PHYSICS 101A – HOMEWORK SET 1

Due in class Friday 10/10/08. I suggest doing this assignment in several stages as we cover the relevant material in lecture and reading.

Reading: Tipler and Llewellyn, Sections 1.1-1.4.

1.) Problem 1.4 (Answer: The time difference is 8.2 s. One of the headings is 8.8°.)

2.) Problem 1.11

3.) Problem 1.12; do not answer b), but just think it over.

4.) Problem 1.13 (Answer: a) (x',y',z',t') = (-9537m, 18m, 4.0m, 3.756×10^{-5} s))

5.) Problem 1.23; assume that $v = 0.5c$ so that you can use the $\beta = 0.5$ spacetime paper handed out in class. (Answer: a) 0.87 m; b) 5.8×10^{-9} s)

6.) Problem 1.24; calculate the spacetime interval in part d) in both the laboratory and the particle's rest frame. (Answer: a) 6.0×10^{-8} s; b) 16.1 m; c) 7.0 m; d) 7.79 m)

7.) A spaceship deaprts from the Earth for the star Alpha Centauri, which is exactly four light-years away. The spaceship travels at 0.75c. How long does it take to get there (a) as measured on Earth and (b) as measured by a passenger on the spaceship? (Answer: a) 5.33 y; b) 3.53 y)

8.) Work Problem 7 using a spacetime diagram in which Earth and Alpha Centauri are at rest. (Hint: Use $c \cdot y$ as the scale unit on the axes; you can use the $\beta = 0.75$ spacetime paper handed out in class).

9.) Problem 1.28 (Answer: a) 0.721 m; b) 43.9°)

10.) Consider two events separated in space by an amount Δx and in time by an amount Δt. Show that there exists a boost $|\beta| < 1$ for which $\Delta x = 0$ if and only if the spacetime interval $(\Delta s)^2 = (c\Delta t)^2 - (\Delta x)^2$ is *timelike*, i.e., $(\Delta s)^2 > 0$.

11.) Problem 1.42 (Answer: a) 0.4 c; b) yes; d) 1370m).

12.) Problem 1.46; you don't need to do part e) in this problem. (Answer: a) 52.7 m; b) 0.987 c; c) 16.1 m; d) 2.1×10^{-7} s)

13.) Problem 1.52. (Answer: 0.798 c at an angle of 111° w.r.t the x' axis)