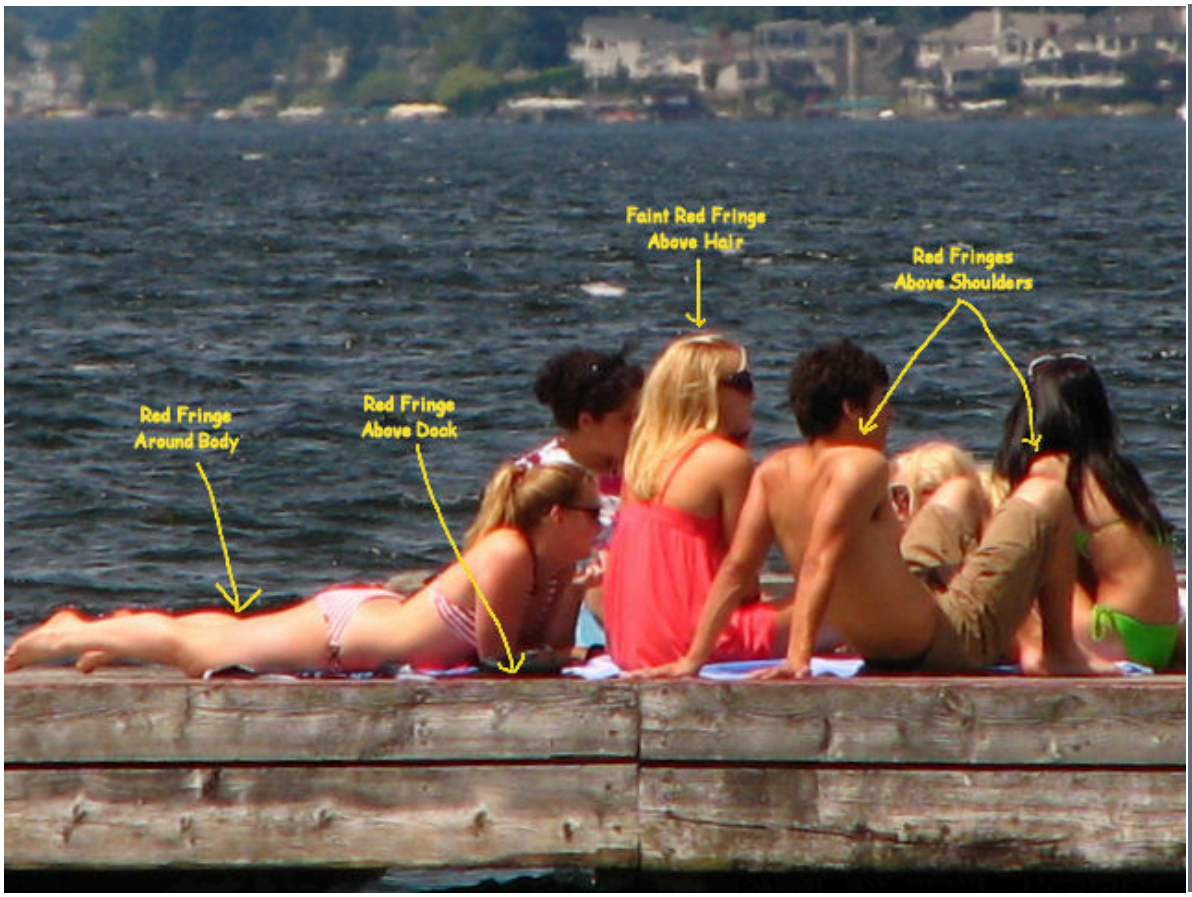
UCA Department of Physics and Astronomy

PHYS 3345: OPTICS



red fringes = chromatic aberration

Assignment 07: Chapter 06
DUE: March 07, 2008

Spring 2008

Work each problem neatly and completely. Unless otherwise noted, each problem is worth **4 points**. You should solve on green engineering paper or blank unruled paper. You must include sufficient demonstration of your problem solving process. If a problem is to be solved by inspection, state this. If graphs or plots are required, you should use an appropriate tool for their construction (there are several respectable options available on the computers in LSC 114).

1. See Figure 6.3 on page 244. For the positive and negative meniscus lenses, construct accurate ray diagrams to show that the principle planes are located outside the lenses as shown.
2. For the positive meniscus lens described in Problem 6.16, calculate the focal length and the locations of the principle planes if the lens is immersed in air. Where would you place an object to result in a real image with transverse magnification $M_T = -1.25$?
3. Hecht, problem 6.16.
4. Hecht, problem 6.22.
5. A thick bi-concave lens ($n_L = 1.5$) has $R_1 = -10.0$cm, $R_2 = +5.0$cm and thickness $d_L = 1.00$cm. Find the system matrix and use it to determine the front and back focal points and the locations of the principle planes. Determine the location and size of the image of an object 1.00cm tall placed 10.0cm in front of the front principle plane.

Review Questions

These are not assigned for grading, but they are the sort of conceptual questions that you should be able to address adequately if they were to show up on an exam.

1. What are the six cardinal points of a lens system?
2. What is meant by calling the principle planes “unit planes?”
3. Distinguish between a meridional ray and a skew ray. Would a 2x2 system matrix be sufficient to transform a skew ray? (Hint: how many variables do you need to uniquely define a skew ray? What would the resulting ray matrix look like?)
4. Describe longitudinal spherical aberration, and distinguish it from transverse spherical aberration (text has a typo: it should be *transverse*, not traverse SA on page 255).
5. How is coma a separate effect from spherical aberration?
6. Use Figure 6.37 (page 268) to explain why the sunbathers in the above photo seem to have red fringes (as opposed, for example, to blue auras or angelic white halos).