ISP220 Homework #12
30 points

Your Name_____

- MULTIPLE CHOICE. Circle the best alternative or alternatives.
- DUE Thursday, April 17
- Please, Please staple!!!!

1. **(6 points) Time goes left to right. Draw and label and include arrows for:**

   i) an electron in the initial state

   ii) a positron in the initial state

   iii) an electron moving backwards in time from the initial state (different from ii!)

2. **(2 point) The "antimatter problem" refers to:**

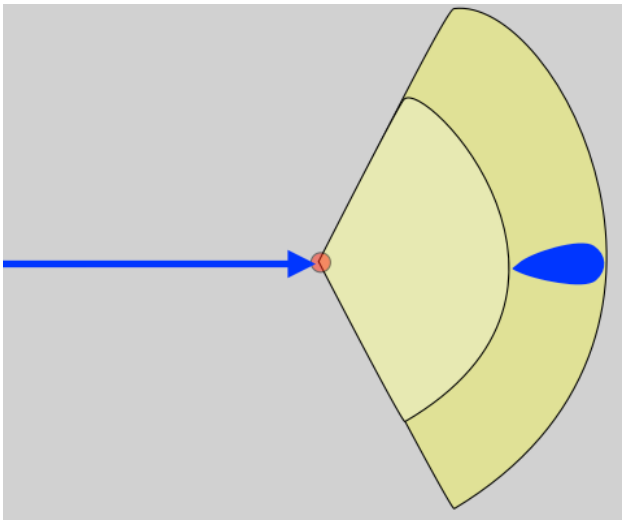
   A) the lack of positrons for medical purposes

   B) the fact that there's only half antimatter and half matter in the universe

   C) the observation that there is no apparent naturally occurring antimatter in the universe.

   D) there isn't an antimatter problem.

   E) because time seems to go both forward and backward.



3. **(2 point) In the figure above, the inner region is the tracker with a magnetic field out of the paper and the outer region is the electromagnetic calorimeter. The arrow and the blob represent respectively in particle physics:**

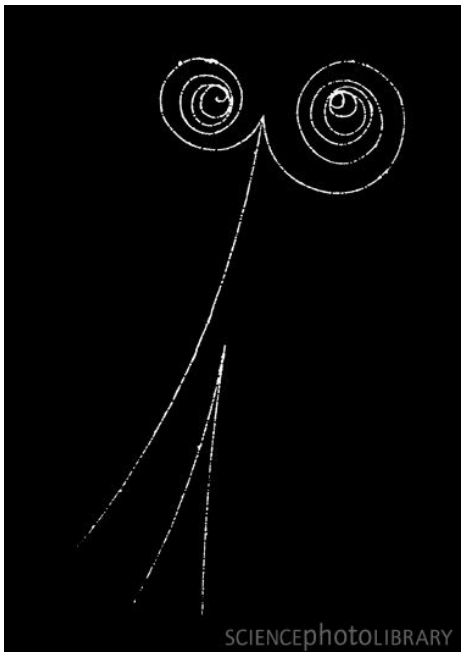
   A) an incoming electron and a photon.

   B) an incoming electron and an electron.

   C) an incoming photon and an electron.

   D) and incoming photon and a photon.

   E) a blue line and a teardrop.



4. **(3 point) In the figure above, one photon comes in from the top and initiates an interesting "trident" event of kicking out an atomic electron from the medium (the long track) and pair-producing to the curling tracks all a the same point. A *second* photon also comes in from the top about the same time and initiates the bottom pair in the inverted "Vee." The question is "pair of what" is in that photon conversion at the bottom?**

   A) two electrons

   B) an electron positron pair

   C) an electron and an antielectron

   D) none of the above

   E) B and C

5. **(2 point) The electron and positron in a Positronium atom at rest:**

   A) stays at rest as positronium atom.

   B) annihilates into single photon.

   C) annihilates into two photons.

   D) spin around one another indefinitely.

   E) There's no such phenomenon.

6. **(5 points) Carefully draw the Feynman Diagram for Compton Scattering in the space below. Label all lines. Include arrows where appropriate and don't where inappropriate. Use the proper symbols for all of the particles. Be neat.**

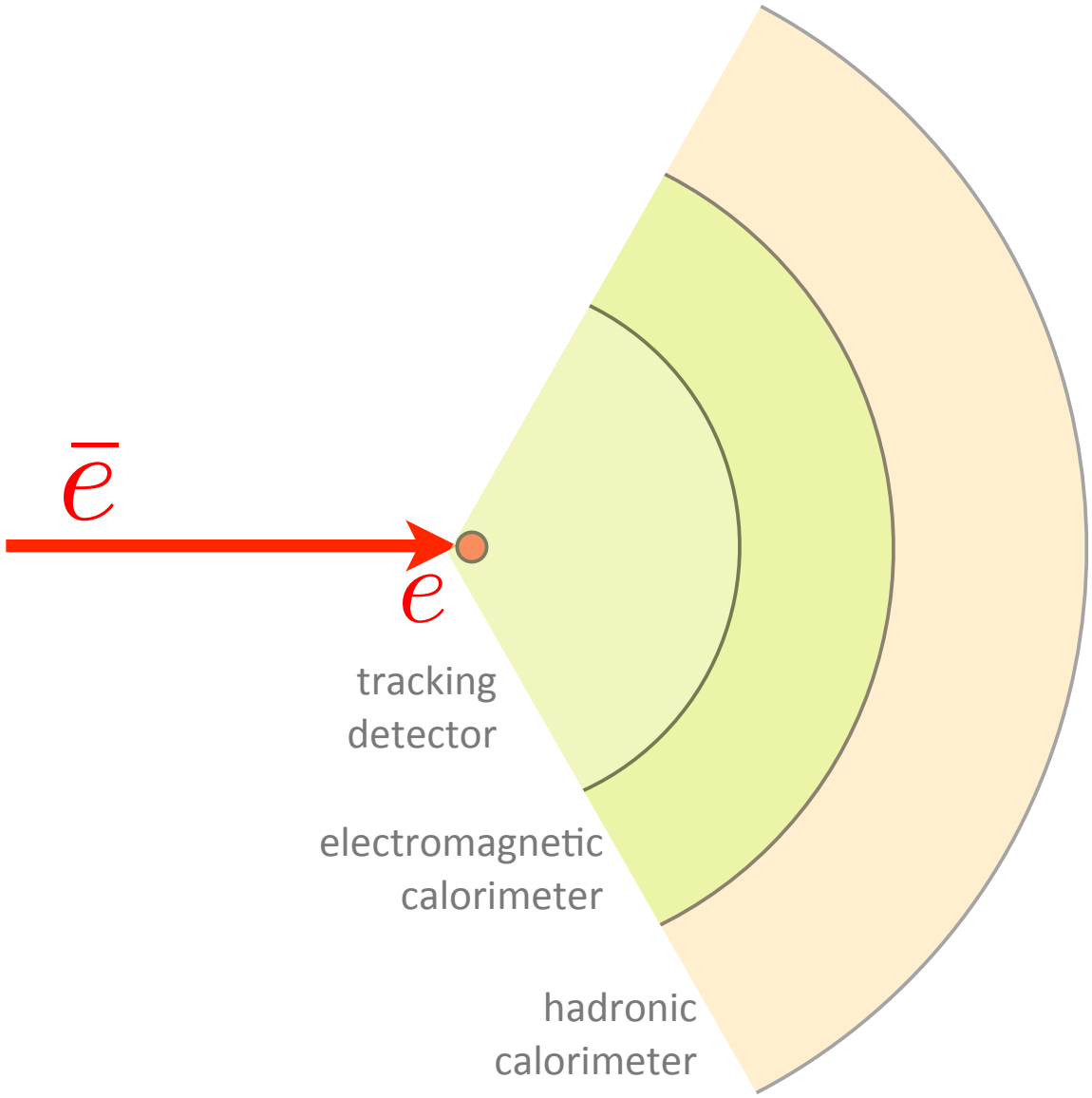
7. The figure on the next page shows the toy detector that was talked about in class. The inner region is the tracking area, with the magnetic field *coming out of the paper* like in lecture. The next ring is the electromagnetic calorimeter where electrons and photons would shower. The outer ring is the hadronic calorimeter where protons and neutrons would shower.

The situation here is the same one from lecture, except...different. Like before, the beam is a positron and the target is electrons. But the reaction is:

$$\bar{e}e \rightarrow \bar{p}p$$

(5 points) Draw the Feynman Diagram for this reaction in the space below. Use the proper symbols for all of the particles. Be neat.

(5 points) On the picture below, draw the final state as it would appear in the detector. Label the particles carefully.


$\bar{e}$
e
tracking
detector
electromagnetic
calorimeter
hadronic
calorimeter