

1) 95(3) : FLRW Dust, Charge and Current Densities  
Charge Density, All Conditions

$$\underline{\underline{\rho_e = 4\pi \epsilon_0 \phi \sigma_\rho}}$$

Current Density

1) Flat Universe

$$J_r = r^2 J_\theta = r^2 \sin^2 \theta J_\phi = \frac{A^{(0)}}{\mu_0} \left( \frac{4\pi \sigma_\rho}{a^2} \right),$$

$$a = \left( \frac{9c}{4} \right)^{1/3} t^{2/3}$$

2) Closed Universe

$$J_r = \frac{A^{(0)}}{\mu_0} \left( 4\pi \sigma_\rho \left( 1 - \frac{r^2}{a^2} \right) \right),$$

$$r^2 J_\theta = r^2 \sin^2 \theta J_\phi = \frac{A^{(0)}}{\mu_0} \left( \frac{4\pi \sigma_\rho}{a^2} \right)$$

$$a = \frac{c}{2} (1 - \cos \phi), \quad t = \frac{c}{2} (\phi - \sin \phi)$$

3) Open Universe

$$J_r = \frac{A^{(0)}}{\mu_0} \left( 4\pi \sigma_\rho \left( \frac{1+r^2}{a^2} \right) \right),$$

$$r^2 J_\theta = r^2 \sin^2 \theta J_\phi = \frac{A^{(0)}}{\mu_0} \left( \frac{4\pi \sigma_\rho}{a^2} \right),$$

$$a = \frac{c}{2} (\cosh \phi - 1), \quad t = \frac{c}{2} (\sinh \phi - \phi)$$

$$\underline{\nabla} \cdot \underline{E} = \frac{\rho_e}{\epsilon_0} \quad ; \quad \underline{\nabla} \times \underline{B} = \frac{1}{c^2} \frac{\partial \underline{E}}{\partial t} + \mu_0 \underline{J}$$