Modern Physics Problem Set 4

Due: Sep 30, 2025

Problem 1

Three galaxies are aligned on an axis in the order A, B, C. An observer in galaxy B is in the middle and observes that the galaxies A and C are moving away from him, both with speeds $0.60c$. What is the speed of galaxies B and C as observed by someone in galaxy A?

Problem 2

A proton and an anti-proton are moving toward each other in a head on collision. If each has a speed of $0.8c$ with respect to the collision point, how fast are they moving with respect to one another?

Problem 3

A spaceship is moving at a velocity $v = 0.7c$ relative to Earth. The spaceship fires a probe at a velocity $u = 0.5c$ relative to the spaceship. What is the velocity of the probe as observed from Earth?

Problem 3

A light signal is sent from the origin of a system K at $t = 0$ to the point $x = 3m, y = 5m, z = 10m$.

a) At what time t is the signal received?

b) Find (x', y', z', t') for the receipt of the signal in a frame K' that is moving along the x axis of K at a speed of $0.8c$.

c) From your results in b) verify that the light traveled with a speed c in the K' frame.

Be careful of round off errors!