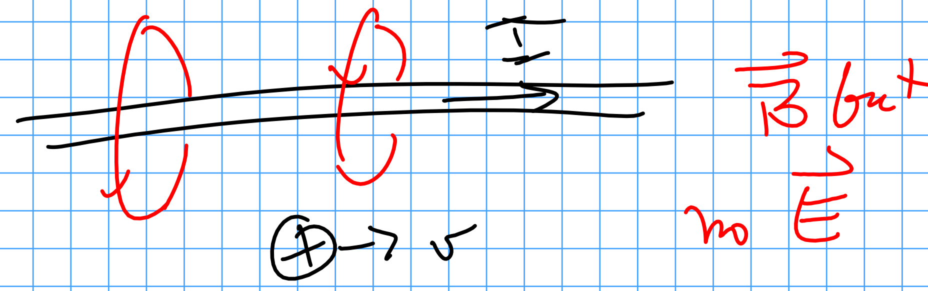
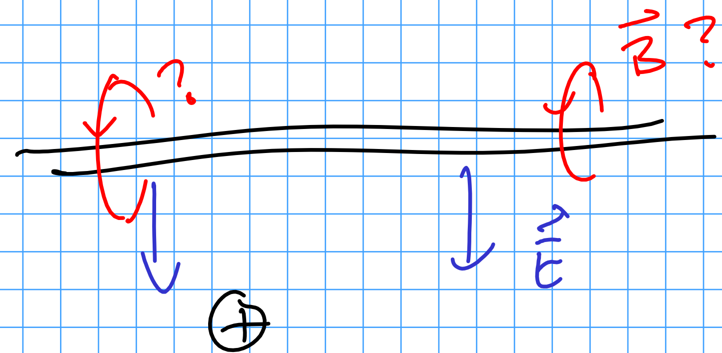
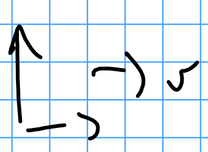
Relativity:





- E & B transform in a funny way between frames

(M) → v $\qquad \frac{1}{2}mv^2 \qquad mv$



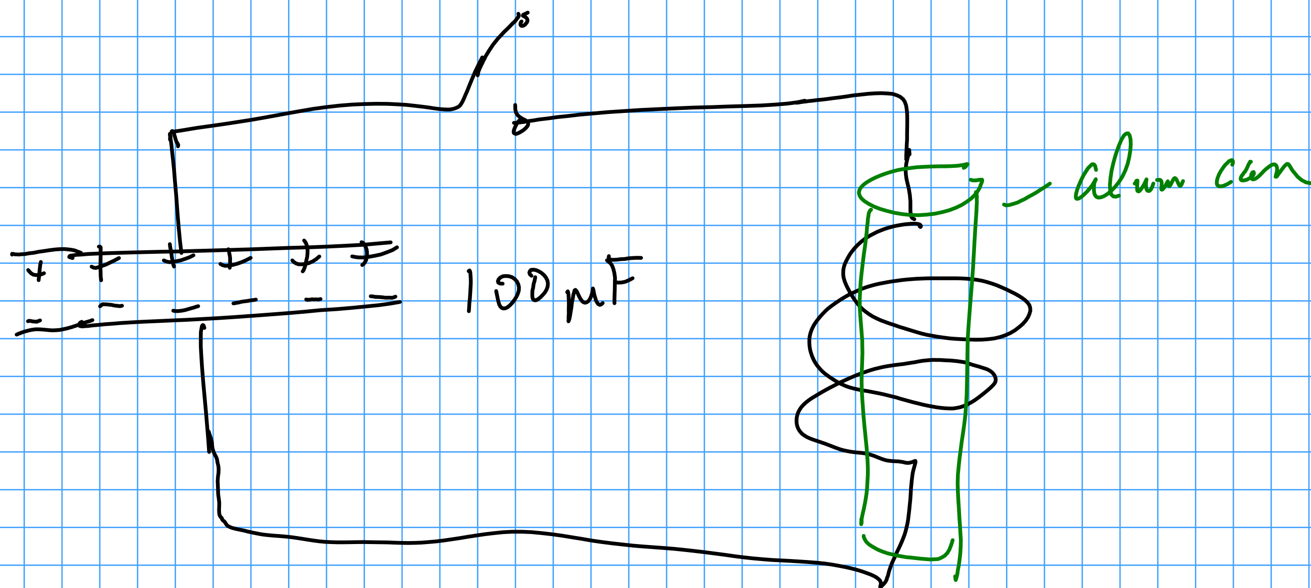
(M) $\qquad KE = 0 \qquad p = 0$

Is energy invariant under trans of coords? NO

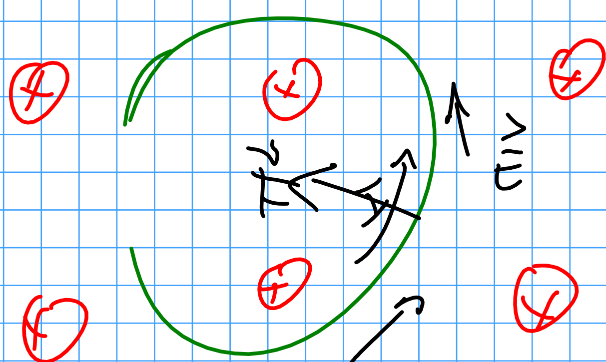
" mom " " " ? NO

$m^2c^4 = E^2 - p^2c^2 \qquad m^2c^4$ invariant

Charge invariant & conserved

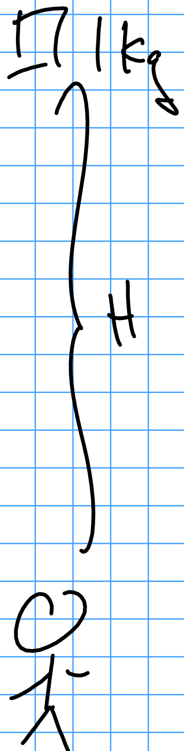


top view



$$\mathcal{E}_{mf} = -\frac{d\Phi_B}{dt}$$

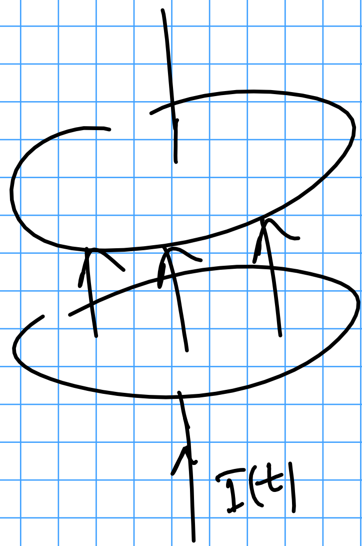
$$d\vec{F} = I\, d\vec{l} \times \vec{B}$$



$$\text{Energy} = \frac{1}{2} CV = \frac{1}{2} 10^{-4} F \left(25 \times 10^{6}\right)$$

$$= 10 \times 10^{2} = 1000 \text{ J}$$

$1000 = 1 \cdot 10\, H \qquad H = 100 \text{ Meters}$



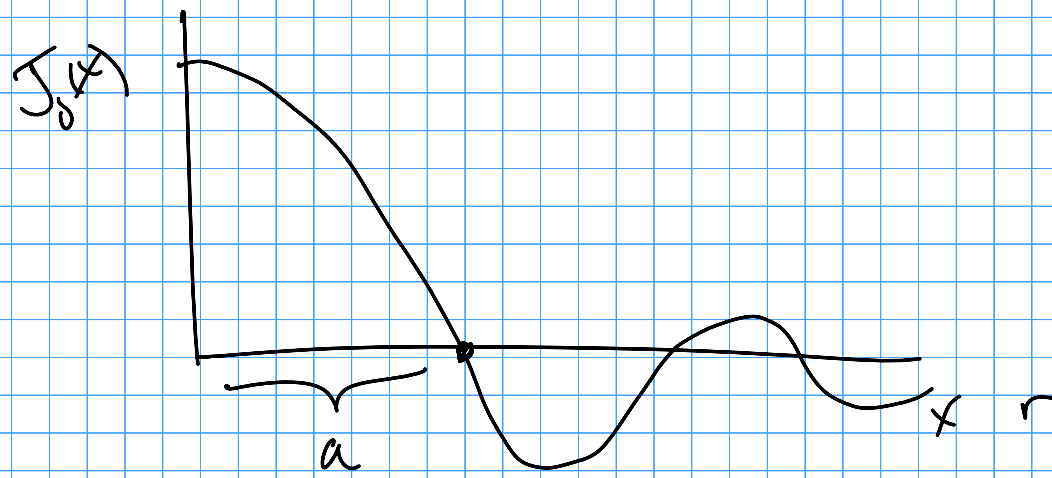
$$E = E_0 e^{i\omega t}\left[1 - \frac{1}{2^2}\left(\frac{\omega r}{c}\right)^2 + \frac{1}{2^2 4^2}\left(\frac{\omega r}{c}\right)^4 + \cdots\right]$$

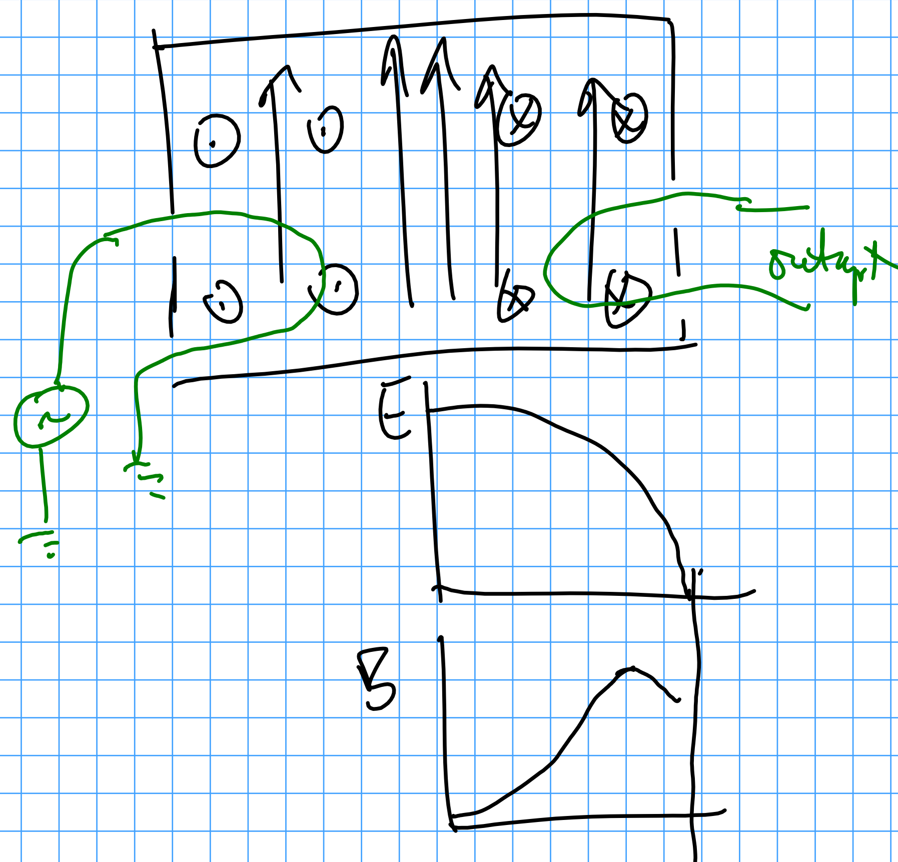
real

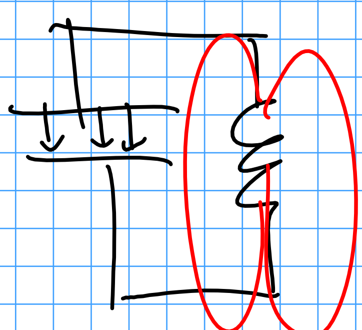
$$B_2 = \frac{-i\,\omega^3 r^3}{16c^4} E_0 e^{i\omega t} \qquad c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

imaginary

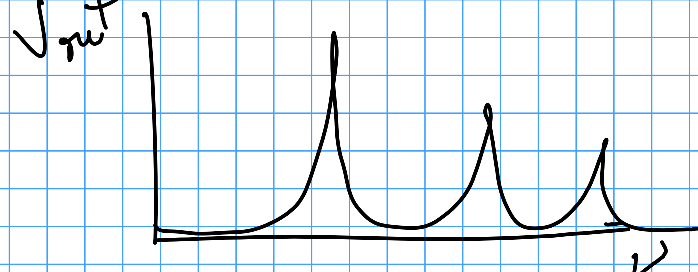
$$J_0(x) = 1 - \frac{1}{(1!)^2}\left(\frac{x}{2}\right)^2 + \frac{1}{(2!)^2}\left(\frac{x}{2}\right)^4 - \frac{1}{(3!)^2}\left(\frac{x}{2}\right)^6 + \cdots$$







Distributed



Overview:

Maxwell's eqns:

$$\vec{\nabla}\cdot\vec{E} = \rho/\epsilon_0 \qquad \vec{\nabla}\cdot\vec{B} = 0$$

$$\vec{\nabla}\times\vec{E} = -\frac{\partial\vec{B}}{\partial t} \qquad \vec{\nabla}\times\vec{B} = \mu_0\vec{J} + \mu_0\epsilon_0\frac{\partial\vec{E}}{\partial t}$$

Cons laws:

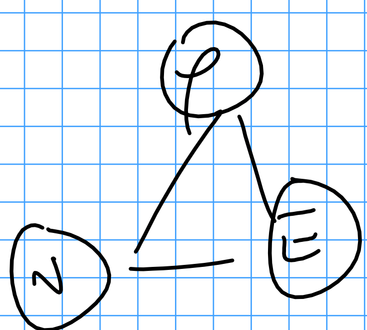
$$\vec{\nabla}\cdot\vec{J} = -\frac{\partial\rho}{\partial t} \qquad \Delta(KE+PE) = W_{non-cons}$$

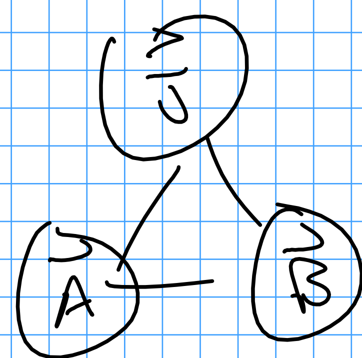
$$\Delta PE = q\Delta V$$

Newtons:

$$\vec{F} = q\vec{E} + q\vec{v}\times\vec{B}$$

Δ diagrams



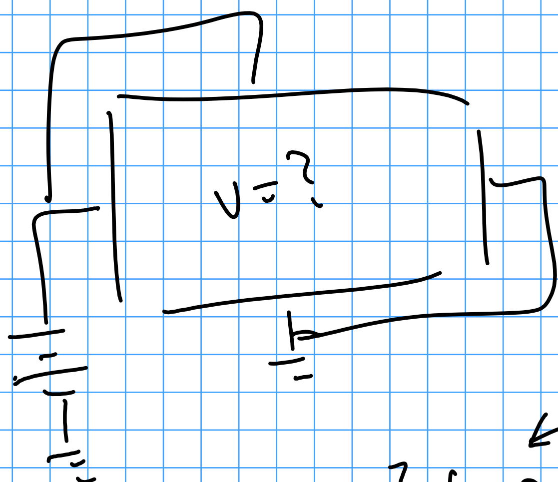


Problems:

- defn. M, L, ...

- given ρ & $\vec{E} = \int \frac{k\,dq}{r^2}\hat{r}$ $\quad dq = \rho\, d\tau$

- given V at bndry find V everywhere



don't know ρ

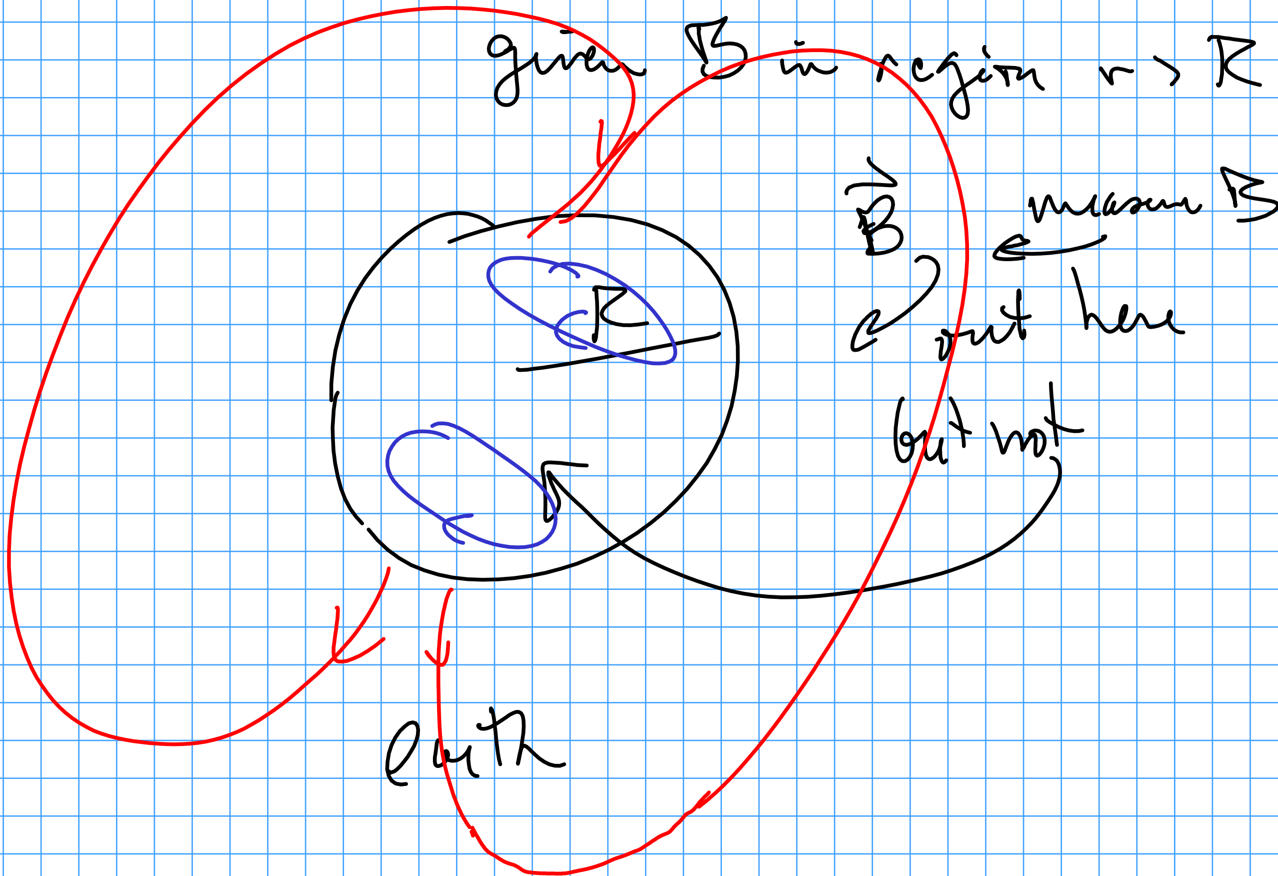
$\nabla^2 V = -\frac{1}{\epsilon_0}\rho$

sin
exp
$Ax + B$
} global

$\nabla^2 V = 0$ $\qquad V = X\, Y\, Z$

↑ local property

- given B in small region of space
What is $\vec{J}$? is $\vec{J}$ unique



INVERSE PROBLEM: given ans in one region ⇒ in another