I. ELECTROSTATICA

1. Câmpul electric în vid

1.1. Sarcina electrică. Intensitatea câmpului electric în vid
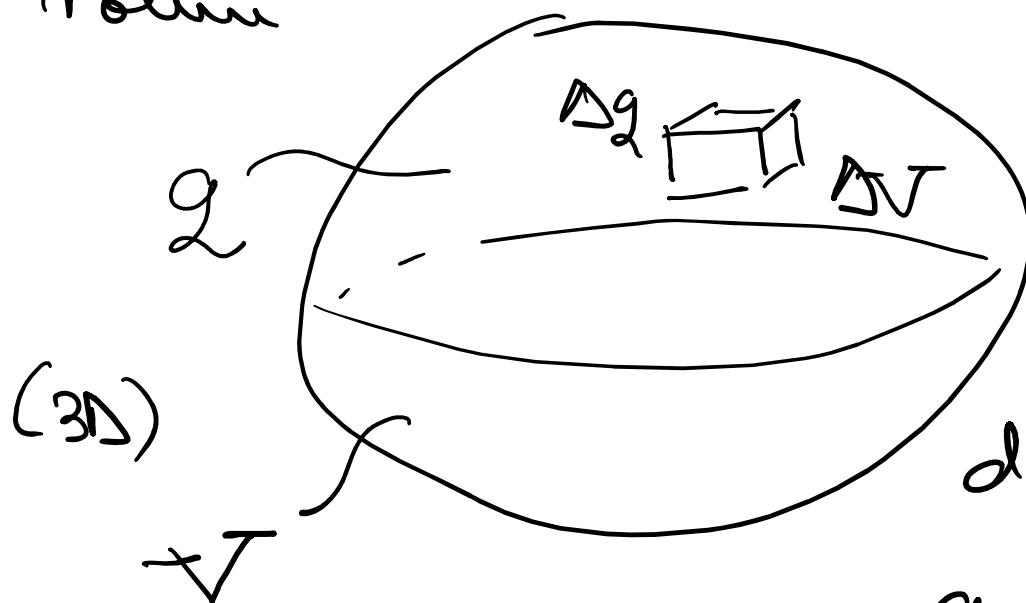

Sticlă

frecare

încălzirea,...

Stare de electrizare
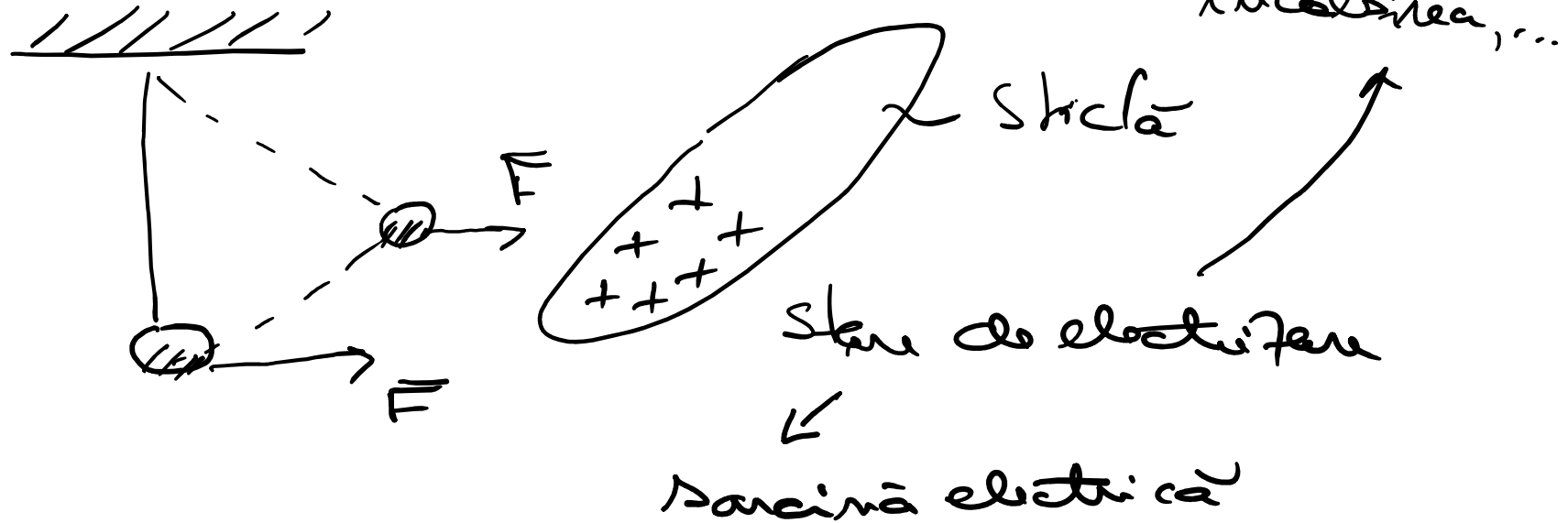
Sarcină electrică

q — sarcină electrică $[C]$

$\rightarrow$ scalară, primitivă, ireductibilă

$\rightarrow$ distribuită

a) volum

densitatea de sarcină

q

Δq ΔV

(3D)

$\vec{V}$

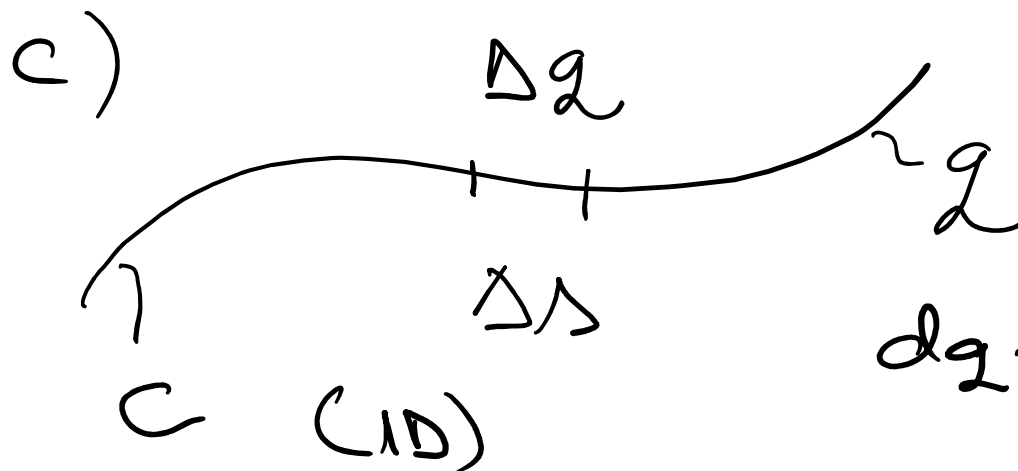$$\rho_v = \lim_{\Delta V \to 0} \frac{\Delta q}{\Delta V} = \frac{dq}{dV}$$

$$dq = \rho_v \, dV$$

$$q = \int_V \rho_v \, dV$$

b)

$$\rho_S = \lim_{\Delta A \to 0} \frac{\Delta q}{\Delta A} = \frac{dq}{dA}$$

$$dq = \rho_S \, dA \Rightarrow q = \int_S \rho_S \, dA$$

c)

$$\rho_\ell = \lim_{\Delta s \to 0} \frac{\Delta q}{\Delta s}$$

$$dq = \rho_\ell \cdot ds \quad | \quad q = \int_\ell \rho_\ell \, ds$$
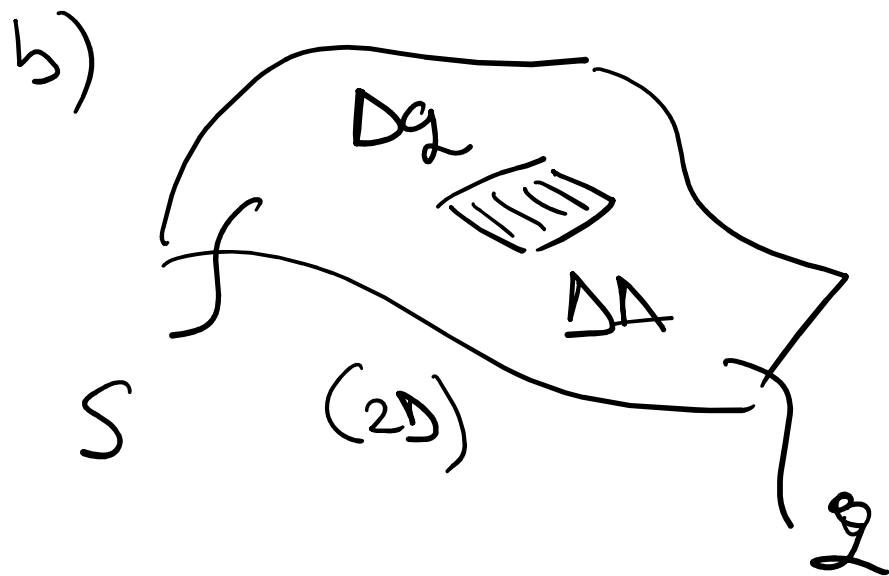
d) $q_K \rightarrow \mathcal{q} = \sum\limits_{k=1}^{n} q_k$ (mulțime

(OD)   numărabilă)

$\underline{Corp\ de\ probă} \rightarrow sarcină\ electrică\ q_0$

$q_0 \ll$, d·în timp

$\color{magenta}{E_V}$

P

$\overline{E} \overset{def}{=} \dfrac{\overline{F}}{q_0}$ $\left[\dfrac{N}{e}\right] \rightarrow \left[\dfrac{V}{m}\right]$

q_0 $\overline{F}$ V

(vid)   SI

intensitatea c. electric în vid
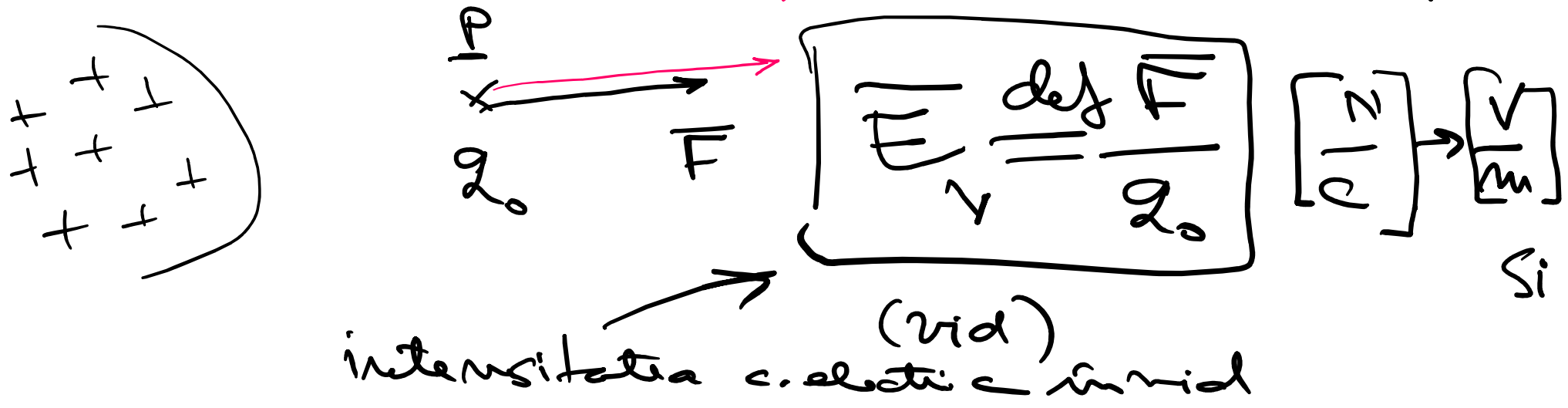
spectrul liniilor de câmp

limii de câmp

$\vec{E}_v$

$^\circ q_o$ →

(traiectoria q_o lăsat liber
în câmp)

$\vec{E}_v$

$\vec{E}_v$

$\vec{E}_v$

$\vec{E}_v$
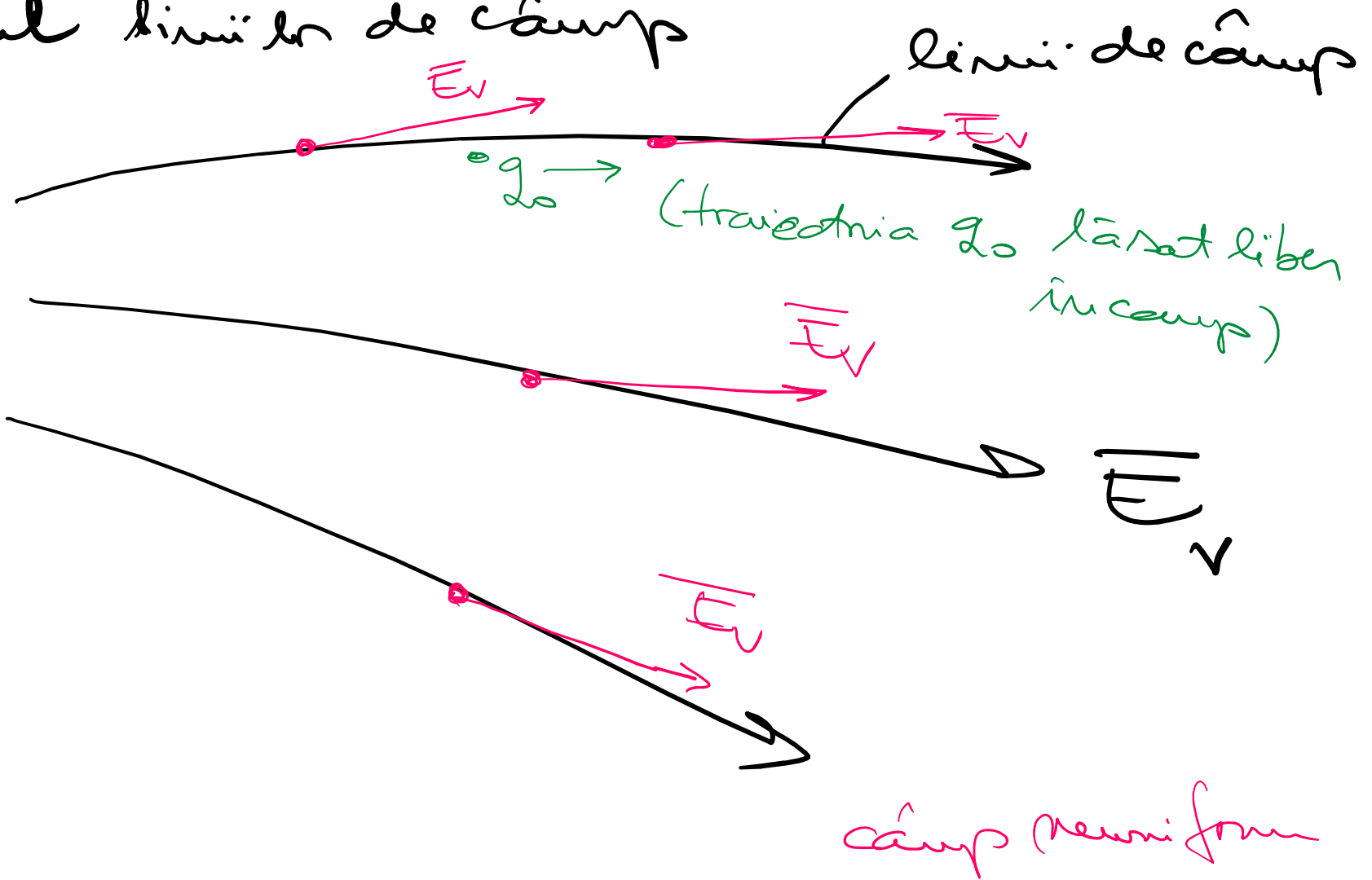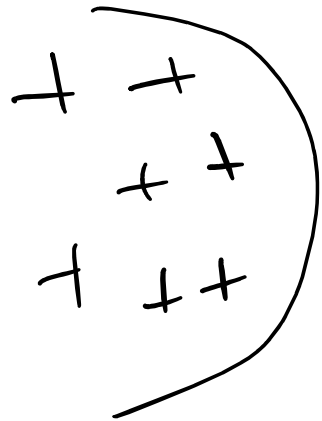
câmp neuniform

2 linii camp nu se pot intersecta!

$\overline{E_{V1}}$

$\overline{E_{V}}$ ✓

$\overline{E_{V2}}$
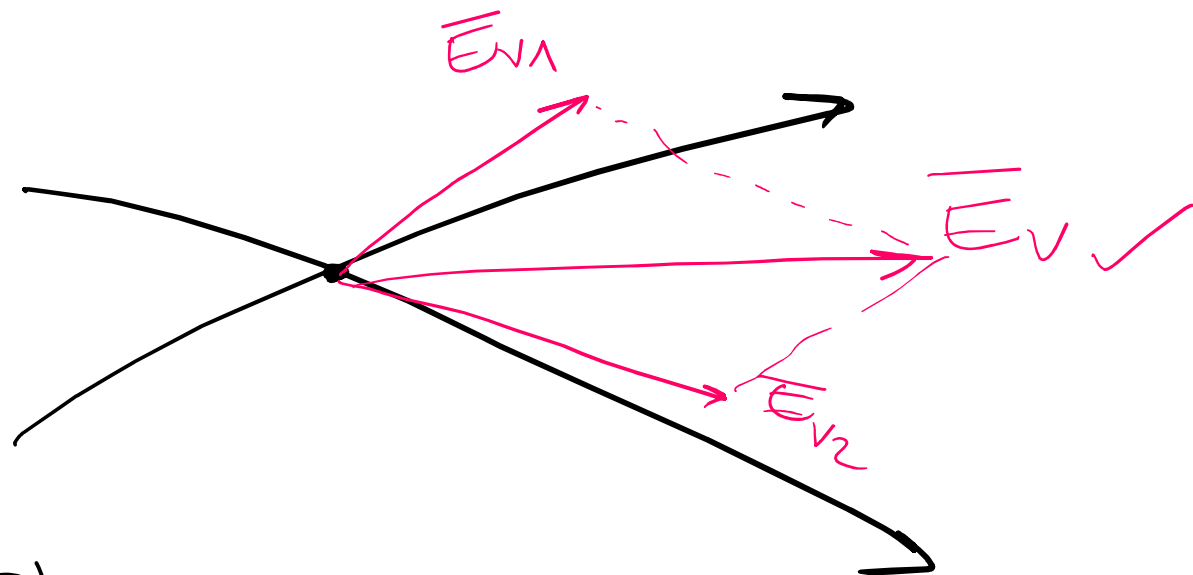
<u>Obs</u>

câmp uniform: $\overline{E_V} = ct$

$\overline{E_V}$ $\overline{E_V}$

$\overline{E_V}$ $\overline{E_V}$

$\overline{E_V}$

$\overline{E_V} = ct$
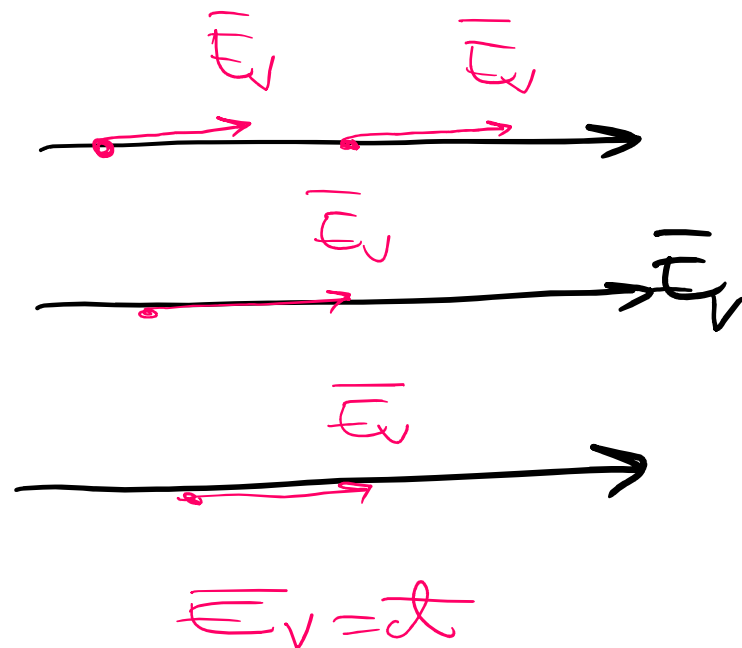
1.2. Câmpuri Coulombiene

→ respectă legea forței dată de Coulomb

q_1 $\quad \bar{r} \quad$ q_2 $\quad \bar{F}$

r

(vid)
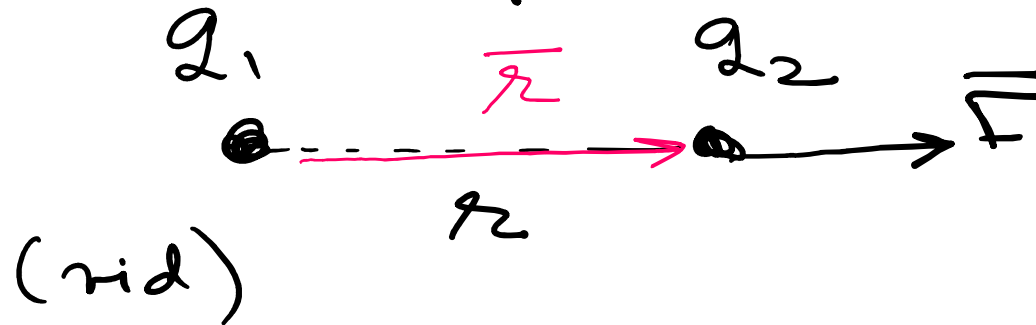
$\bar{r}$ – vector de poziție

$$F \sim \frac{q_1 \cdot q_2}{r^2}$$

$$\bar{F} = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2} \cdot \frac{\bar{r}}{r}$$

$$\varepsilon_0 = \frac{1}{4\pi \cdot 9 \cdot 10^9} \left[\frac{F}{m} \right]$$

permitivitatea electrică a vidului

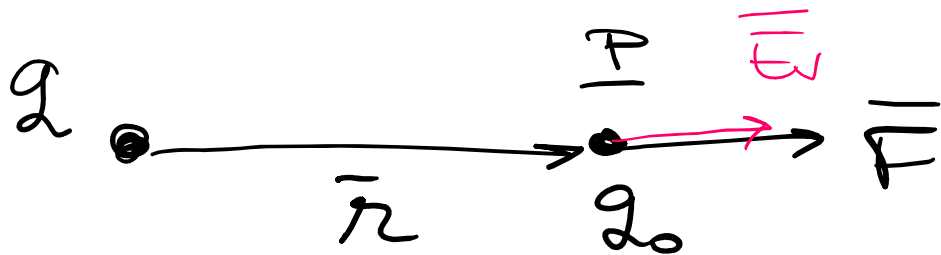$$q \bullet \xrightarrow{\overline{r}} \quad \underset{q_0}{\overset{P}{\bullet}} \xrightarrow{\overline{E_v}} \overline{F}$$

$$\overline{F} = \frac{1}{4\pi\varepsilon_0} \frac{q \cdot q_0}{r^2} \frac{\overline{r}}{r}$$

$$\overline{E_v} = \frac{\overline{F}}{q_0} = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} \cdot \frac{\overline{r}}{r}$$

$$\overline{E_v} = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} \cdot \frac{\overline{r}}{r} \longrightarrow d\overline{E_v} = \frac{1}{4\pi\varepsilon_0} \frac{dq}{r^2} \cdot \frac{\overline{r}}{r}$$

$$dq = \rho_v dV \mid \rho_s dA \mid \rho_e ds$$

$$\overline{E}_V = \frac{1}{4\pi\varepsilon_0}\left[\int\limits_V \frac{\rho_v\,dV}{R^2}\frac{\overline{R}}{R} + \int\limits_S \frac{\rho_s\,dA}{R^2}\frac{\overline{R}}{R} + \int\limits_C \frac{\rho_e\,ds}{R^2}\frac{\overline{R}}{R} + \right.$$

$$\left. + \sum_{k=1}^{n} \frac{q_k}{R_k^2}\cdot\frac{\overline{R_k}}{R_k} \right]$$

$\underbrace{\phantom{\overline{E}_V = \frac{1}{4\pi\varepsilon_0}\left[\int\limits_V \frac{\rho_v\,dV}{R^2}\frac{\overline{R}}{R} + \int\limits_S \frac{\rho_s\,dA}{R^2}\frac{\overline{R}}{R} + \int\limits_C \right]}}$

metoda directă de calcul a campului electric

Obs

1) principiul superpunerii efectelor
   (principiul superpoziției)

2) integrale vectoriale, multiple

dq_1

dq_2

z

$\bar{r}$

$d\bar{E}_{v2}$

$d\bar{E}_{v1}$

$\uparrow dE_{vz}$

dE_{vy}

O

y

x

dE_{vx}

$\Rightarrow$ Modelarea numerică a
cămpului elmag.

1.3. Teorema lui Gauss

Noțiuni introductive

a) notații geometrice

ds

$\overline{ds}$

C

(deschisă)

$\overline{dA}$

S

dA

$\overline{ds}$

$\overline{ds}$

ds

$\overline{ds}$

$\overline{dA}$

Γ (închisă)

$\vec{dA}$

$\vec{dA}$

$\vec{dA}$

Σ

Σ
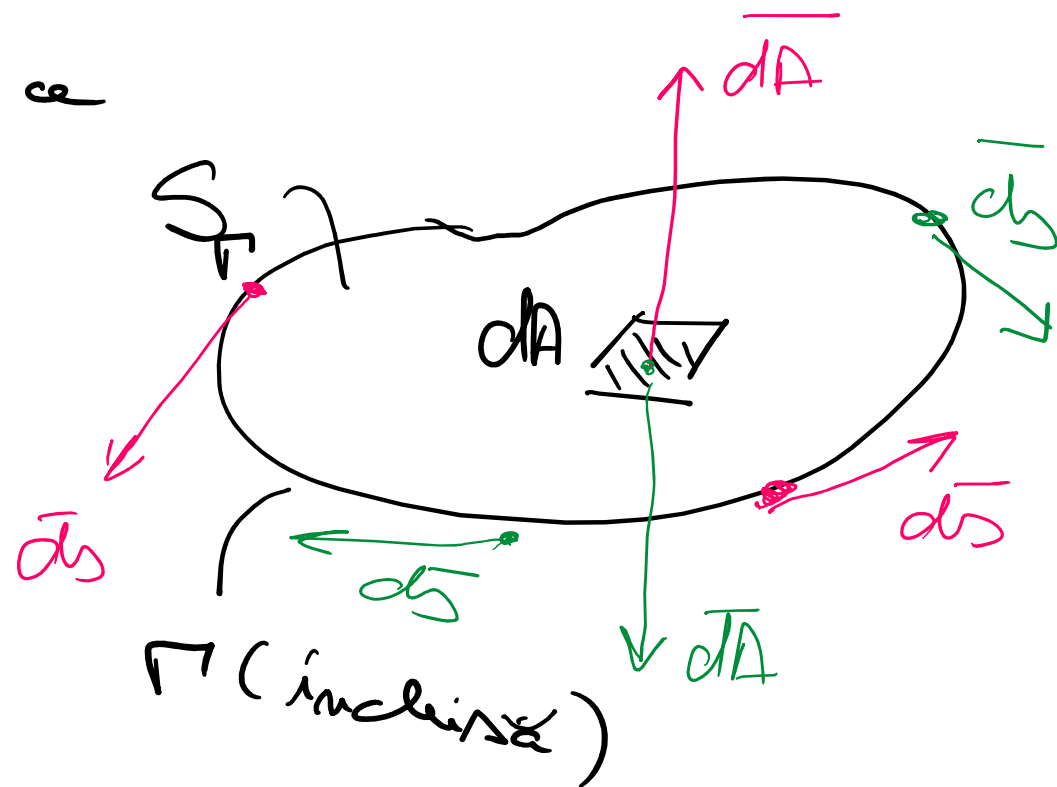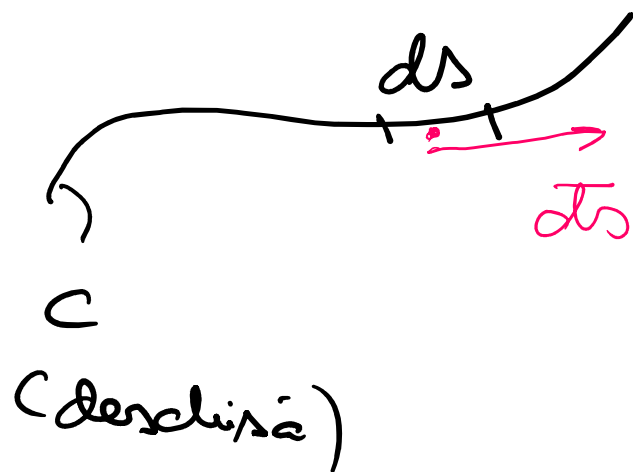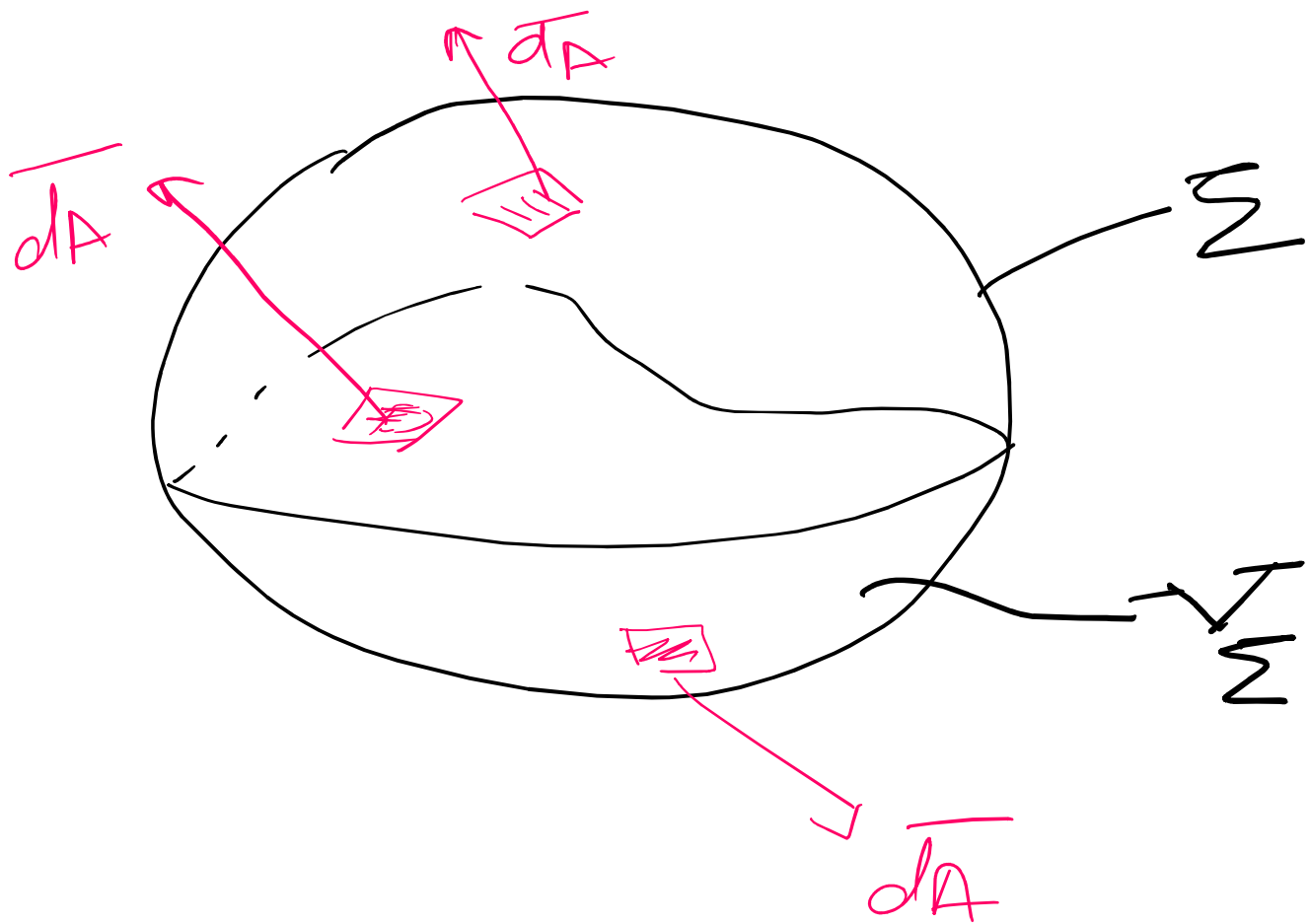
b) flux (electric)

$$\Psi = \int_S \overline{E_v} \, \overline{dA}$$

$$\Psi = \int_S E_v \cdot dA \cdot \cos\alpha$$