PHYS4000 Introduction to Astrophysics   HW #6   Due 28 Apr 2017

(1) Maoz, Problem 8.1.

(2) Maoz, Problem 10.8.

(3) *Double points.* Find the distance to the galaxy M81 using the Cepheid variable observations described in W. Freedman, et al., Ap.J. 427(1994)628.

Download the file m81vDataPruned.csv from the course website. It contains the data for the first 24 Cepheids in that paper, in a format readable by any number of computer programs. The first column is the day of the observation, and the next 24 columns are the apparent visual magnitudes for the star in question on that day.

The Period-Luminosity relationship for Cepheids (the line shown in Maoz Fig. 8.1) is

$$L = 282 \, L_\odot \, (P/\text{day})^{1.10}$$

and you can convert apparent visual magnitude m to observed flux f with

$$m = 4.74 - 2.5 \log_{10} \frac{f}{f_0}$$

where $f_0 = 3.21 \times 10^{-10}$ W/m^2. (See Carroll and Ostlie.) For this calculation, use the average visual magnitude of the Cepheid in question.

Note that Freedman's measurements were over a long period of time, in fact covering several periods of any of the Cepheids. You will need to spend some effort to piece together a full pulsation and calculate the period. *Use at least two Cepheids*, best with two rather different periods, to make a distance determination and demonstrate consistency.