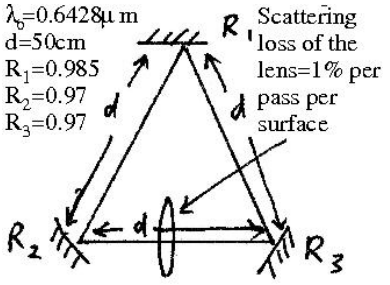
HW 6 due 10/25/2017 (no late homework)

1) Consider a soap film that is illuminated by white light. If the film is emerald green (wavelength = 510 nm), how thick is the film which acts like an etalon? Is this the only possible thickness? Assume the soap film has an index of approximately n=1.34 and that you are viewing it at an angle of 45 degrees. (10 points).

2) Problem 10.1-6 (page 401 of the text book)[Problem 9.1-3 page 340 of the 1st Ed.]. (10 points)

3) Consider a laser cavity formed by 3 mirrors that make up an equilateral triangle, see the diagram for the parameter of the cavity. (10 points)



a) Find the free spectral range ($\Delta\nu_{FSR}$ or ν_F) of this cavity.
b) Find the photon lifetime (τ_p).
c) Find the finesse ($\mathcal{F}$) of the cavity.
d) Find the cavity Q.
e) Find the linewidth $\delta\lambda$ in nm.

Extra Credit

4) For the following problem, you will need to take a ruler to measure the figure. (To save your time, I have measured and marked some physical length in cm on the figure by hand.) Drawn to scale in the graph below is the relative power transmitted through the cavity as the distance d is increased from initial value of $d_o = 2\,\text{cm}$ to 2cm + 0.5 μm. The source is a single-mode laser of wavelength of wavelength λ_o and the cavity is filled with air.

a) What is the wavelength of the source?
b) What is the finesse?
c) Find the full width at half maximum (FWHM) of the resonance and express your answer in MHz.
d) What is the cavity Q?
e) Find the photon lifetime.