HW 2.1

Sunday, January 24, 2021 4:41 PM

$$\left.\begin{aligned}&\nabla^2\phi + \frac{\partial(\vec{\nabla}\cdot\vec{A})}{\partial t} = -\frac{\rho}{\varepsilon_0}\\ &\nabla^2\vec{A} - \frac{1}{c^2}\frac{\partial^2\vec{A}}{\partial t^2} = -\mu_0\vec{J} + \vec{\nabla}\left(\vec{\nabla}\cdot\vec{A} + \frac{1}{c^2}\frac{\partial\phi}{\partial t}\right)\end{aligned}\right\} \text{E.o.M.}$$

Condition: $\frac{\partial(\vec{\nabla}\cdot\vec{A})}{\partial t} = 0$

$$\phi' = \phi - \frac{\partial\chi}{\partial t} \qquad \vec{A}' = \vec{A} + \vec{\nabla}\chi$$

$$\frac{\partial}{\partial t}(\vec{\nabla}\cdot\vec{A}') = \frac{\partial}{\partial t}\left(\vec{\nabla}\cdot\vec{A} + \vec{\nabla}\cdot\vec{\nabla}\chi\right) = 0$$

$$\frac{\partial(\vec{\nabla}\cdot\vec{A})}{\partial t} = -\frac{\partial(\vec{\nabla}\cdot\vec{\nabla}\chi)}{\partial t} = f(\vec{x},t)$$

E.o.M.

$$\nabla^2\phi = -\frac{\rho}{\varepsilon_0}$$

$$\nabla \quad \phi \quad - \quad \varepsilon_0$$

$$\nabla^2 \vec{A} - \frac{1}{c^2}\frac{\partial^2 \vec{A}}{\partial t^2} = -\mu_0 \vec{J} + \vec{\nabla}\left(\vec{\nabla}\cdot\vec{A} + \frac{1}{c^2}\frac{\partial \phi}{\partial t}\right)$$

Conditions for new gauge:

$$\phi' = \phi - \frac{\partial \chi}{\partial t} \qquad \vec{A}' = \vec{A} + \vec{\nabla}\chi$$

$$\frac{\partial}{\partial t}\left(\vec{\nabla}\cdot\vec{\nabla}\chi\right) = 0$$