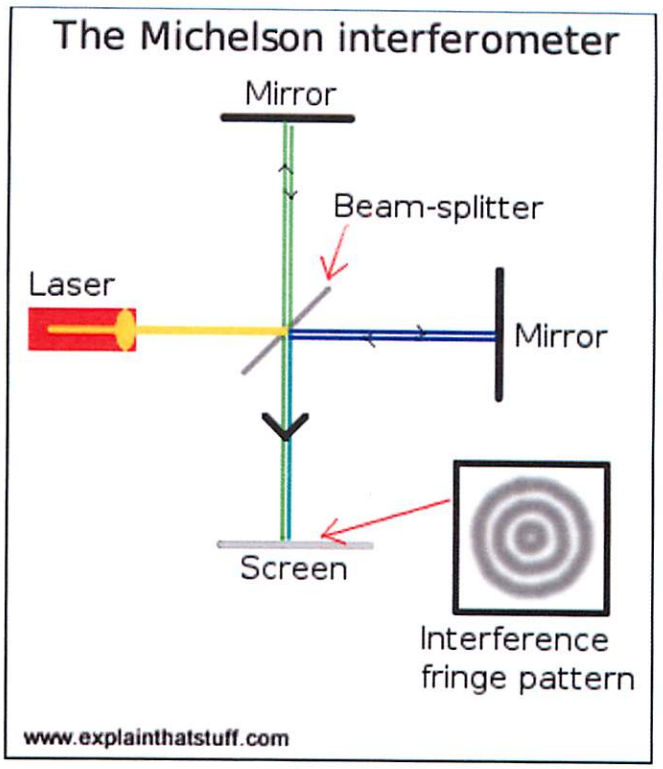
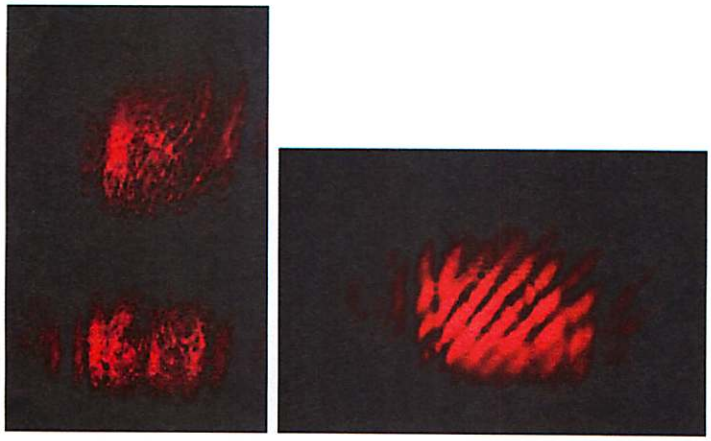

The Michelson interferometer
Mirror
Beam-splitter
Laser
Mirror
Screen
Interference
fringe pattern
www.explainthatstuff.com

Figure 5: Photos of the output beam projected on a wall. On the left are two misaligned beams. Fringes due to optical imperfections are visible on the beam spots but are not sensitive to changes in the alignment of the optics. The picture on the right shows the beams overlapping and highly sensitive fringes, traveling across the beams at an (arbitrary) 45 degree angle.



3 Use and Interpretation

3.1 What are you looking for?

To observe an interference pattern it is important that the two reflected beams occupy the same space, that is, they need to overlap on the beam splitter. With the laser on, start by aligning the non-adjustable mount so that it's beam hits near the middle of the beam splitter and position the beam expander so that this beam, after it reflects off the splitter, passes through it and can be projected onto a wall or paper. Next move the adjustable mirror so the beams overlap. Depending on the degree of misalignment you can look for the two beams on the wall, on the beam splitter or by moving a paper around near the beam expander.
Once you see the beam spots overlap you should see fringes, dramatic lines of light and dark. Depending on your alignment they are likely to look relatively straight. A perfectly aligned Michelson will show circular interference patterns. An example of such lines is shown in **Figure 5** The more lines there are the more of an angle between the two mirrors. To decrease the number of lines and increase the interferometer's sensitivity, you may need try displacing the mirrors (from side to side) and then re-adjust the angle of the adjustable mirror.

3.2 Ideas to explore

The interferometer is very sensitive to disturbances. Some things you can explore include:

- Vibrations from the ground, such as having someone jump near the interferometer and then trying to damp the motion with different materials.
- Changes in the air between the arms, such as breathing down one arm or heating the air.
- Applying heat one part of the platform so relative arm length slowly changes.

3.3 Additional Resources

Optics, Eugene Hecht, 4th Edition, Addison Wesley, 2002, page 407. Provides a mathematical derivation of the circular fringes obtained when the interferometer is precisely aligned.

Hyperphysics provides a basic overview of light behavior and includes schematics of the Michelson interferometer, photos of fringes and details of the Michelson-Morley experiment. `http://hyperphysics.phy-astr.gsu.edu/hbase/HFrame.html`.

Figure 6: Layout of a Michelson Interferometer