Answer on Question #42935, Physics, Relativity

Task: You are standing at an Los Angeles Spaceport observing a spaceship travelling towards you at 0.95 times the speed of light.

The captain of the spaceship, who is stationed midway between the front and rear of the ship, sends out radio signals to turn on light beacons located at the front and rear of the ship. He observes both beacons to be turned on simultaneously.

Without performing any calculations, describe and explain in your own words what is observed by you on the ground in Los Angeles. Use diagrams to illustrate your answer.

Solution:

Two events happening in two different locations that occur simultaneously in the reference frame of one inertial observer, may occur non-simultaneously in the reference frame of another inertial observer . From the first equation of the Lorentz transformation in terms of coordinate differences

$\Delta t' = \gamma(\Delta t - \dfrac{v \Delta x}{c^2})$. It is clear that two events that are simultaneous in frame S (satisfying Δt = 0), are not necessarily simultaneous in another inertial frame S' (satisfying Δt' = 0). Only if these events are additionally co-local in frame S (satisfying Δx = 0), will they be simultaneous in another frame S'.

The time lapse between two events is not invariant from one observer to another, but is dependent on the relative speeds of the observers' reference frames

Suppose a clock is at rest in the unprimed system S. Two different ticks of this clock are then characterized by Δx = 0. To find the relation between the times between these ticks as measured in both systems, the first equation can be used to find:

$\Delta t' = \gamma \Delta t$ for events satisfying $\Delta x = 0$.

This shows that the time (Δt') between the two ticks as seen in the frame in which the clock is moving (S'), is longer than the time (Δt) between these ticks as measured in the rest frame of the clock (S).

so we will be in Los Angelis watch deceleration time switching lighthouses than on the spaceship.