Announcements

- Homework
  - Homework 9 is due on Monday!
  - Homework 10 is going to be super short (like 1 or 2 problems) and will be due a week from *today*
- Physics Tea at 3!
- Physics Seminar today on Laser Fusion!!
  - 3:30pm in Collins 318
- Read Chapter 6.1 for Monday

Q1

For an infinite solenoid of radius R, with current $\mathcal{I}$, and n turns per unit length, what would be a correct way of writing $\vec{\mathbf{J}}$?

A. $\vec{\mathbf{J}} = n\mathcal{I}\hat{\phi}$

B. $\vec{\mathbf{J}} = n\mathcal{I}\delta(r-R)\hat{\phi}$

C. $\vec{\mathbf{J}} = \frac{\mathcal{I}}{n}\delta(r-R)\hat{\phi}$

D. $\vec{\mathbf{J}} = \mu_0 n\mathcal{I}\delta(r-R)\hat{\phi}$

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Q2

What is required in order to define a vector potential where:

$$\nabla^2 \vec{\mathbf{A}} = -\mu_0 \vec{\mathbf{J}}$$

A. $\boldsymbol{\nabla} \times \vec{\mathbf{A}} = 0$
B. $\boldsymbol{\nabla} \cdot \vec{\mathbf{A}} = 0$
C. $\boldsymbol{\nabla} \cdot \vec{\mathbf{A}} = \boldsymbol{\nabla} \times \vec{\mathbf{A}}$
D. $\vec{\mathbf{A}} \to 0$ at ∞

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Q3

What flexibility do you have in defining the vector potential, given the Coulomb gauge ($\nabla \cdot \vec{\mathbf{A}} = 0$)? That is, what can $\vec{\mathbf{A}}_2$ be that gives us the same $\vec{\mathbf{B}}$? Here C or $\vec{\mathbf{C}}$ is an arbitrary scalar or vector function.

A. $\vec{\mathbf{A}}_2 = \vec{\mathbf{A}} + C$
B. $\vec{\mathbf{A}}_2 = \vec{\mathbf{A}} + \vec{\mathbf{C}}$
C. $\vec{\mathbf{A}}_2 = \vec{\mathbf{A}} + \nabla C$
D. $\vec{\mathbf{A}}_2 = \vec{\mathbf{A}} + \nabla \cdot \vec{\mathbf{C}}$

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Q4

Assuming $\vec{\mathbf{J}}$ goes to 0 at ∞, we can calculate $\vec{\mathbf{A}}$ in Cartesian using:

$$\vec{\mathbf{A}}(\vec{\boldsymbol{r}}) = \frac{\mu_0}{4\pi}\int \frac{\vec{\mathbf{J}}(\vec{\boldsymbol{r}}_s)}{\mathscr{r}} d\tau_s$$

Can this integral also be done in spherical coordinates?

A. Yes, no problem
B. Yes, r_s can be spherical but $\vec{\mathbf{J}}$ needs to be in Cartesian components
C. Yes, $\vec{\mathbf{J}}$ can be spherical, but r_s needs to be in Cartesian components
D. No, this will not work due to cross terms in the spherical Laplacian

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Q5

Assuming the Coulomb gauge, the vector potential $\vec{\mathbf{A}}$ due to a long straight wire with current $\vec{\mathcal{I}}$ along the z-axis points in what direction?

A. $\hat{\boldsymbol{z}}$

B. $\hat{\phi}$

C. $\hat{\boldsymbol{s}}$

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