HW#10; Phys 110B. Due Wed. 4/26 (no late HW due to Midterm on Mon 5/1!)

1) Problem 12.25 (both editions). Note that in part D you need to use the (ordinary) velocity addition formulas that appear just before this problem. Be careful to transform the two velocity components separately. In part E, I hope you recognize why the transformation is much easier!

2) A) Solve Problem 12.33 (12.32 in 3rd edition).
B) Now show that the 4-momenta of the two particles add up properly.
C) Now boost all the 4-momenta (initial and final) into the center-of-mass frame (in which the final particle is at rest.) Check that they still add up properly, and that your values make sense.

3) Problem 12.34 (12.33 in 3rd edition)

4) Problem 12.37 (12.36 in 3rd edition). Hint: When you take the derivative of the denominator, you might try writing u^2 in terms of its 3 cartesian coordinates, to better see where the dot product in the answer comes from.

5) (This is a sample problem from last year's midterm!) Alice leaves Earth on a 0.8c spaceship. Bob stays on Earth. Bob waits for one year after the launch, then fires a laser pulse at Alice. As measured by Bob, the total energy in the pulse is equal to Alice's spaceship's rest mass.

A) Draw a spacetime diagram from both Bob's and Alice's perspective, each showing 1) the spaceship launch, 2) the laser emission, and 3) the laser hitting the spaceship. Label the spacetime coordinates of each event on both diagrams.

B) From Alice's perspective, how far away is Earth when she is hit by the laser?

C) From Alice's perspective, how much energy is in the laser pulse?

D) If the laser pulse is entirely absorbed by Alice's spaceship, from Bob's perspective, how fast will she be travelling after she absorbs the pulse? (Hint: add the 4-momenta together!)