

PHYSICS 515B  
**ELECTROMAGNETIC THEORY**  
Prof. Fulvio Melia

*Section V Problems (due Wednesday, September 23)*

Problem 1: Show that the spacetime coordinates of an event seen in two reference frames moving at a velocity  $v$  relative to each other in the  $z$ -direction are related by the Lorentz transformation

$$x' = x$$

$$y' = y$$

$$z' = \gamma(z - vt)$$

$$t' = \gamma(t - vz/c^2)$$

where

$$\gamma = \frac{1}{\sqrt{1 - (v/c)^2}}.$$

One way to do this is to begin with the general transformation  $x'^{\mu} = a^{\mu}_{\nu} x^{\nu}$  and solve for the  $a^{\mu}_{\nu}$  coefficients using properties of the metric, symmetries, etc.

Problem 2: Jackson 11.3

Problem 3: Jackson 11.5

Problem 4: Jackson 11.9

Problem 5: Jackson 11.10