INTERFEROMETRY

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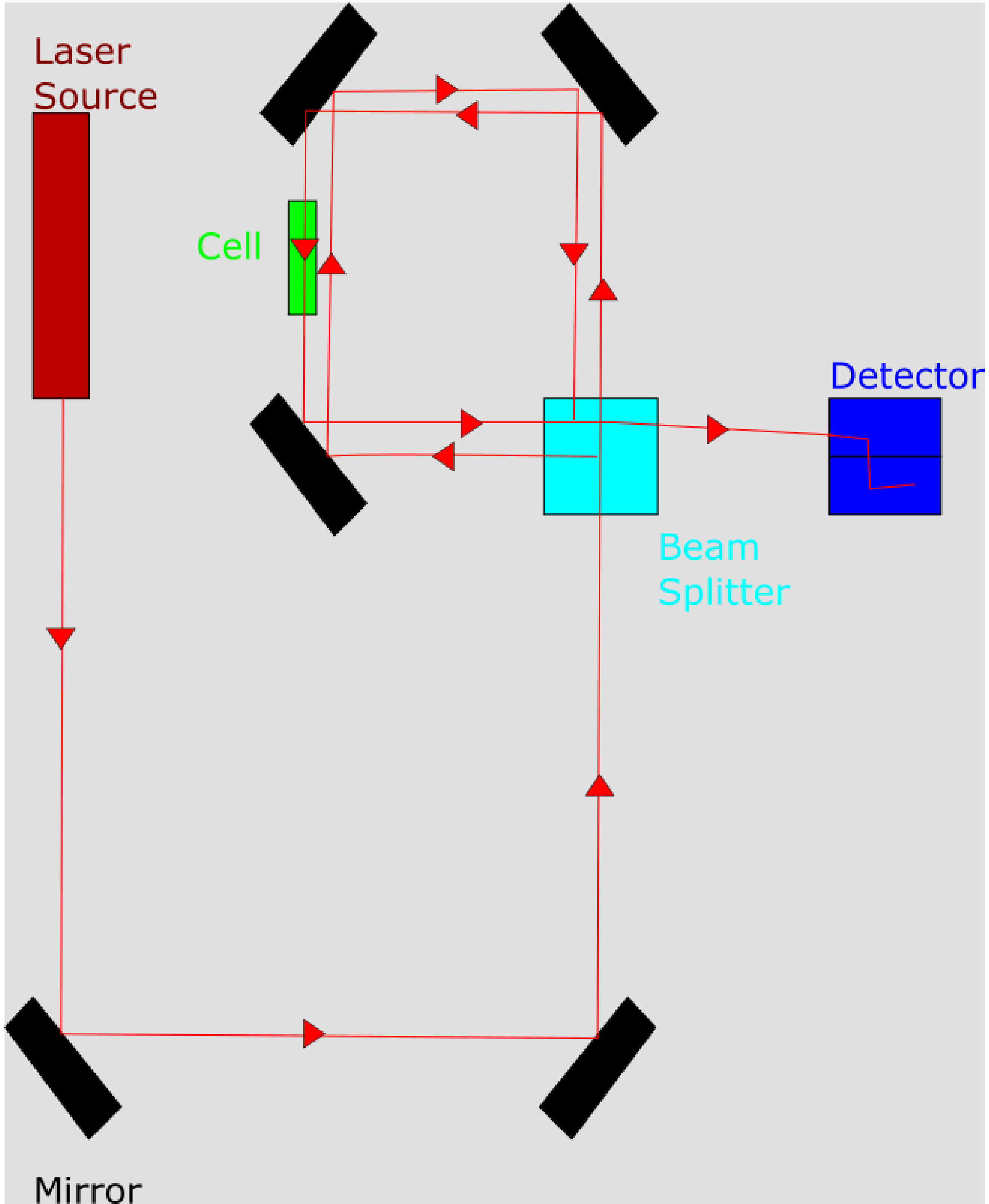


EXPERIMENTAL SETUP

Our setup relied on multiple mirrors to direct the beam toward the beam splitter. Past the beam splitter, we used three mirrors at roughly 45° angles. There are setups that involve fewer mirrors, but they require more precision to calibrate.

MAIN IDEA: MICHELSON INTERFEROMETER

- Beam is split, then recombined.
- While the beams are split, one can be altered without altering the other.
- Recombination causes interference.
- Relating fringe count to change in distance and wavelength allows us to calculate either distance or wavelength.
- Effective distance through a gas is dependent on index of refraction, which changes with pressure.
- Michelson-Morley experiment popularized the setup
- Used to directly observe gravity waves.

MAIN IDEA: CONSTRUCTIVE AND DESTRUCTIVE INTERFERENCE

- The constructive interference happens went the both wave are add to make on wave.
- Destructive interference happen went one wave troughs out of phase.
- Michelson-Morley experiment used interference to count fringing.
- Light have wave like property, so interference have contractive and destructive interference

EQUIPMENT: DIELECTRIC VS METAL FILM

- There are several kinds of beam splitters. Two methods are to use a dielectric or metal film coating.
- The purpose of a beam splitter is to have both a high transmittivity and a high reflectivity so that a beam hitting it at a 45° angle will be split into a reflected and transmitted beam.
- Dielectric coating is made of several layers of various thickness and materials.
  - These exploit various indices of refraction to manipulate the way light travels through them.
  - Dielectric coating layers are generally made of metal oxides.
  - Minimal effect on polarization
  - Roughly splits the beam 50/50 in terms of intensity
  - Usually tuned in to a single wavelength, which is inconvenient for some uses
- Metal film, or half-silvered, beam splitters use an extremely thin layer of metal so that there is both significant reflectivity and transmittivity.
  - Significant loss of intensity
  - Uneven polarization and splitting
  - Work for wide bandwidths, which makes them useful favorable when dielectric coatings cannot be used.

EQUIPMENT: MIRROR

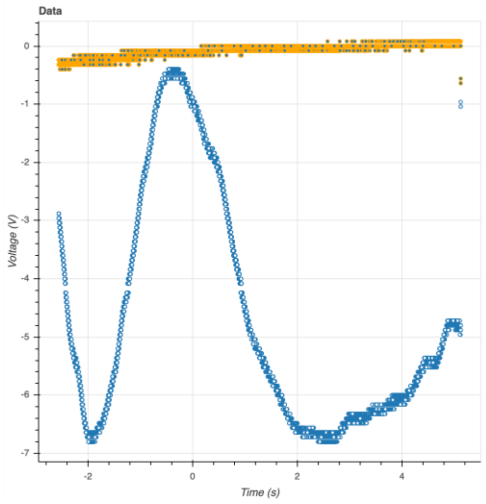
- You can achieve the proper alignment of the mirrors by using metal block
- In this experiment the number of bright and dark fringes of the interferometer will be counted in order to measure the path length change due to a moving mirror.
- Realigned our interferometer was easy, we realigned every week.
- $k = \frac{microns\ of\ actual\ mirror\ travel}{mictons\ of\ travel\ of\ the\ screw\ threads}$

DATA ANALYSIS

Fringe count corresponds to the number of peaks or valleys in the optical data.

Wave length= 633nm

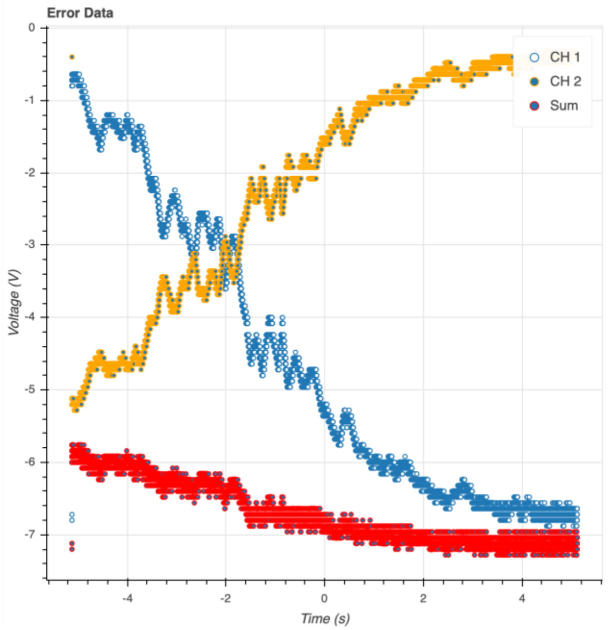
10v = 1atm

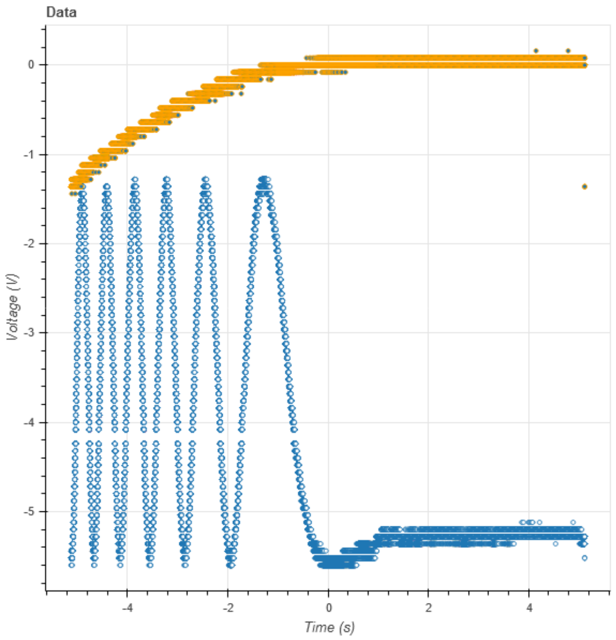


$$d = \frac{N\lambda}{2}$$

$$d = \Delta n L$$

$$n = 1 + kp$$





By solving for k, $n = 1 + \frac{N\lambda}{2L\Delta p} p$

Run	Voltage Error	n at 1 atm	K	N	Δp	Error
Run	0.0496	1.00+4^3	1.897*10^-5	6	1.001	0.0002