_0 = U_E = \frac{1}{2} C V^2$$



Old TV



$$U_e = V_a e = \frac{1}{2} m_e v_e^2$$

$$v_e^2 = \frac{2 V_a e}{m_e}$$

$$= \frac{2 \cdot 1000 \cdot 1.6 \cdot 10^{-19}}{9 \cdot 10^{-31}}$$

$$\simeq 300 \cdot 10^{12}$$

$$v_e \simeq 10 \cdot 10^6 \ m/s$$

$$t = \frac{l}{v_e} = \frac{l}{\sqrt{\frac{2 V_a e}{m_e}}}$$

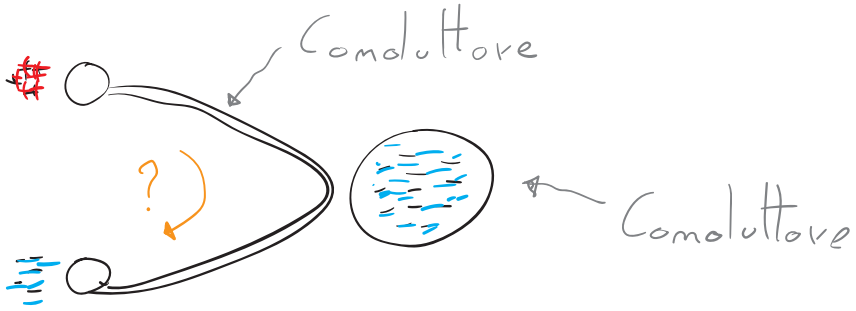
[m]

$$h = \frac{1}{2} a t^2 = \frac{1}{2} \frac{V_d e}{d m_e} \frac{l^2 m_e}{2 V_a e} = \frac{1}{4} \frac{V_d}{V_a} \frac{l^2}{d}$$

[V] [m²] [V] [m]

$$a = \frac{F}{m} = \frac{E e}{m_e} = \frac{V_d e}{d m_e}$$

$$V = -E d$$ } Condensatore piano


Conduttore
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Conduttore