Lecture 2 (1/21/05)

Relativsitic Electrodynamics (continued)

3. Spacetime diagram, lightcone, loss of simultaneity

4. Examples using Lorentz transformations: Lorentz contraction, time dilation

Typical procedure: a) label events b) apply Λ.

5. D=3+1 generalization (simple and fancy) (pg. 547)

6. 4-vectors and differential invariant length

$$\Lambda^{\mu}{}_{\nu} = \begin{pmatrix} \gamma & -\gamma v^1 & -\gamma v^2 & -\gamma v^3 \\ -\gamma v^1 & 1+\frac{(\gamma-1)(v^1)^2}{\vec{v}^2} & \frac{(\gamma-1)v^1v^2}{\vec{v}^2} & \frac{(\gamma-1)v^1v^3}{\vec{v}^2} \\ -\gamma v^2 & \frac{(\gamma-1)v^1v^2}{\vec{v}^2} & 1+\frac{(\gamma-1)(v^2)^2}{\vec{v}^2} & \frac{(\gamma-1)v^2v^3}{\vec{v}^2} \\ -\gamma v^3 & \frac{(\gamma-1)v^1v^3}{\vec{v}^2} & \frac{(\gamma-1)v^2v^3}{\vec{v}^2} & 1+\frac{(\gamma-1)(v^3)^2}{\vec{v}^2} \end{pmatrix}$$

$$\Lambda^{\mu}{}_{\nu}(v)\Delta x^{\nu} = \Delta x'^{\mu}$$

Must learn to distinguish the power from labels from context!

$$ds^2 = dx^{\mu}dx_{\mu}$$

7. Easy method to compute proper time of an arbitrary worldline.

8. Relativistic energy and momentum (11.5, pg. 533)

$$\vec{p} = \mathcal{M}(u)\vec{u}$$

$$E = \mathcal{E}(u)$$