Summary of Electro-and Magnete-dynamics

$\vec{\nabla}\cdot\vec{B}(\bar{x},t) = \frac{\rho(\bar{x},t)}{\varepsilon_0}$ Gauss law $\vec{\nabla}\cdot B(\bar{x},t) = 0$

$\vec{\nabla}\times\vec{B}(\bar{x},t) = -\frac{\partial\vec{B}(\bar{x},t)}{\partial t}$ Ampere's law $\vec{\nabla}\times\vec{B}(\bar{x},t) = \mu_0 J(\bar{x},t) + \frac{1}{c^2}\frac{\partial\vec{B}(\bar{x},t)}{\partial t}$

$\nabla\phi(\bar{x},t) = -\vec{B}(\bar{x},t) - \frac{\partial\vec{A}(\bar{x},t)}{\partial t}$ $\vec{\nabla}\cdot\vec{A}(\bar{x},t) = -\frac{1}{c^2}\frac{\partial\phi(\bar{x},t)}{\partial t}$

$\nabla^2\phi(\bar{x},t) = -\frac{\rho(\bar{x},t)}{\varepsilon_0} + \frac{1}{c^2}\frac{\partial^2\phi(\bar{x},t)}{\partial t^2}$ $\nabla^2\vec{A}(\bar{x},t) = -\mu_0 J(\bar{x},t) + \frac{1}{c^2}\frac{\partial^2\vec{A}(\bar{x},t)}{\partial t^2}$

$\phi(\bar{x},t) = \frac{1}{4\pi\varepsilon_0}\int_{\bar{x}'}\frac{\rho(\bar{x}',t')_{ret}}{|\bar{x}-\bar{x}'|}d^3\bar{x}'$ $\vec{A}(\bar{x},t) = \frac{\mu_0}{4\pi}\int_{\bar{x}'}\frac{J(\bar{x}',t')_{ret}}{|\bar{x}-\bar{x}'|}d^3\bar{x}'$

$\vec{E}(x,t) = -\nabla\phi(\bar{x},t) - \frac{\partial\vec{A}(\bar{x},t)}{\partial t}$ $\vec{B}(\bar{x},t) = \vec{\nabla}\times\vec{A}(\bar{x},t)$

Lorenz Gauge : $\vec{\nabla}\cdot\vec{A}(\bar{x},t) + \frac{1}{c^2}\frac{\partial\phi(\bar{x},t)}{\partial t} = 0$

$t = t' - \tau = t' - \frac{R}{c}$ retardation (Ch. 2)

$R = |\bar{x}-\bar{x}'|$

The potentials given are in the near field.

(Ch. 3)

$\vec{S}(r,t) = \frac{1}{\mu_0}\vec{E}(r,t)\times\vec{B}(r,t)$ Poynting vector

Larmor Formula for power

How do $\vec{E}(\bar{x},t)$ and $\bar{B}(\bar{x},t)$ depend on the source?