PHGN 480: Laser Physics due 14 Oct 2011
Homework 6

Geometric optics problems:

1) Svelto 4.1
2) Pump laser optics: a Ti:sapphire laser is pumped with a collimated green laser beam (532nm, diameter d=2mm) and lases at 800nm. To get good pump overlap with the laser mode, the pump beam is focused through the curved dielectric mirror that is near the laser crystal.
    a. If the curved mirror radius is 100mm, and the pump lens focal length is 75mm, determine the distance the lens must be from the curved mirror to place the pump beam focus at the focal point of the curved mirror. Treat both optics as "thin". You can solve this either with ABCD or the imaging equation.
    b. What is the f-number of the final beam focus? (f-number = dist to focus/beam diameter). If we now treat the beam as a Gaussian laser beam ($d = 1/e^2$ diameter), what would the diffraction-limited focal spot diameter be?

Fabry-Perot probems: problems 4.3 and 4.4 have answers in the back of the book – you can use these as worked examples.

3) Svelto 4.5
4) A scanning Fabry-Perot interferometer can be used to look at the longitudinal modes of a laser. A Nd:YAG laser is oscillating at the wavelength of 1.064mm on 100 longitudinal modes spaced by 100 MHz. Design a scanning Fabry-Perot interferometer made of two air-spaced mirrors that is able to resolve all these modes. Include in your design the spacing of the mirrors, the finesse and the corresponding minimum mirror reflectivity. In addition specify the sweep distance that the piezoelectric transducer that corresponds to one free spectral range of the interferometer.

Gaussian beam problems: problems 4.7, 4.9, 4.11, 4.13, 4.14 are also answered at the back of the book. These are all useful examples.

5) Svelto 4.8
6) Svelto 4.10