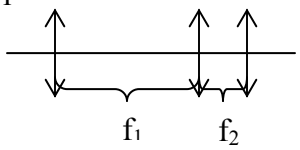
PHY 431 Homework Set #5

Due October 22 at the start of class

1) Aperture Stop (35%)

Consider the following simple telescope configuration made up of these lenses as follows:

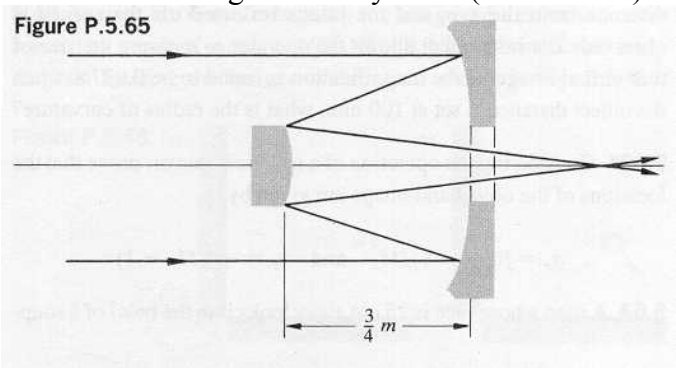
L_1: f_1=10 cm, Diameter(D) = 4 cm
L_2: f_2= 2 cm, D =1.2 cm
L_3: f_3= 2 cm, D =1.2 cm

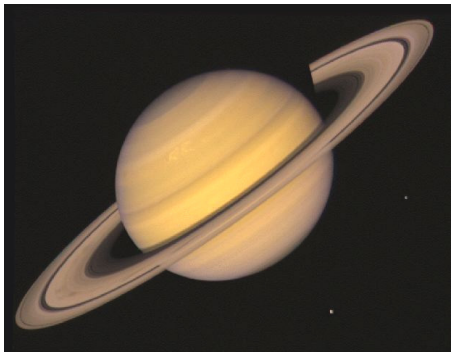


a. Trace a typical bundle of rays through the system.
b. Calculate the position of the exit pupil and the diameter of the exit pupil.

2) Telephoto (25%)

[Hecht 5.65] A homemade telephoto "lens" (Fig. P.5.65) consists of two spherical mirrors. The radius of curvature is 2.0 m for the primary and 60 cm for the secondary. How far from the smaller mirror should the film plane be located if the object is a star? What is the effective focal length of the system? (use f = -R/2)





3) Astronomical Telescope (40%)

(A) An objective of an astronomical telescope has a diameter of 12.5 cm and a focal length of 85.0 cm. When it is used with an eyepiece having a focal length of 2.5 cm and a diameter of 1.5 cm, what will be

a. the angular magnification,
b. the object diameter of the exit pupil,
c. the object field angle,
d. the image field angle, and
e. the eye relief (distance between the eyepiece and your eye).

(B) The diameter of the Saturn is 74,500 miles, and it is located 746 million miles away from the earth. If you can resolve one tenth of the size of the Saturn, you can resolve the ring around the Saturn. Assume normal visual acuity. What is the minimum magnification required for a telescope to resolve the ring? What is the minimum diameter of the objective? Does the telescope in (A) meet the requirements?