Physics 302/572: Electromagnetic Theory II

Read: Griffiths 12.1

"**G**, **PS**" refer to Griffiths and Pollack & Stump books respectively.
Problems with stars are not for credit and will NOT be graded.

Homework 10

Exercise 1 (G 12.4)

As the outlaws escape in their getaway car, which goes $\frac{3}{4}c$, the police officer fires a bullet from the pursuit car, which only goes $\frac{1}{2}c$. The muzzle velocity of the bullet (relative to the gun) is $\frac{1}{3}c$. Does the bullet reach its target
   a) according to Galileo?
   b) according to Einstein?

Exercise 2 (G 12.8)

A rocket ship leaves earth at a speed of $\frac{3}{5}c$. When a clock on the rocket says 1 hour has elapsed, the rocket ship sends a light signal back to earth.
   a) According to *earth* clocks, when was the signal sent?
   b) According to *earth* clocks, how long after the rocket left did the signal arrive back on earth?
   c) According to the *rocket* observer, how long after the rocket left did the signal arrive back on earth?

Exercise 3 (G 12.9)

A Lincoln Continental is twice as long as a VW Beetle, when they are at rest. As the Continental overtakes the VW, going through a speed trap, a (stationary) policeman observes that they both have the same length. The VW is going at half the speed of light. How fast is the Lincoln going? (Leave your answer as a multiple of c.)

Exercise 4 (G 12.13)

Sophie Zabar, clairvoyante, cried out in pain at precisely the instant her twin brother, 500 km away, hit his thumb with a hammer. A skeptical scientist observed both events (brother's accident, Sophie's cry) from an airplane traveling at $\frac{12}{13}c$ in the

direction from the brother to Sophie. Which event occurred first, according to the scientist? How *much* earlier was it, in seconds?

Exercise 5 (G 12.21)

The coordinates of event A are $(x_A, 0, 0)$, t_A and the coordinates of event B are $(x_B, 0, 0)$, t_B. Assuming the interval between them is spacelike, find the velocity of the system in which they are simultaneous.

*Exercise 6

Make up a limerick inspired by the special theory of relativity (see an example in the problem G 12.22).