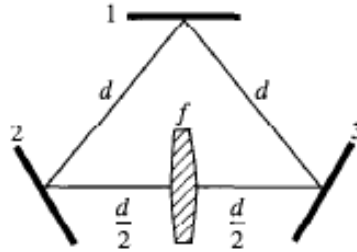


Laser Physics I (PHYS/ECE 464), Fall 2022

Homework #3, Due Monday, Sept. 19

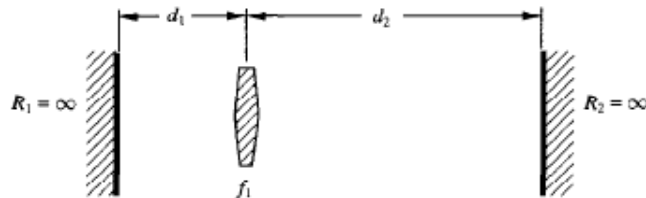
1 Consider the ring laser cavity shown in the accompanying diagram.

- Show an equivalent-lens waveguide for this cavity and identify a unit cell starting just after the lens and proceeding counterclockwise around the triangle.
- What is the transmission matrix for this unit cell? (Demonstrate that you have the component matrices in proper order.)
- What are the values of d/f that make this a stable cavity?



2 Consider the cavity shown in the accompanying diagram.

- Construct an equivalent-lens waveguide.
- Indicate a unit cell starting at a flat mirror, R_1 .
- Find the ray matrix for the unit cell of (b).
- Discuss the stability of this cavity by constructing a diagram similar to Fig. 2.9.



3. Consider the double concave confocal cavity shown below:

- Find the roundtrip ABCD matrix (Choose the starting point to be just before mirror 2).
- Discuss the stability of this cavity for the symmetric $R_1=R_2$, and asymmetric ($R_1 \neq R_2$) cases.
- A ray parallel to optical axis is incident on mirror 2 at a distance x_0 -as shown. Derive an expression for the position $x(s)$ of this ray (on mirror 2) as a function of roundtrip number s . Discuss your results for cases $R_1=R_2$, $R_1>R_2$ and $R_1<R_2$.
- Draw the ray diagram for a few round trips in each case.

