

PHY 251 Spring 2007: homework problem set 1, due Wednesday, Jan. 31.

Some general comments: you'll see that I always work out an algebraic solution first and then plug in the numbers at the end. Also, if you put mks (meter · kilogram · second) units in, you get an answer in mks units out. Therefore I tend to be lazy about writing the units in the numerical calculations.

**Problem 1:** Work out the speed of the earth in its orbit from first principles. That is, start from equating gravitational force and centripetal force, and use the mass of the sun, and the mean earth-sun separation distance, to calculate the earth's speed in its orbital path.

**Problem 2:** Show that one cannot use the Galilean relativity transformation of (Sep. 7 lecture, Eq. 3)

$$\begin{aligned}x_2 &= x_1 - vt_1 \\y_1 &= y_2 \\z_1 &= z_2 \\t_1 &= t_2\end{aligned}\tag{1}$$

and also satisfy in both frames  $S_1$  and  $S_2$  the relationships for expansion of light spheres (Sep. 7 lecture, Eqs. 1 and 2):

$$x_1^2 + y_1^2 + z_1^2 - c^2 t_1^2 = 0\tag{2}$$

$$x_2^2 + y_2^2 + z_2^2 - c^2 t_2^2 = 0.\tag{3}$$

**Serway problem 1.4:**

**Serway problem 1.5**

**Serway problem 1.7**

**Serway problem 1.10**

**Serway problem 1.15**

**Serway problem 1.16**

**Serway problem 1.18**

**Serway problem 1.25**

**Serway problem 1.26**