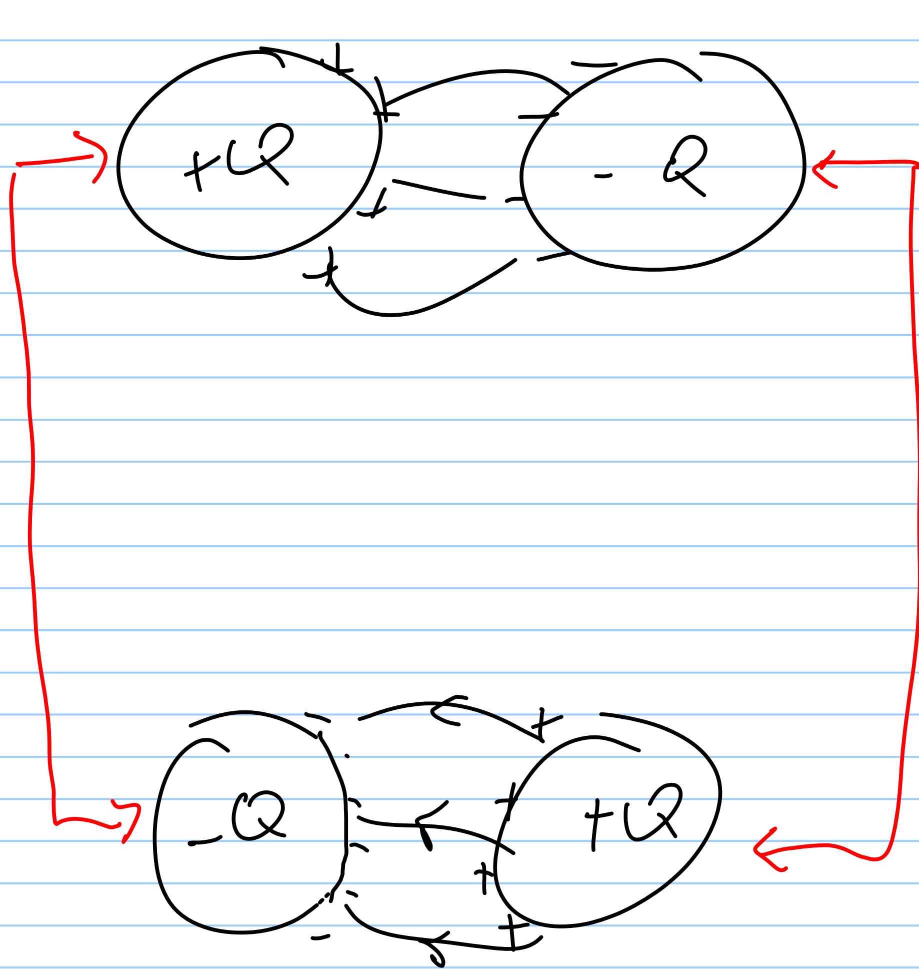
Note Title 2/5/2010



charge, conducting spheres

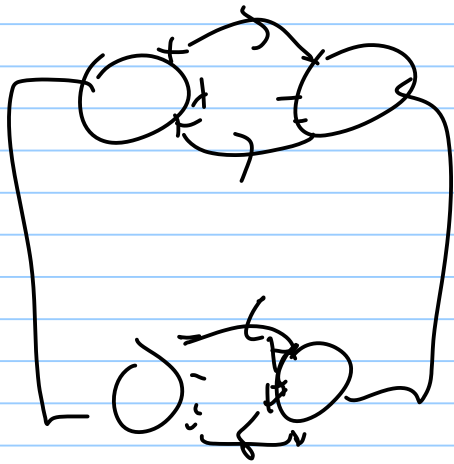
Principle: Newtons ?

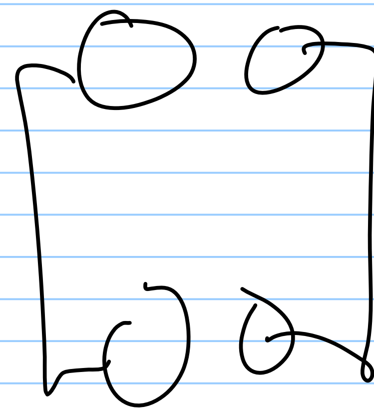
Cons energy charge

$W_{nc} = \Delta(KE + PE)$

Total energy minimized

2 configurations



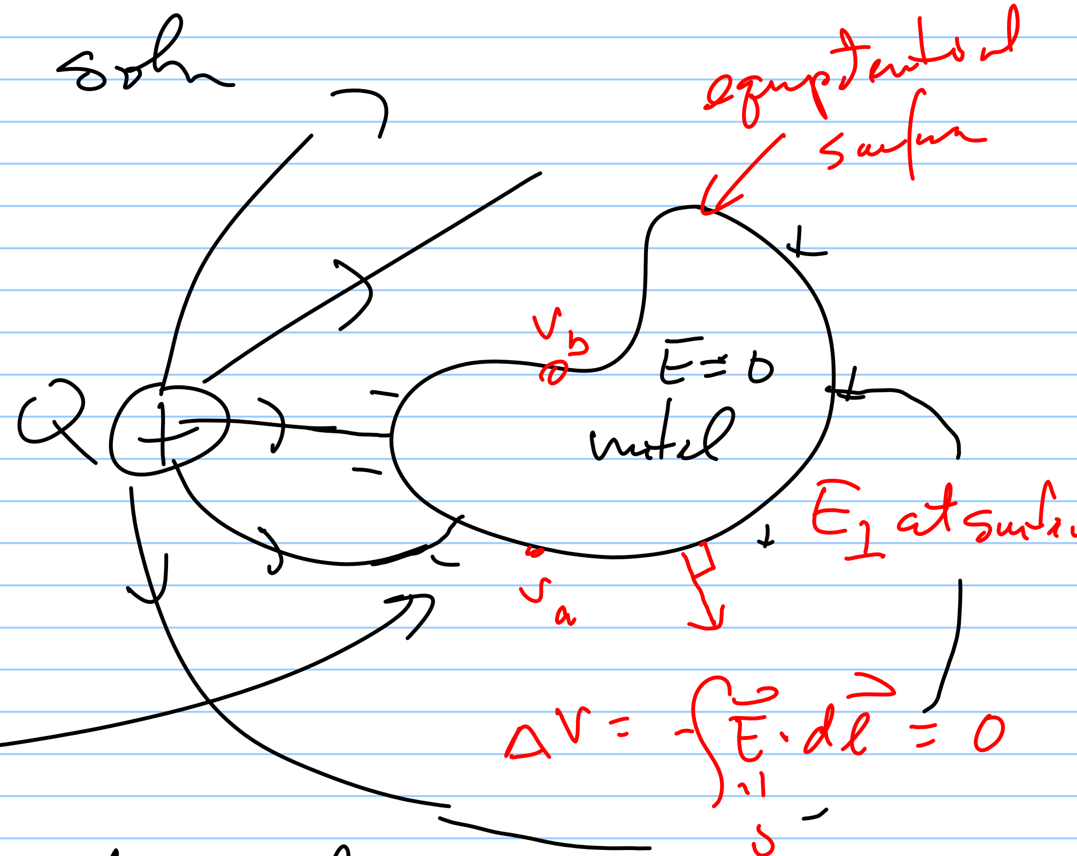


$\text{Energy} = \frac{1}{2}\epsilon_0 \int E^2 \, d\tau \neq 0$

$E = 0$

Uniqueness th. $\Rightarrow$ nature provides only 1 soln

How do find soln to



assume a component $E_\parallel$ at surface $\vec{F} = q\vec{E}_\parallel = m\vec{a}$

If we know σ

$$\vec{E} = \int \frac{k\,dq}{r^2}\hat{r} \qquad dq = \sigma\, da$$

To find σ fund. principle ?

given V on surface we want E or V & σ

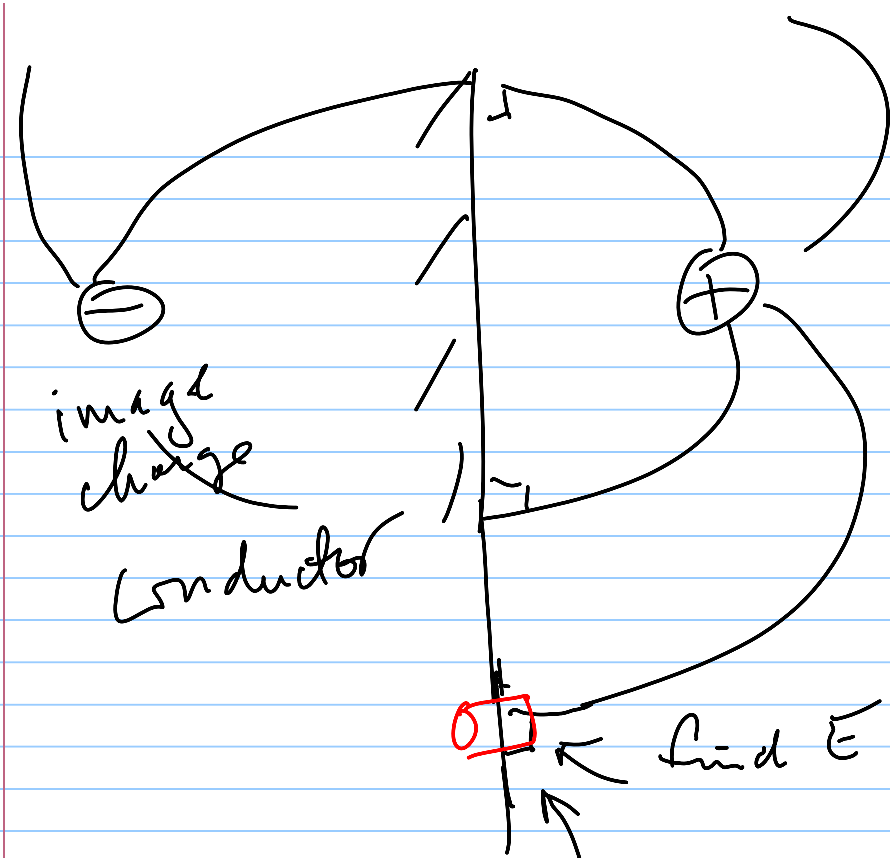
$$\vec{\nabla}\cdot\vec{E} = \rho/\epsilon_0 \quad \Rightarrow \quad \boxed{\nabla^2 V = -\rho/\epsilon_0}$$

$$\vec{E} = -\vec{\nabla}V$$

$$\vec{\nabla}\cdot\vec{\nabla}V = \left(\hat{x}\frac{\partial}{\partial x} + \hat{y}\frac{\partial}{\partial y}\right)\cdot\left(\hat{x}\frac{\partial V}{\partial x} + \hat{y}\frac{\partial V}{\partial y}\right)$$

$$= \frac{\partial^2}{\partial x^2}V + \frac{\partial^2}{\partial y^2}V \doteq \nabla^2 V$$

Method I: Guess

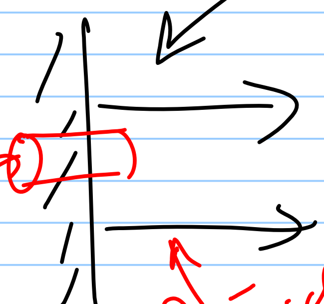


$E_\perp$ satisfied

$$\vec{E} = \frac{kq_1}{r_1^2}\hat{r}_1 + \frac{kq_2}{r_2^2}\hat{r}_2$$

find E

Uses Gauss Law region to find σ



$0 = \underset{\overset{\shortparallel}{0}}{\vec{E}} \cdot d\vec{a}$

$$\oint \vec{E} \cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0} = \frac{\int \sigma\, da}{\epsilon_0} \Rightarrow E_{surface} = \frac{\sigma}{\epsilon_0}$$