

Practise mid term exam

PHY2361

Exercise 1 :

The earth and sun are 8.3 light-minutes apart. Ignore their relative motion for this problem and assume they live in a single inertial frame, the Earth-Sun frame. Events A and B occur at $t = 0$ on the earth and at 2 minutes on the sun respectively.

- Find the time difference between the events according to an observer moving at $u = 0.8c$ from Earth to Sun. Which event occurs first?
- What is the speed of a spacecraft that makes the trip from the Sun to the Earth in 5 minutes according to the on board clocks?

Exercise 2 :

Two rockets of rest length L_0 are approaching the earth from opposite directions at velocities $\pm c/2$.

How long does one of them appear to the other?

Exercise 3 :

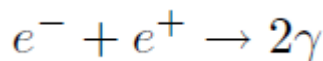
A stationary observer on Earth observes spaceships A and B moving in the same direction toward the Earth. Spaceship A has speed $0.5c$ and spaceship B has speed $0.80c$.

Determine the velocity of spaceship A as measured by an observer at rest in spaceship B.

Problem 4 :

An electron e^- with kinetic energy $K = 1.000 \text{ MeV}$ makes a head-on collision with a positron e^+ at rest. (A positron is an antimatter particle that has the same mass as the electron but opposite charge.)

In the collision the two particles annihilate each other and are replaced by two photons of equal energy, each traveling at angles Θ ($-\Theta$) with the electron's direction of motion. (A photon is a massless particle of electromagnetic radiation having energy $E = pc$.) The reaction is



The rest energy of an electron is: $mc^2 = 0.511 \text{ MeV}$

Determine the :

- energy E of each photon.
- momentum p_γ of each photon.
- momentum p of the electron before the collision if the angle $\Theta = 45.3^\circ$.

