# Physics 1090 Homework #9

*Due Thursday December 3*

 **Reading assignment**: Chapters 21 – 25 of the notes.

**1.** Draw a diagram showing the orbits of earth, Jupiter and its satellite Io and explain in your own words how Römer found the speed of light by observing eclipses of Io.

**2.** Imagine you are in a ship with a silent engine sailing on a perfectly smooth sea, you are in a closed room with no window.

(a) How can you tell if the ship, moving in a straight line, is slowing down?  Draw a little diagram of you sitting on a chair, with the forces on you, and $\vec{F} = m\vec{a}$ .

(b) How can you tell if the ship, moving at constant speed, is moving in a circle?  Draw a similar diagram.

(c) Now imagine you don't even know the direction of the front of the ship—you're just in a featureless cubical room, but you *can* have various physics-type toys.   Do (a) and (b) feel different to you?   Could you distinguish between them somehow?   (*Hint*: Foucault's Pendulum!)

**3.** If Galileo's experiment,  the two guys with lanterns, were reenacted with lasers, one guy being on the Moon, the other on Earth, using ordinary watches for timing, how good an estimate of the speed of light do you think could be made?

**4.** After reading lecture 21, explain how much a clock is slowed down as seen by you if it's moving relative to you at 80% of the speed of light, that is at 0.8$c$, where c = 3x10$^8$ meters per second. How long would it take a spaceship moving at that speed to reach alpha Centauri, 4 light years from here?  How much would the astronauts age on the trip?

**5.** Explain *in your own words* the Fitzgerald contraction, and how it follows from the slowing down of a moving clock.

**6.** (a) Find out what Thomas Jefferson thought of Isaac Newton, and write a couple of sentences or so summarizing TJ's opinion.

(b) Write a few sentences on how the Scientific Revolution (that is, mainly, the work of Galileo and Newton) influenced the Founding Fathers and hence the Declaration of Independence, etc., (if at all!).