Physics 390: Homework set #1

Due Thursday September 16, 2004

Reading: Tipler & Llewellyn, Chapter 3

Questions:

1. Show that the classical wave equation

$$\frac{\partial^2 f}{\partial t^2} - c^2 \frac{\partial^2 f}{\partial x^2} = 0$$

is satisfied by *any* function f that depends on x and t in the combination $u = x \pm t$: $f(x,t) = f(u) = f(x \pm ct)$.

2. Planck's constant is $h = 6.626 \times 10^{-34}$ J·s. What familiar physical quantity from classical mechanics also has dimensions of J·s?

3. In what region of the electromagnetic spectrum does the blackbody radiation from a roomtemperature object peak? What sorts of problems would we have if our eyes were sensitive in this region?

4. The Compton scattering formula suggests that objects viewed from different angles should reflect light of different wavelengths. Why don't we observe a change in color of objects as we change the viewing angle?

Problems: 3, 14[1], 30, 36, 45, 49, 54

[1]Hint: the total energy density is $U = \int_0^\infty u(\lambda)d\lambda = \int_0^\infty u(f)df$. Remember to consider the effect of transforming the integration variable from λ to f.