Homework Set #9 **Due: 5-29-12**

Turn this homework set in promptly <u>by noon</u>. I will post solutions at 12:30 pm so you can have them to study for the midterm.

(1) Derive the relation on text page 211: $r_m^2 = 2Rm\lambda$.

Don't start with the equation given in the middle of the page beginning: $\Delta z = R - \ldots$
If you want to use that (I didn't), show that it is true first. No matter your approach, you will need to use the fact that the path length difference responsible for the phase difference is small compared to R.

(2) In a coherent detection scheme, the local oscillator at the IF amplifier has a power of 1.0 W and the signal has a power of 1.0 mW. Both beams can be taken to have uniform spatial modes 3 mm in diameter. The LO beam has a wavelength of 630 nm and the signal wavelength is only slightly different. **(a)** What is the maximum possible power level of the IF component? **(b)** Suppose the LO and signal beams are not collinear, but have a 2^o angle between their k-vectors. What is the phase difference variation between them across their beam profiles? (Assume the beam profiles are still fully overlapped

(3) What is the phase and group velocity of these wavelengths for BK7: 400 nm, 500 nm, 600 nm, 700 nm.

(4) text 5.31

(5) text 5.39

(6) text 5.41

(7) text 5.45