Name: ____ Due September 9, 2003 9:30 a.m.

Physics/Astronomy/Planetary Sciences 589 Homework 1

This homework is due on the 9th of September in class and is based on the light-travel-time lectures and notes of the week of August 25th and following.

1) A beam of light-emitting particles is moving at a speed V at an angle Θ with respect to an observer's line of sight. Show that the apparent transverse speed of the particles (as seen by the observer at a large distance) is:

$$V_{\rm app} = V \sin\Theta / (1 - \beta \cos\Theta).$$

What is the maximum possible $V_{\rm app}$ for the range of possible Θs (Hint: This is a function of V)? For what Vs can $V_{\rm app}$ be greater than c, the speed of light?

2) Calculate h, the distance from the line of sight between a point source of a light pulse and an observer at great distance and the intersection of that light pulse with a perpendicular scattering screen at a distance R_0 from the source along the line of sight, as a function of time. What is the apparent speed of the ring of intersection? Is there anything "interesting" about this result?