Phys 2053: Homework XI

due April 13, 2016

1. (*2 pts*) An electron is traveling wit a speed of $v = 0.2c$ in x-direction.

1. Determine all four components of its 4-velocity as well as its 4-momentum.

2. Determine its kinetic energy.

2. (*2 pts*) Electrons are accelerated to high speeds by a two-state machine. The first stage accelerates the electrons from rest to $0.99c$, and the second stage accelerates the electrons from $0.99c$ to $0.999c$. By how much does each stage increase the kinetic energy of an electron?

3. (*3 pts*) An electron having a kinetic energy of 10 GeV makes a head-on collision with a positron having the same energy. The collision produces two muons ($mc^2 = 105.7$ MeV) moving in opposite directions. Find the kinetic energy and velocity of each muon.

4. (*3 pts*) An experiment is designed in which a proton and an antiproton collide, producing a particle with a mass of 9700 MeV. What must be the incident kinetic energies and velocities of the colliding particles?