Lecture 1 (1/19/05)

Units:

1. Maxwell Equations (pg. 557)

2. Why many units? $c = 1$, Heaviside-Lorentz units. (Appendix, pg. 775)

SI:

$$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\epsilon_0}$$

$$\vec{\nabla} \times \vec{B} - \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t} = \mu_0 \vec{J}$$

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{E} + \frac{\partial \vec{B}}{\partial t} = 0$$

Gaussian:

$$\vec{\nabla} \cdot \vec{E} = 4\pi\rho$$

$$\vec{\nabla} \times \vec{B} - \frac{1}{c}\frac{\partial \vec{E}}{\partial t} = \frac{4\pi}{c}\vec{J}$$

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{E} + \frac{1}{c}\frac{\partial \vec{B}}{\partial t} = 0$$

Heaviside-Lorentz (HL)

$$\vec{\nabla} \cdot \vec{E} = \rho$$

$$\vec{\nabla} \times \vec{B} - \frac{1}{c}\frac{\partial \vec{E}}{\partial t} = \frac{1}{c}\vec{J}$$

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{E} + \frac{1}{c}\frac{\partial \vec{B}}{\partial t} = 0$$

3. Going from Heaviside-Lorentz to SI

4. Going from Gaussian to SI

Relativistic Electrodynamics:

1. Goal: Understand

$$S = \int d^4x [\frac{-1}{4} F_{\mu\nu} F^{\mu\nu} - J_\mu A^\mu]$$

2. Introduction to special relativity (11-3, pg. 524). Note:$\vec{\beta} = \vec{v}$ since $c = 1$.