Observational Astronomy - Spring 2014
Homework 10 - Cosmology 1

1. Figure 1 on the next page shows the Period-Luminosity relation for Cepheid variable stars, and Figure 2 shows measurements of the brightness of a Cepheid variable in the Andromeda galaxy. Using these two figures, calculate the distance to the Andromeda galaxy. Use the average brightness of the Andromeda Cepheid when applying to Figure 1.

2. The H_β spectral line is measured in the lab to have a wavelength of 486.1 nm. You measure the spectrum of a nearby star and find that this line is blue-shifted and has a wavelength of 485.7 nm. Is the star approaching us or receding from us? At what velocity?

3. You measure the spectrum of a galaxy and find that the galaxy has a redshift z = 0.06. How fast is it moving away from us? If the Hubble constant is 70 km/sec/Mpc, how far away is the galaxy?

4. Let's estimate the age of the universe. Pick two galaxies, one 10 Mpc away, and one 100 Mpc away. Calculate how fast each one is moving away from us, assuming a Hubble constant of 70 km/sec/Mpc. Assuming they have always been moving at that speed, calculate how long it has taken them to reach their present distance. Do you see that this will give the same result no matter how far away the galaxy is? What is your estimate of the age of the Universe given this procedure?
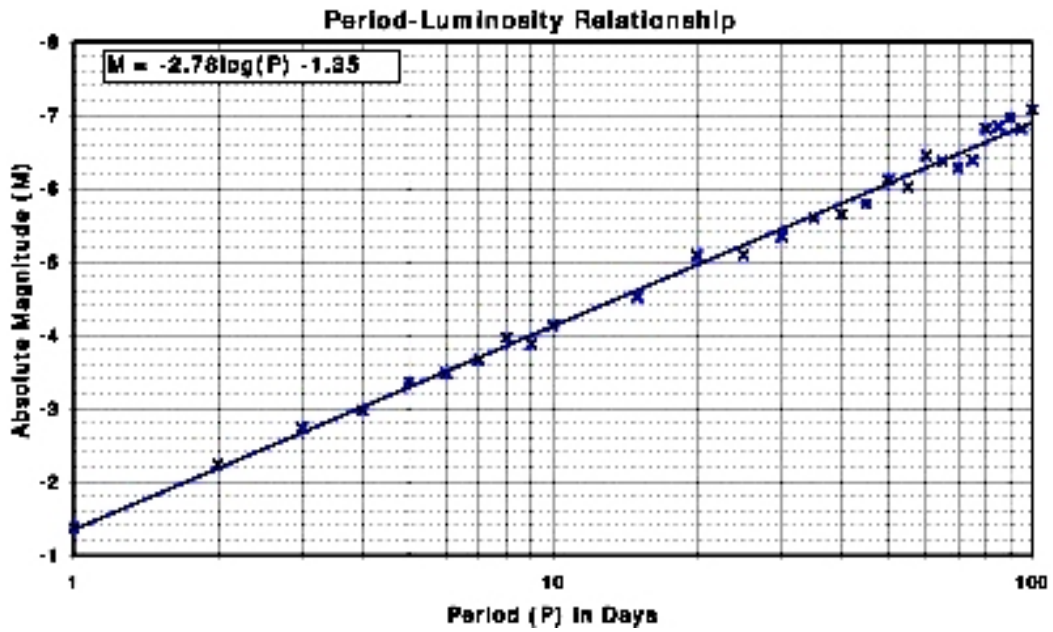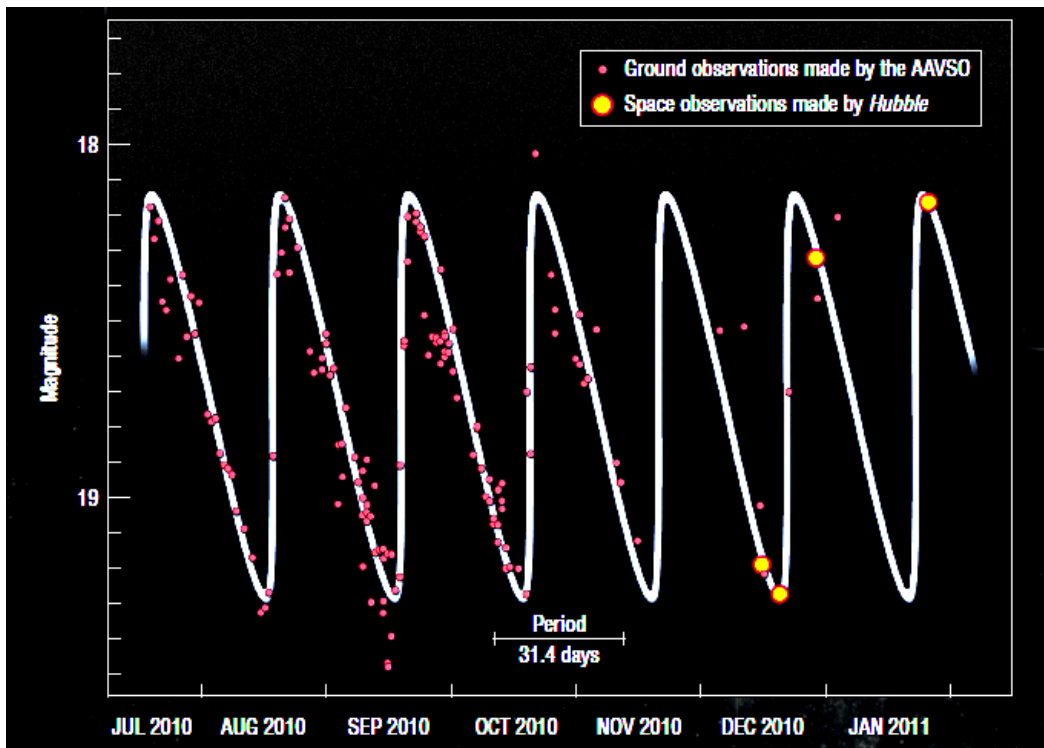
Figure 1: Cepheid Period-Luminosity Relation

Figure 2: A Cepheid measured in the Andromeda Galaxy