HW 2: A rod of length $\ell_o$ lies in the $x'y'$ plane of its rest frame and makes an angle $\theta_o$ with the $x'$ axis. What is the length and orientation of the rod in the lab frame $(x, y)$ in which the rod moves to the positive $x$ direction with a uniform speed $u$? (Fig. 1)

HW 3: Tipler 1-42

HW 4: The Doppler effect is used in many devices especially in tracking moving bodies. Consider a satellite moving with velocity $\vec{v}$ at $\vec{r}$ from a ground radar. The satellite sends out EM signal of frequency $f_o$ (proper frequency). The detector on the ground would detect Doppler shifted frequency $f_D$. Since the frequency $f_o$ is known, the ground station would measure the beat frequency $f_D - f_o$.

(1) Show that $f_D - f_o \approx f_o \left( 1 + \frac{v}{c} \cos \theta \right)$. Here $\theta$ is the angle between $-\vec{r}$ and $\vec{v}$.

(2) The radial velocity of the satellite is $\frac{dr}{dt} = \hat{r} \cdot \vec{v}$. Then you can calculate the total radial distance of travel between times $t_a$ and $t_b$ by simply counting the number of cycles of beat frequency ($N_{ba}$):

$$\Delta r = r_b - r_a = -\lambda_o N_{ba},$$

where $\lambda_o$ is the proper wavelength of the satellite signal.

HW 5: Tipler 1-43.

HW 6: Tipler 2-3 (a) and (b).

HW 7: Tipler 2-8 (a) and (b).
HW 8: Tipler 2-9.

HW 9: Tipler 2-42.