Homework Set #7 **Due: 5-14-12**

(1) Parallel rays are incident on a +100 mm, planoconvex lens, made of a glass with n = 1.5.

(a) If the lens is oriented so that the rays hit the curved side first, where are the foci associated with the *reflections* from the two lens surfaces. (Two answers required, one for each surface.)

(b) Repeat (a) for the case where the rays hit the flat side first.

This may be a little tricky at first but you don't need pages of calculations. More than one approach is possible.

(2) The index of refraction of a medium is often fairly well-described by the *Sellmeier* equation:

$$n^2(\lambda) - 1 = \frac{B_1 \lambda^2}{\lambda^2 - C_1} + \frac{B_2 \lambda^2}{\lambda^2 - C_2} + \frac{B_3 \lambda^2}{\lambda^2 - C_3}$$

The coefficients for many glasses can be found in the Schott catalog which is linked to on the public web site, or available from the Schott web site:

http://www.us.schott.com/advanced_optics/english/our_products/materials/data_tools/index.html.

BK7 is specified on p10 and SF5 on p 88. Look at these pages as well as pages 1-4 to see what everything means. You can go for years without needing this kind of detail, but I've had to refer to this catalog more than a few times.

(a) Plot both indices of refraction and the focal length of the achromat designed in example 4.6 over the optical spectrum.

(b) Come up with a figure-of-merit for how well the achromat works over the range 500 – 650 nm. By figure-of-merit, I mean a single number that characterizes the performance of the achromat and would allow you to compare one achromat with another and pick the best one, without having to look at graphs and tables of numbers.

I'll pretty much accept anything that's not flat-out wrong. This is not a common homework question for you, but it is the kind of thing people doing research have to come up with. Do a good enough job and you might even get it named after you. Look up the Schumacher coefficient! Nothing, right? Nada.

(3) text 4.22

(4) text 4.23

(5) text 4.24

Problems (1) and (2) are worth 15 points each. The rest, 10 points.