Once you construct potentials such that $\vec{B} = \nabla \times \vec{A}$ and $\vec{E} = -\nabla V - \frac{\partial \vec{A}}{\partial t}$ for a particular physical situation, including boundary conditions, those potentials are unique.

A) True.

B) False.

Consider the static point-charge potentials $V = \frac{kq}{r}$ and $A = 0$. Are these in the Coulomb gauge, the Lorentz gauge, both, or neither?

7 0

A) Only Coulomb B) Only Lorentz

C) Both D) Neither

43 0

Coulomb: $\nabla \cdot \vec{A}$

Consider the equivalent static point-charge potentials $V = 0$ and $\vec{A} = \frac{-kqt\hat{r}}{r^2}$. Are these in the Coulomb gauge, the Lorentz gauge, both, or neither?

3 A) Only Coulomb

3 B) Only Lorentz

C) Both
5

D) Neither
39

$\bar{B} = \nabla \times \bar{A}$ $\bar{E} = -\nabla V - \partial \bar{A}/\partial t$

Can the actual <u>values</u> (not the gradients, curls, etc) of the potentials $\vec{A}$ and V *ever* affect a physical outcome?

A) Yes

B) No

C) Both

D) Neither

If $\oint \vec{A} \cdot \overrightarrow{dl}$ is just another way of writing magnetic flux, it ought not depend on gauge. Show that if you do a gauge transformation on A, you don't change $\oint \vec{A} \cdot \overrightarrow{dl}$

Take the divergence of both sides of Faraday's law:

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

What do you get?

A. $0 = 0$

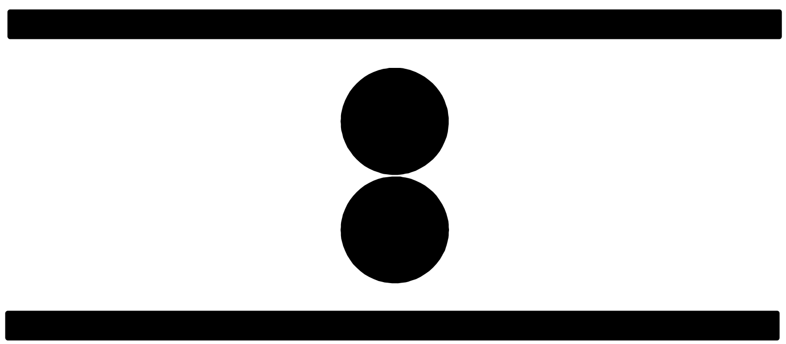
B. A partial differential equation (perhaps a wave equation of some sort ?) for **B**

C. Gauss' law

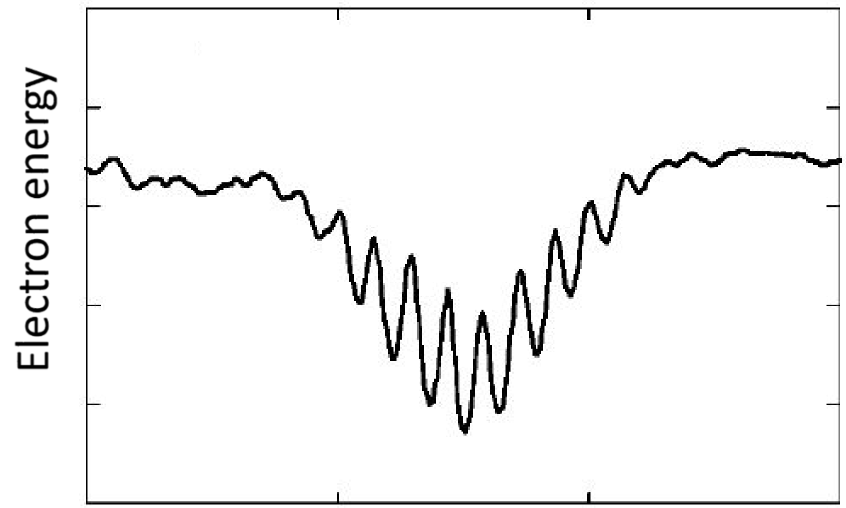
D. It's something, but I don't know what it is.

You heard about/read about two different gauges. In the Coulomb gauge, $\nabla \cdot \vec{A} = 0$. In the Lorentz gauge, $\nabla \cdot \vec{A} = -\mu_0 \varepsilon_0 \frac{\partial V}{\partial t}$. That's all well and good in theory, but when you're solving actual problem, how does one actually force one's $\vec{A}$ and/or V to be such that one or the other gauge condition is satisfied?

Discuss this and click in when you're done.



Quantum-scale conducting channel
with two anti-dot obstruction



*From Johnson, Kohl, Retzlaff, 2002