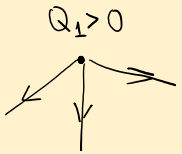
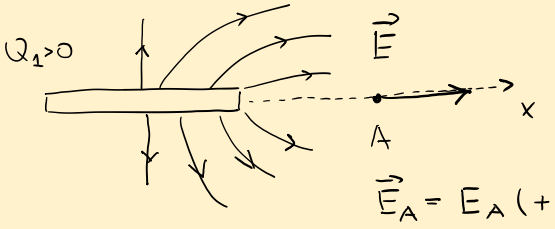
RN – 03 - Predavanje 05 – 18.10.2021.

Studijski program: Energetika, elektronika i telekomunikacije (E1)

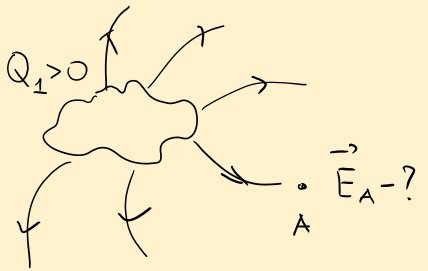
18.10.2021. godine



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

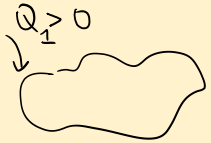


$$\vec{E}_A = E_A(+\vec{i}_x)$$



Opisujemo el. polje:

1. $\vec{E}$ - pomoću principa superpozicije
2. $\vec{E}_A = E_A(+\vec{r}_0)$ - analitički izraz
3. Crtamo linije $\vec{E}$





$$\frac{A \text{ prilikom prebacivanja } \Delta Q \text{ iz } A \text{ u } R}{\Delta Q} =$$

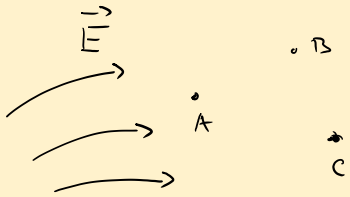
$$= \int_A^R \vec{E}\cdot d\vec{l} = V_A\ [V]$$

$$V_A = \int_A^R \vec{E}\cdot d\vec{l}$$

- u podintegralnoj funkciji se nalaze vektori

$$\int x\,dx,\ \int \frac{dx}{x^2}$$

- $\vec{E}\cdot d\vec{l} = E\,dl\cos\sphericalangle(\vec{E}, d\vec{l})$



$$V_A = f(R)$$

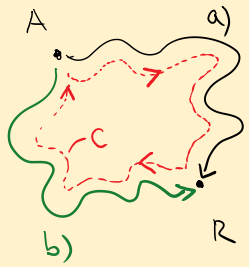
$$V_B = f(R)$$

$$V_C = f(R)$$

R - ostaje uvek ista

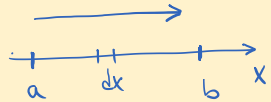
R: $V_R = \int_R^R \vec{E}\cdot d\vec{l} = 0\ [V]$



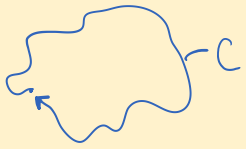


$$V_A = \int_A^R \vec{E}\cdot d\vec{l}$$

$\int_a^b x\,dx \Rightarrow$



$\oint_C f(x)\,dx \Leftarrow$



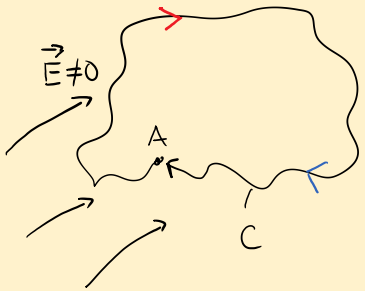
$V_A^{a)} \stackrel{?}{=} V_A^{b)}$

$$C:\ \oint_C \vec{E}\cdot d\vec{l} = 0 = \int_{Aa}^{R} \vec{E}\cdot d\vec{l} + \int_{Rb}^{A} \vec{E}\cdot d\vec{l}$$

$$= \int_{Aa}^{R} \vec{E}\cdot d\vec{l} - \int_{Ab}^{R} \vec{E}\cdot d\vec{l}$$

$$0 = V_A^{a)} - V_A^{b)} \Rightarrow \boxed{V_A^{a)} \equiv V_A^{b)}}$$

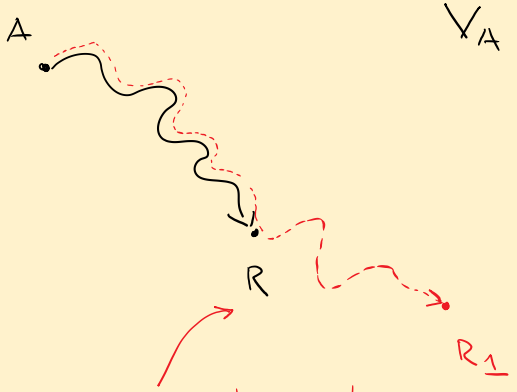
potencijal tačke u el. statičkom polju ne zavisi od putanje



$$A_{uk} = 0 = \oint_C \vec{E}\cdot d\vec{l}$$

$$\Rightarrow \boxed{\oint_C \vec{E}\cdot d\vec{l} = 0}$$

zakon održanja energije u el. stat. polju



postaje obična tačka u el. polju i ima potencijal u odnosu na R_1

$$V_A = \int_A^R \vec{E}\cdot d\vec{l} = V_A^R$$

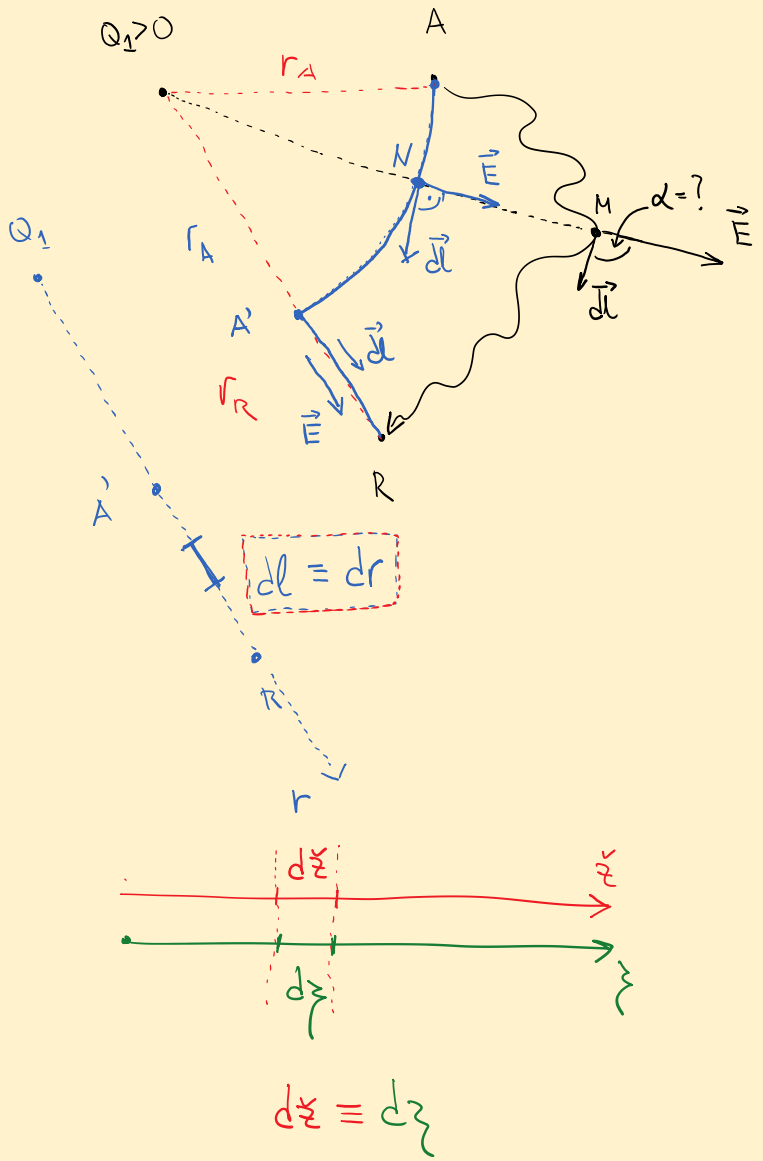
$$V_A^{R_1} = \int_A^{R_1} \vec{E}\cdot d\vec{l} = \int_A^R \vec{E}\cdot d\vec{l} + \int_R^{R_1} \vec{E}\cdot d\vec{l}$$

$$V_A^{R_1} = V_A^R + \boxed{U_{RR_1}}$$

$$U_{RR_1} = \int_R^{R_1} \vec{E}\cdot d\vec{l} \neq V_R - V_{R_1}$$

($\neq 0$; $V_{R_1} = 0$)

PRIMER:



$$V_A = \int_A^R \vec{E}\cdot\vec{dl} \qquad \vec{dl} = dl\,(+\vec{l}_0)$$

$M: \alpha - ?$

$N: \alpha = \frac{\pi}{2}$ ✓

$$V_A = \cancel{\int_A^{A'} \vec{E}\cdot\vec{dl}} + \int_{A'}^R \vec{E}\cdot\vec{dl}$$

0 $\quad \vec{E} \perp \vec{dl}$ $\qquad \vec{E} \parallel \vec{dl}$

$$\vec{E}\cdot\vec{dl} = E\,dl\cos\sphericalangle(\vec{E},\vec{dl})$$

$$\Rightarrow V_A = \int_{A'}^R E\,dl\cos 0^\circ = \int_{A'}^R E\,dl = \int \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{r^2}dl = \frac{Q_1}{4\pi\varepsilon_0}\int \frac{dl}{r^2}$$

$$= \frac{Q_1}{4\pi\varepsilon_0}\int_{r_A}^{r_R}\frac{dr}{r^2} = \frac{Q_1}{4\pi\varepsilon_0}\left(-\frac{1}{r}\right)\Big|_{r_A}^{r_R} = \frac{Q_1}{4\pi\varepsilon_0}\left[\left(-\frac{1}{r_R}\right)-\left(-\frac{1}{r_A}\right)\right]$$

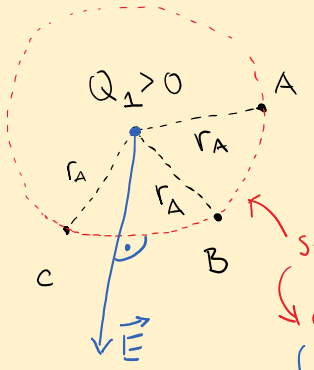
$$V_A = \frac{Q_1}{4\pi\varepsilon_0}\left[\frac{1}{r_A}-\frac{1}{r_R}\right]$$ - potencijal tačke u el. stat polju tačkastog naelektrisanja (izvor)

R: $r_R \to \infty$ dogovor $\Rightarrow$

$$V_A = \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{r_A}$$

$$E_A = \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{r_A^2}$$

- izrazi važe isključivo za izvor - TAČKASTO NAELEKTRIS.

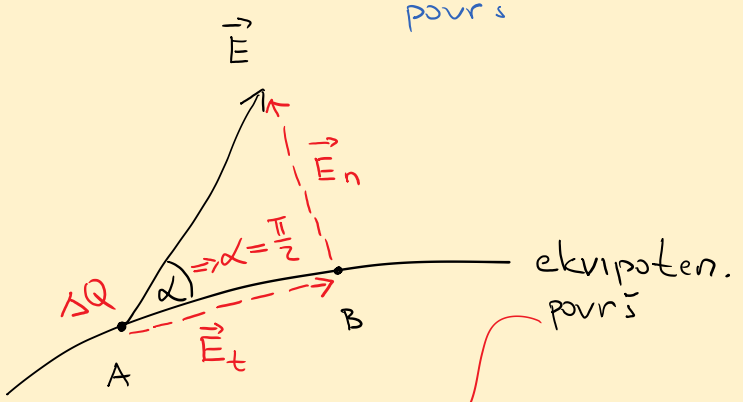


$$V_A = \frac{1}{4\pi\varepsilon_0}\frac{Q_1}{r_A} = V_B = V_C$$

sfera $\Rightarrow$ V-const

$\Rightarrow$ ekvipotencijalna površ

$\Rightarrow$ $\vec{E} \perp$ na ekvipotencijalnu površ

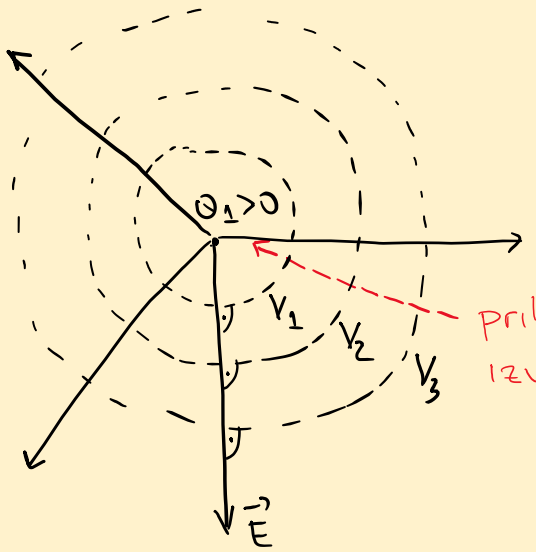


$V_A \equiv V_B$

$$\Rightarrow V_A - V_B = 0 = \int_A^B \vec{E}\,d\vec{l} = \int_A^B \vec{E}_t \cdot d\vec{l}$$

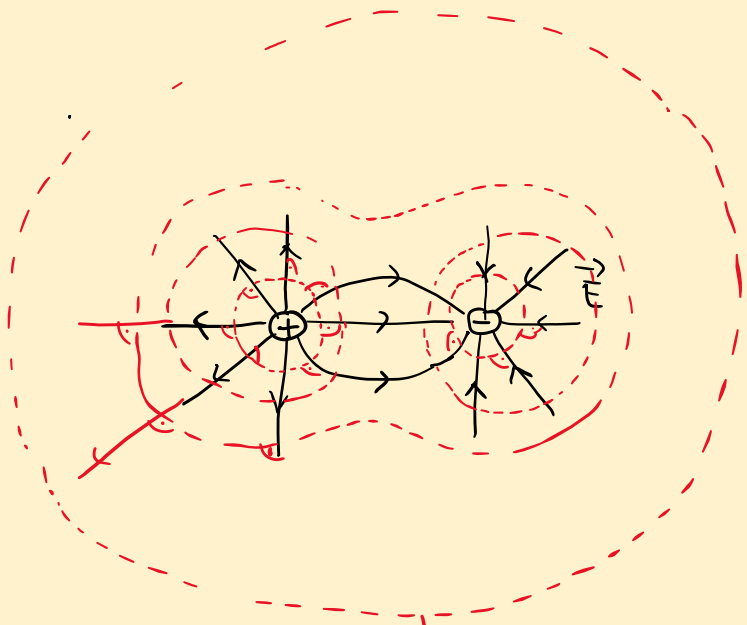
$$\Rightarrow \boxed{E_t = 0}$$

$$\Rightarrow \boxed{E_n \neq 0}$$

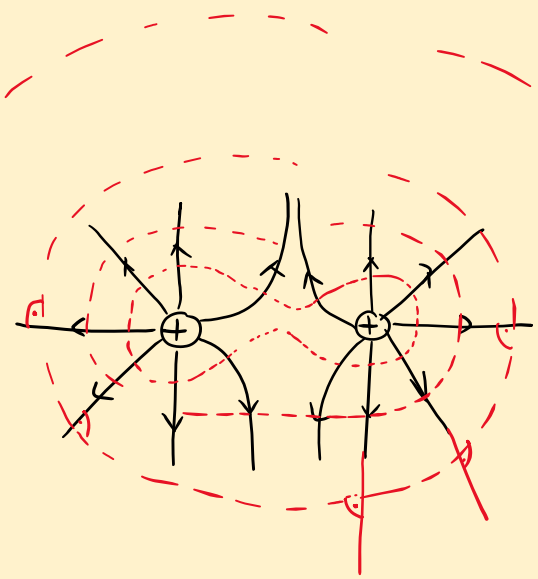


$|V_1| > |V_2| > |V_3|$

približavamo se izvoru (raste potencijal)



zadnja ekvipot. površ je sfera



zadnja ekvipot. površ je sfera