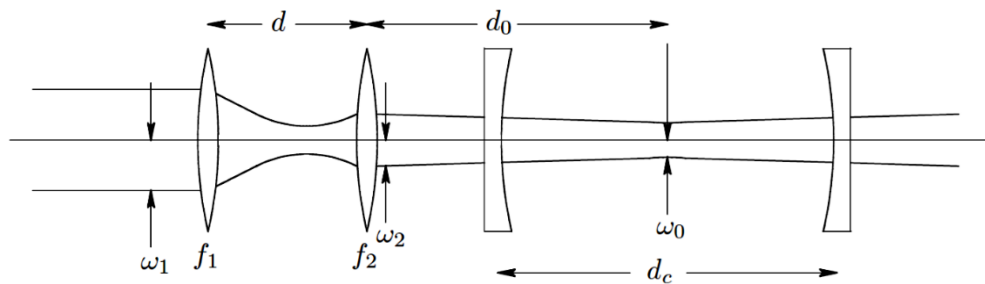


Homework #5 (Due date Nov. 9.)

1. Derive Eq. 2.64 and Eq. 2.65 in the main textbook.
2. Problem 2.7 of the main text book (Quantum Electronics for Atomic Physics).
3. Can you explain the procedure #4 at page 32 of the main text book. How much do you need to separate the distance between two lens from  $f_1+f_2$ ? Estimate the distance for the following two cases.
  - 1) The mode matching to the following confocal cavity of  $R = 10\text{ cm}$  with the laser beam of  $\lambda = 1\text{ }\mu\text{m}$ . The waist of the input beam is  $\omega_1 = 1\text{ mm}$ . Here you assume the beam waist is located at the position of lens  $f_1$ , wherever it is. What are your choices of  $d_0, f_1, f_2$ , and  $d$  for the proper mode matching? How much different the distance  $d$  from  $f_1+f_2$ ?



- 2) The mode matching to the fiber, which requires the beam waist  $\omega_0 = 20\text{ }\mu\text{m}$  at the surface of the fiber for  $\lambda = 0.532\text{ }\mu\text{m}$ . The waist of the input beam is  $\omega_1 = 1\text{ mm}$ . Here you assume the beam waist is located at the position of lens  $f_1$ , wherever it is. What are your choices of  $d_0, f_1, f_2$ , and  $d$  for the proper mode matching? How much different the distance  $d$  from  $f_1+f_2$ ?