Short HW 2: **Momentum Flow**

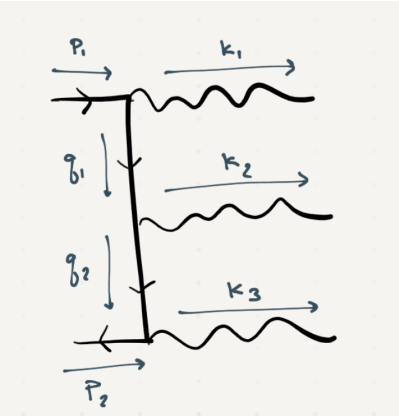
Course: Physics 165, *Introduction to Particle Physics* (2018)
Instructor: Prof. Flip Tanedo (flip.tanedo@ucr.edu)

Due by: **Thursday**, January 18

Note that this short assignment is due in class on Thursday. You have only *two days* to do it. This should be quick, I recommend doing it right after class on Tuesday.

1 Total Momentum Conservation for a $2 \to 3$ process

In class we drew the following diagram for $e^+e^- \to 3\gamma$.



Using the conservation of four-momentum at each vertex, show that the total four-momentum is conserved. That is, prove:

$$(p_1 + p_2)^\mu = (k_1 + k_2 + k_3)^\mu \ . \tag{.1}$$

Hint: Start by writing the conservation of four-momentum at each vertex. Those are three equations with unspecified q_1^μ and q_2^μ. Use two equations to determine what these virtual momenta are, then plug them into the last equation to prove the above relation.

2 Kinematics

I totally screwed up on Long Homework 1. $\mu \to e\gamma$ is possible kinematically, though not dynamically in any model we have seen thus far. Ignoring what the Feynman diagram, work out what the magnitude of the 3-momentum of the γ is in the muon rest frame. If you haven't turned it in, you should put this in your Long Homework 1 and submit it on Thursday. If you have turned it in, submit it with this Short Homework 2 and I'll grade it accordingly.

3 Read the weekly homework

Before class on Thursday, go over the weekly ("long") homework assignment due on January 23. Write out one question that you would like to have answered on Thursday. Ideally it would be about the topics of in the homework.