Does the vector potential exist or is it just a mathematical construct?

http://en.wikipedia.org/wiki/Ontology

"Ontology deals with questions concerning what entities exist or can be said to exist"

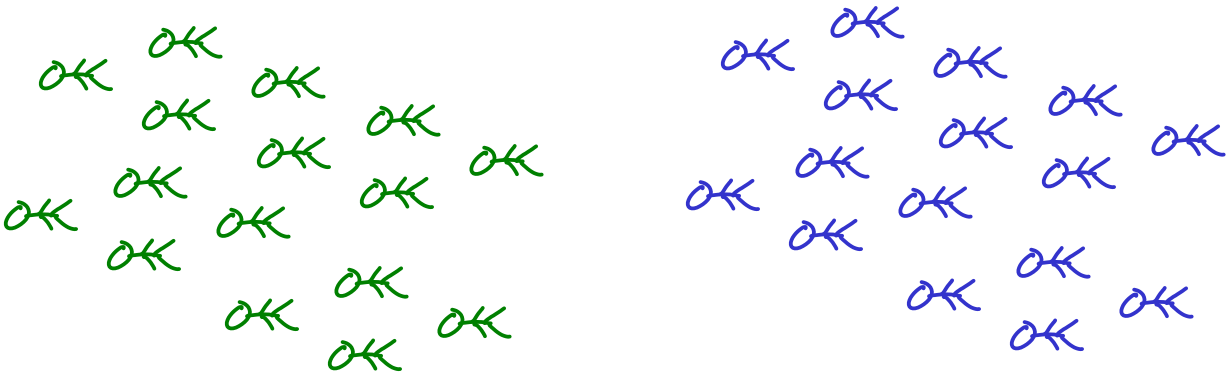
In the double slit expt. the wavefunction is near zero where there is B. Does this mean that B does not affect the motion of the wavefunction? A is not zero where the wavefunction is large. Does this mean the A affects the wavefunction?

http://en.wikipedia.org/wiki/Epistemology

"It questions what knowledge is and how it can be acquired, and the extent to which knowledge pertinent to any given subject or entity can be acquired."

Why does the skydiver analogy break down in E&M?

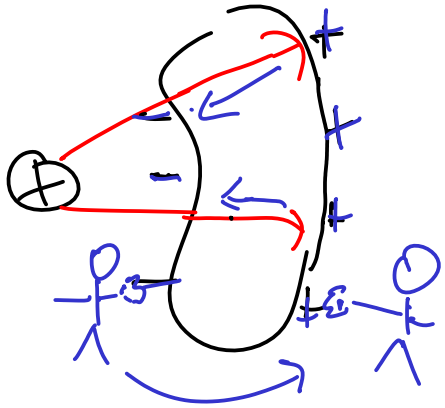
As far as we know there is no negative mass analogous to negative charge.



There has been some conjecture that antimatter falls differently from matter.

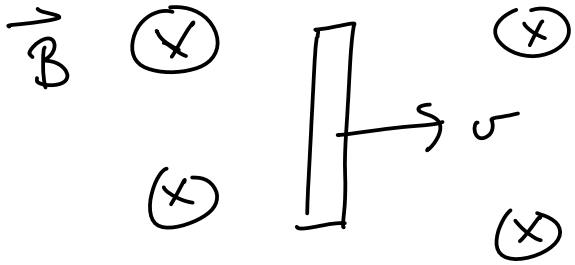
In addition there is no conductor of mass like a conductor of charge on whose surface the gravitational potential is constant.

How is E generated in a conductor with a battery?

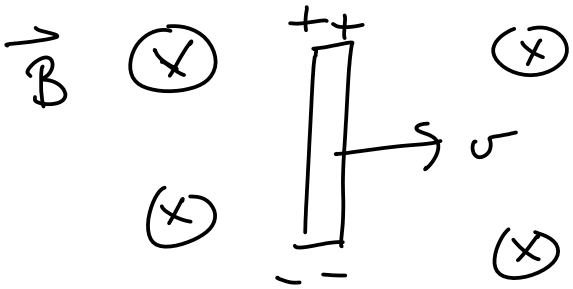


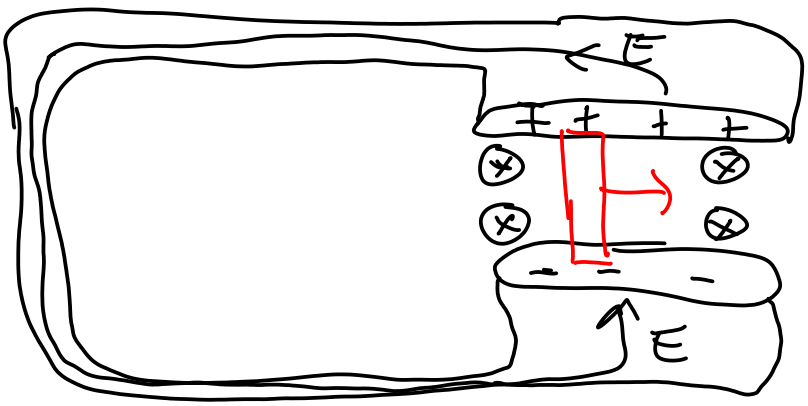
I pick up the charges and move them to the other side of the conductor causing a steady current to flow (acting as a battery)

Another tweezer method:



Like a battery it picks up charges and moves them to the other side of the conductor





The wire moving in B slides along the metal surfaces.

What entity does work to move the charges and generate heat in the wire?

Faraday's law:

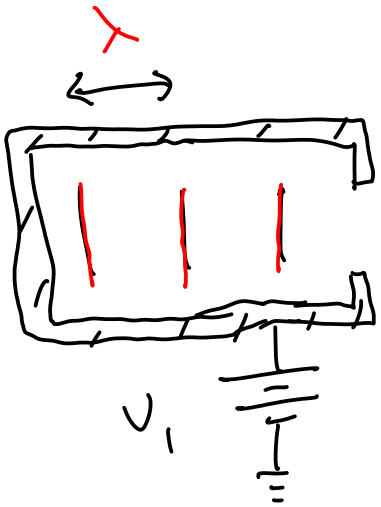
$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

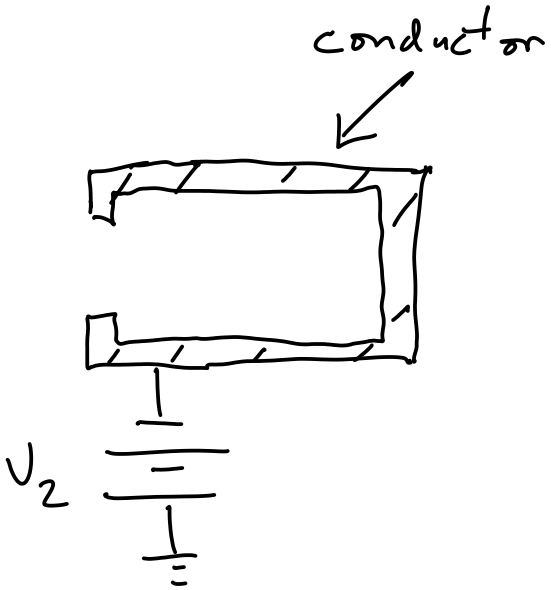
Questions about this model?

The cost of a ball and bat.

Knee-Jerk thinking

Analytic thinking





$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi(x,t) + qV(x) = i\hbar\frac{\partial}{\partial t}\psi(x,t)$$

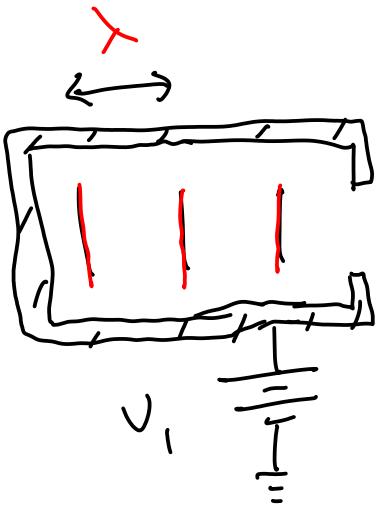
Questions:

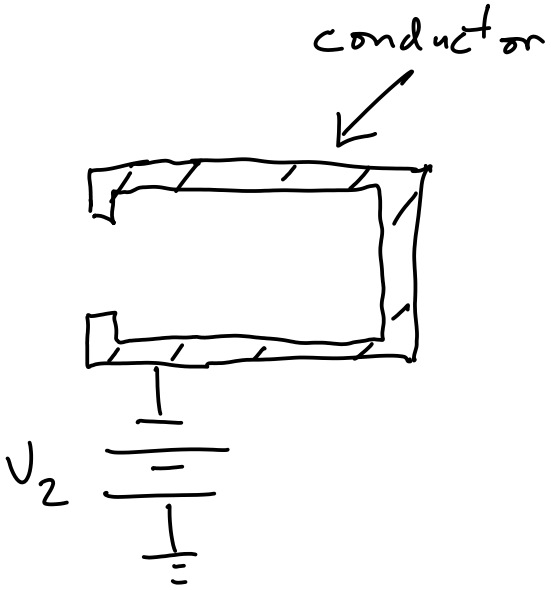
(congruous) How do you calculate V(x)?

(congrous) How do you calculate a solution to this Schrodinger eqn with boundary conditions?

(modify) What simplifying assumptions can I make?

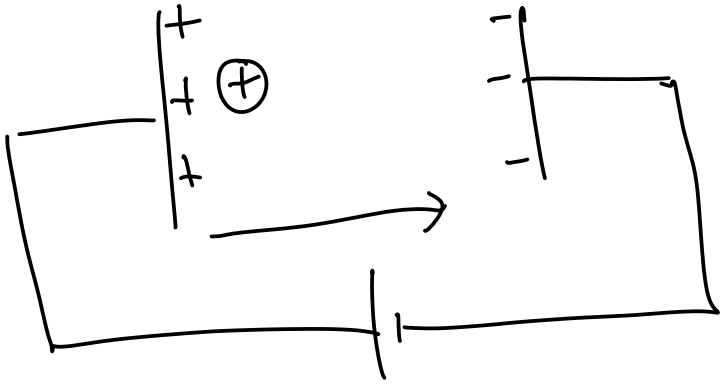
(analogy) The Sch eqn is a statement of energy conservation. What is energy conservation classically?

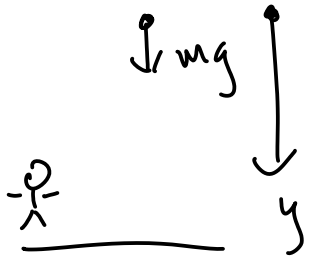




Simplify

Analogy





$PE = mgy$

$$qV(x) = qE_0x$$

$$E = -\frac{\partial V}{\partial x} = E_0$$

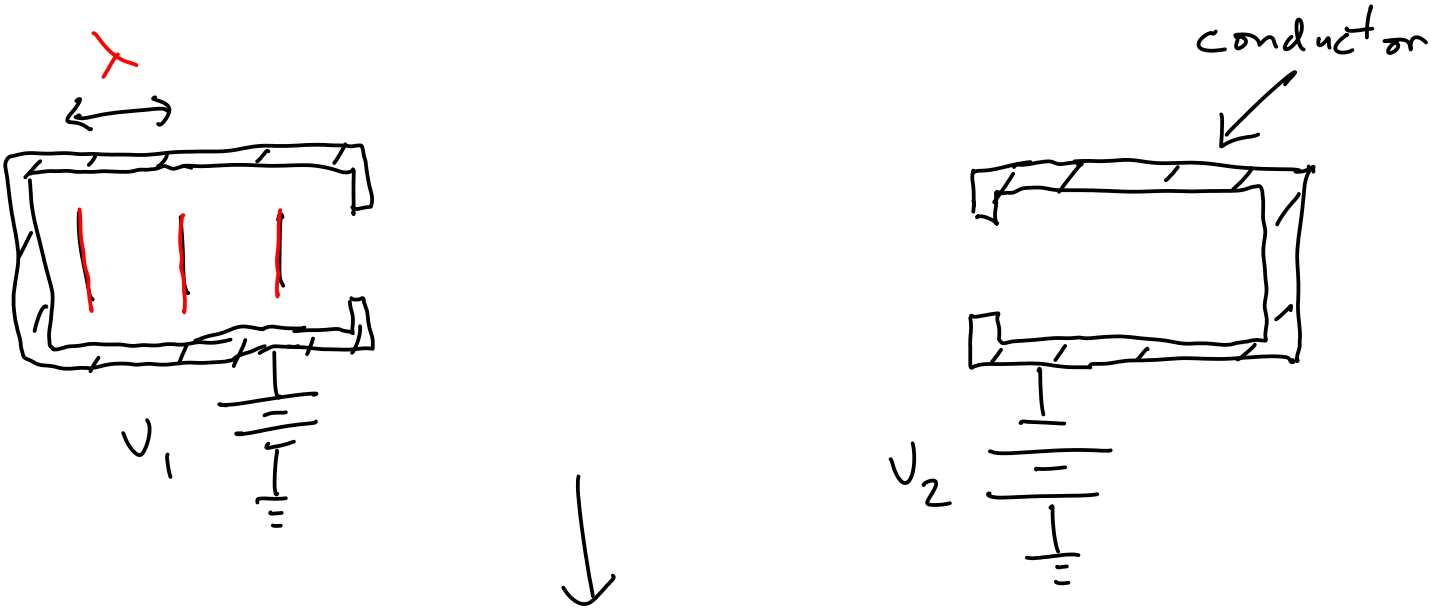
$$KE + PE = \frac{p^2}{2m} + qE_0x = \text{Total Energy}$$

As the particle moves its momentum increases while its potential energy decreases but the total energy remains the same.

(informational) How are the classical parameters related to the quantum parameters?

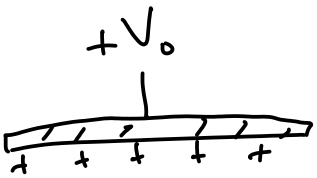
$p = \hbar k$ $\quad E_{tot} = \hbar \omega$

So $k = \frac{2\pi}{\lambda}$ increases but the total energy or frequency remains the same.



(analogy) Where have I seen a wave whose frequency doesn't change but its wavelength and speed change?

(causal/creative) How does the wavefunction bend due to an electric field?



Questions

(modify) What simplifying assumptions can I make?

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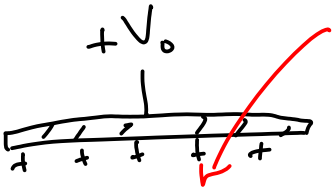
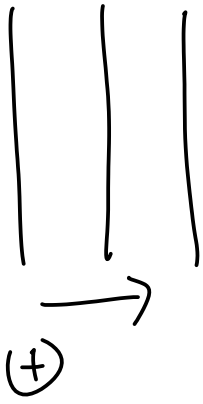
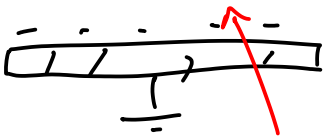


high Potential energy





low potential energy

In a region of large potential energy the particle moves slowly.

$$p = \frac{h}{\lambda} \qquad \lambda \text{ large}$$

In a region of small potential energy the particle move fast.

$$p = \frac{h}{\lambda} \qquad \lambda \text{ small}$$