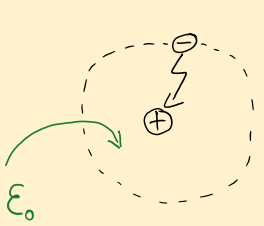
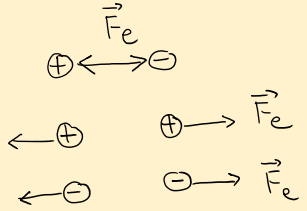
RN – 02 - Predavanje 03 – 11.10.2021.

Studijski program: Energetika, elektronika i telekomunikacije (E1)

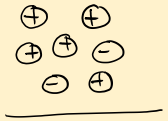
11.10.2021. godine

ELEKTRIČNO POLJE





električne sile između elemen. naelek.

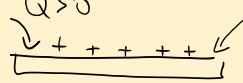


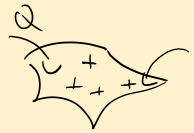
$\Sigma[+5+(-2)] = +3C = Q\,[C]$

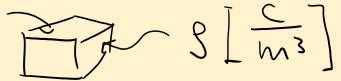
pojedinačna nael. u Q su istog znaka $\Rightarrow$ deluju odbojne F_e

---

0. Q → tačkasto naelek.

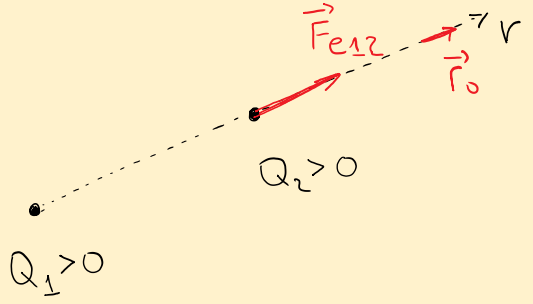
1. 

2. 

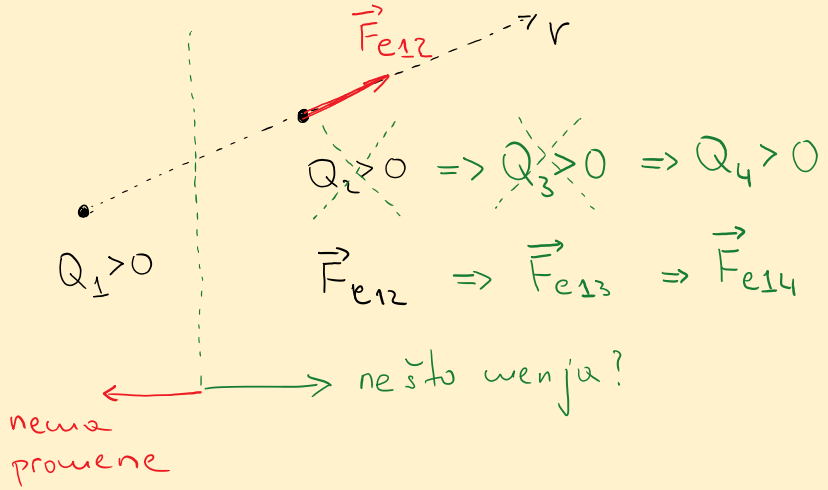
3. 

STRUKTURA JE NAELEKTR.

OVO SU IZVORI EL. POLJA



$$\vec{F}_{e12} = \underbrace{\frac{1}{4\pi\varepsilon_0}\frac{|Q_1||Q_2|}{r^2}}_{F_{e12}>0}(+\vec{r}_0)$$



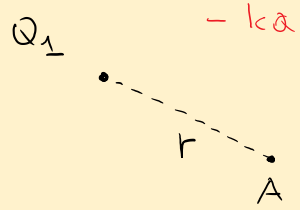
$\Rightarrow F_{e1x}$ - ko je uzrok

$\Rightarrow Q_1$ ✓

Q_1 - uradi nešto u svojoj okolini - modifikuje okolinu

Q_1 - stvara električno polje u svojoj okolini

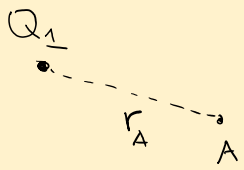
- kako proveriti:



1. Q_1 – izvor
2. Izvor ⇒ električno polje
3. $\vec{E}$ – vektor jačine el. polja (opisuje postojeće el. polje)

$\Rightarrow$

$$\vec{E}_A(r) = \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{r_A^2}(+\vec{r}_0) \quad \left[\frac{V}{m}\right]$$

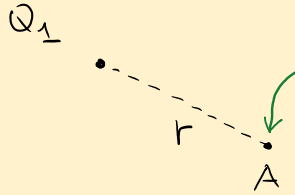


TAČKASTI IZVOR

$\Rightarrow$

1. $Q_1 \neq 0 \Rightarrow E_A \neq 0$
2. $r_A \to \infty \Rightarrow E_A \to 0$
3. $\varepsilon_0 = 8{,}85 \cdot 10^{-12}$ permitivnost vakuuma

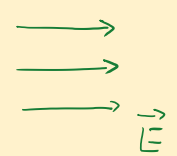
2



$\Delta Q > 0 \Rightarrow \vec{F}_{e1\Delta Q} \neq 0 \Rightarrow \vec{E}_A \neq 0$

$F_{eA} \neq 0 \qquad \vec{F}_{e1\Delta Q} = \Delta Q \vec{E}_A$

ΔQ – probno naelektrisanje [1C]

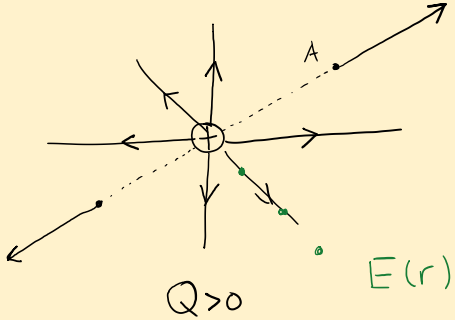


a) E – const
b) pravac i smer je uvek isti

$\Rightarrow$ homogeno el. polje

USAMLJENA TAČKASTA NAELEKTRISANJA

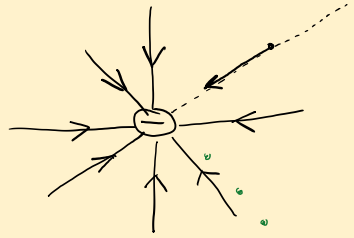
$$\vec{E}_A = E_A(+\vec{r}_0) \qquad E_A = \frac{1}{4\pi\varepsilon_0}\frac{|Q_1|}{r_A^2}(-\vec{r}_0)$$



$Q>0$

$E(r) \neq \text{const}$

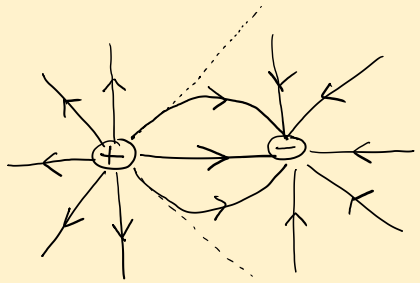
nehomogena el. polja

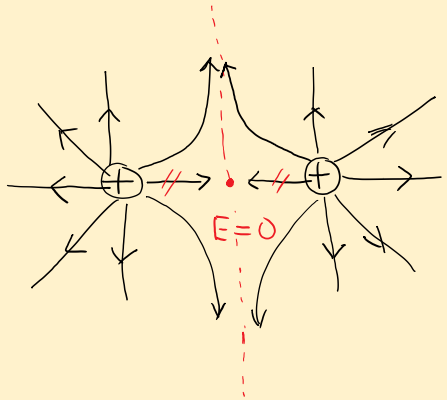


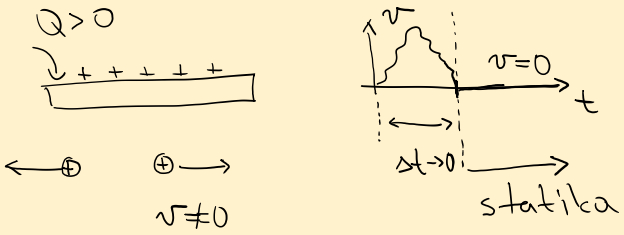
$Q<0$

$E(r) \neq \text{const}$

KOMBINACIJA TAČKASTIH NAELEK.



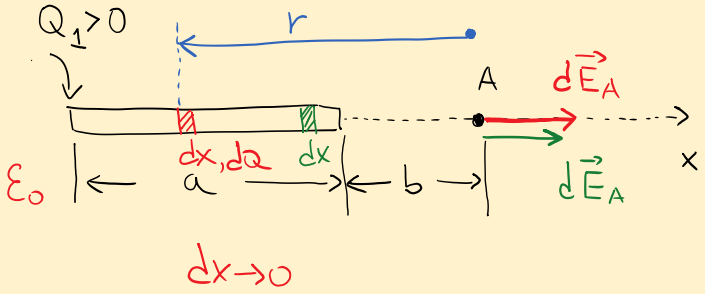




statika - nema pomeranja (Q) ⇒ elektro-statično polje

PRIMER 1.

$\vec{E}_A$ - ? ⇒ 1. $Q_1>0$ ⇒ $Q'\left[\frac{C}{m}\right]$ ⇒ pretpostavka ⇒ $Q' = \frac{Q}{a}$ - const $\left[\frac{C}{m}\right]$



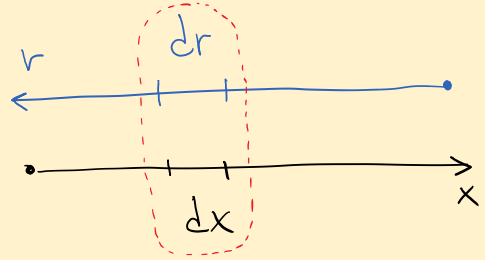
$dx \to 0$

2. $dx, dQ = Q'dx$ ⇒ dx je za tačkasto nael.

⇒ $d\vec{E}_A = \frac{1}{4\pi\varepsilon_0}\frac{dQ}{r^2}(+\vec{i}_x)$

$dx \to 0$, $dQ = Q'dx$ ⇒ tačkasto nael. ⇒ $d\vec{E}_A = dE_A(+\vec{i}_x)$

⇒ $d\vec{E}_A \parallel d\vec{E}_A$



$dx \equiv dr$

$$\Rightarrow E_A = \int_{\text{po štapu}} dE_A = \int \frac{1}{4\pi\varepsilon_0}\frac{dQ}{r^2} = \int \frac{1}{4\pi\varepsilon_0}\frac{Q'dx}{r^2} = \frac{Q'}{4\pi\varepsilon_0}\int\frac{dx}{r^2} = \frac{Q'}{4\pi\varepsilon_0}\int\frac{dr}{r^2}$$

$$= \frac{Q'}{4\pi\varepsilon_0}\int_b^{b+a}\frac{dr}{r^2} = \frac{Q'}{4\pi\varepsilon_0}\left(-\frac{1}{r}\right)\Big|_b^{b+a} = \frac{Q'}{4\pi\varepsilon_0}\left[\left(-\frac{1}{b+a}\right)-\left(-\frac{1}{b}\right)\right]$$

$$= \frac{Q'}{4\pi\varepsilon_0}\left[\frac{1}{b}-\frac{1}{b+a}\right] > 0 \quad \Rightarrow \quad \vec{E}_A = \frac{Q'}{4\pi\varepsilon_0}\left(\frac{1}{b}-\frac{1}{b+a}\right)(+\vec{i}_x)$$