Università degli Studi di Padova

Fisica 1

Lezione 50: Divergenza

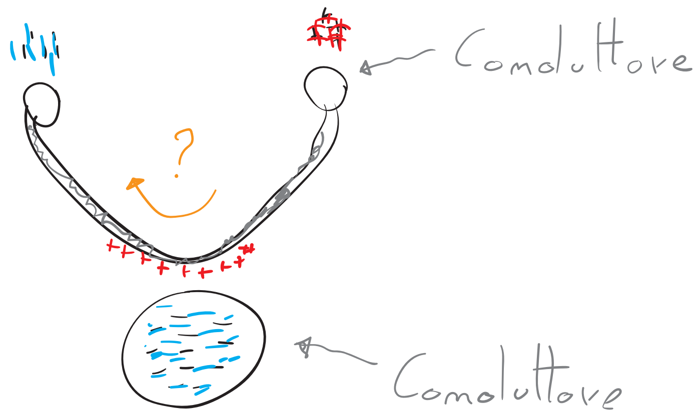
Prof. Giubilato

Semiconduttori (....)

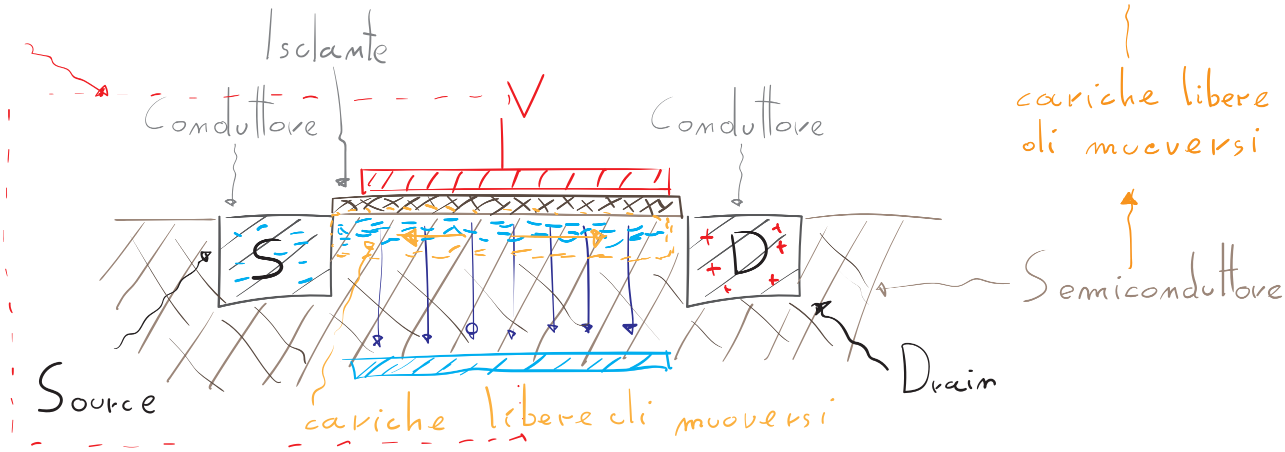
La carica si sposta?

↓

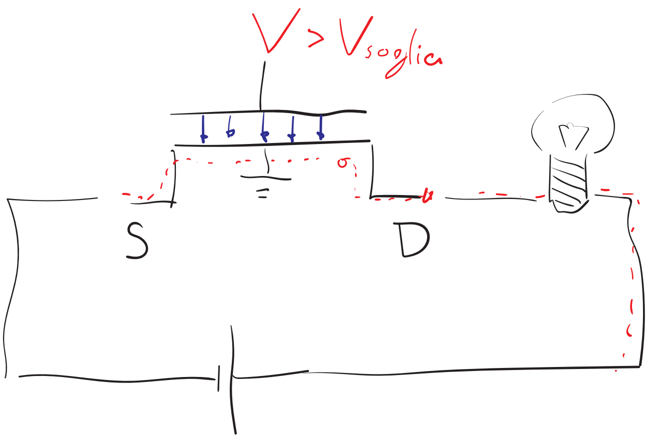
Si



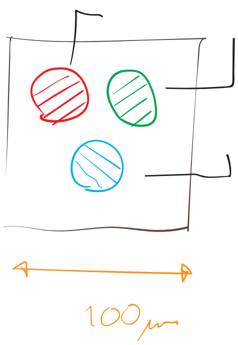
MOS



NEW TV



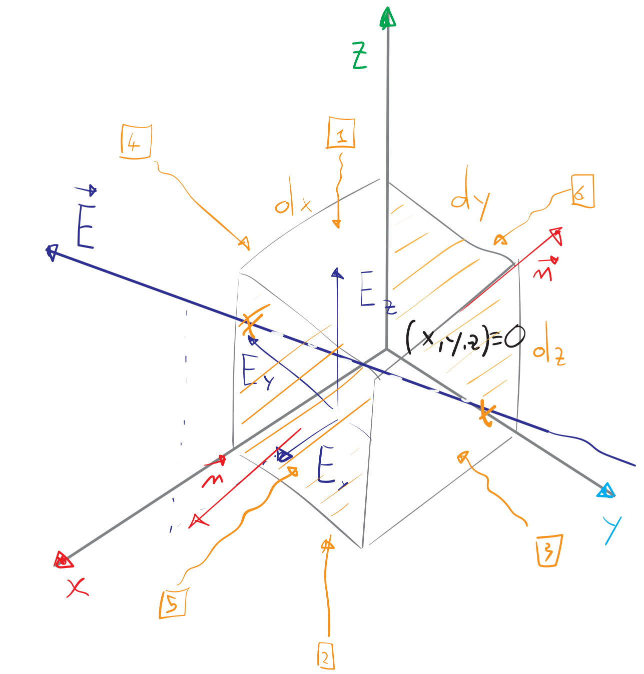
LED →



Università degli Studi di Padova

Divergenza

$$\phi_{\Sigma}(\vec{E}) = \oint\!\!\oint_{\Sigma} \vec{E} \cdot d\vec{\Sigma} \overset{G}{=} \frac{q_{\Sigma}}{\varepsilon_0} \longrightarrow \text{globale}$$



$$\phi_{\Sigma}(\vec{E}) = \phi_{1}(\vec{E}) + \cdots + \phi_{6}(\vec{E})$$

$\Sigma \to$ 6 facce cubetto

$$= -E_x(x,y,z)\,dy\,dz + E_x(x+dx,y,z)\,dy\,dz$$
$$-E_y(x,y,z)\,dx\,dz + E_y(x,y+dy,dz)\,dx\,dz$$
$$-E_z(x,y,z)\,dx\,dy + E_z(x,y,z+dz)\,dx\,dy$$

$$\frac{\partial E}{\partial x}dV + \frac{\partial E}{\partial y}dV + \frac{\partial E}{\partial z}dV = \left\{ \begin{aligned} &= \frac{-E_x(x,y,z)\,dy\,dz\,dx + E_x(x+dx,y,z)\,dy\,dz\,dx}{dx} \\ &\frac{-E_y(x,y,z)\,dx\,dz\,dy + E_y(x,y+dy,dz)\,dx\,dz\,dy}{dy} \\ &\frac{-E_z(x,y,z)\,dx\,dy\,dz + E_z(x,y,z+dz)\,dx\,dy\,dz}{dz} \end{aligned} \right.$$

densità spaziale di carica

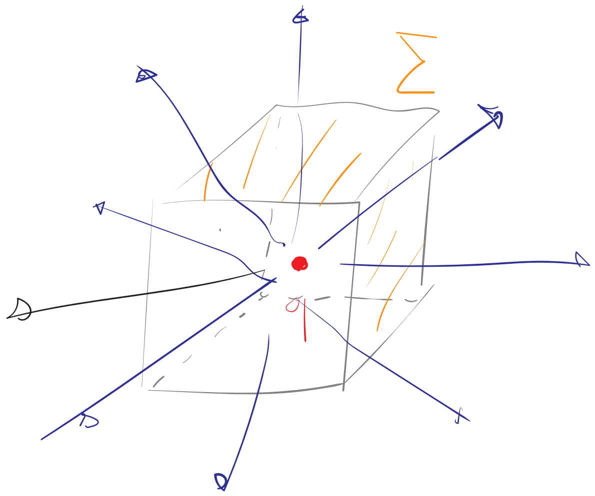
$$\frac{\partial E_x}{\partial x}dV + \frac{\partial E_y}{\partial y}dV + \frac{\partial E_z}{\partial z}dV \overset{G}{=} \frac{q}{\varepsilon_0} = \frac{\rho}{\varepsilon_0}dV$$

$$\underbrace{\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)}_{\nabla \cdot \text{ divergenza}} \vec{E}\,dV \overset{G}{=} \frac{\rho}{\varepsilon_0}dV \qquad \nabla \cdot \vec{E}(x,y,z) \overset{G}{=} \frac{\rho(x,y,z)}{\varepsilon_0}$$

Locale Th. gauss

$$\nabla \cdot \vec{E}_{(x,y,z)} = \rho_{(x,y,z)} / \varepsilon_0$$ Divergenza

sorgenza



$\phi(\vec{E})$

flusso = sorgente

$$\phi_{\Sigma}(E) = \oint_{\Sigma} \vec{E}\, d\vec{\Sigma} = \iiint_{V_{\Sigma}} \nabla \cdot \vec{E}\, dV$$

Stokes

$$\nabla \cdot \vec{E} = \rho / \varepsilon_0$$

$$-\nabla \cdot (\nabla V) = \rho / \varepsilon_0$$

$$-\nabla^2 V = \rho / \varepsilon_0$$