Electric dipole radiation : From potentials to Fields

$$\phi(\vec{x},t) = \frac{1}{4\pi\varepsilon_0}\int_{\vec{x}'} d^3\vec{x}'\ \frac{1}{R}\left[\rho(\vec{x}',t')\right]$$

$$\simeq \frac{1}{4\pi\varepsilon_0}\left\{\frac{q_0\cos(\omega t')}{r_+} - \frac{q_0\cos(\omega t')}{r_-}\right\}$$

$$= \frac{1}{4\pi\varepsilon_0}\left\{\frac{q_0\cos\left(\omega\left(t+\frac{r_+}{c}\right)\right)}{r_+} - \frac{q_0\cos\left(\omega\left(t+\frac{r_-}{c}\right)\right)}{r_-}\right\}$$

scalar Potential

Find $\phi = \phi(r,\theta,t)$

$t_+' = t + \frac{r_+}{c}$

$t_-' = t + \frac{r_-}{c}$