PHY 3106, Fall 2017, Homework #3

due Thursday, Sept. 7, at 9:30 am (beginning of class)

1.) You receive a ticket for driving through a red light. However, since you are a brilliant physics student, you decide to convince the judge that the light looked green to you. How fast would you need to be going for length contraction to make red light ($\lambda = 700\ nm$) appear green ($\lambda = 500\ nm$)?

2.) The quasar 3C 273 was measured to have a relative shift $\frac{\lambda-\lambda_0}{\lambda_0}$ of 0.158. Using this shift, find how fast the galaxy is moving away from us. [You can find more about it on Wikipedia if you type in the name, by the way.]

3.) If an airplane flies at 300 m/s around the planet, and the earth's circumference is about 4×10^7m, calculate the time dilation for an around-the-world trip. Ignore the earth's rotation and gravity.

4.) In the rest frame of the sample, the number of muons at time *t* is given by $N(t) = N_0 e^{-t/\tau}$, where N_0 is the number at *t*=0, and τ is the mean lifetime (or "half life") of 2.2 μs. A) Assume the muons are produced at a height of 5.0 km, and head toward the ground as a speed of 0.91c. What fraction will reach the ground? B) what fraction would reach the ground if classical mechanics were correct?