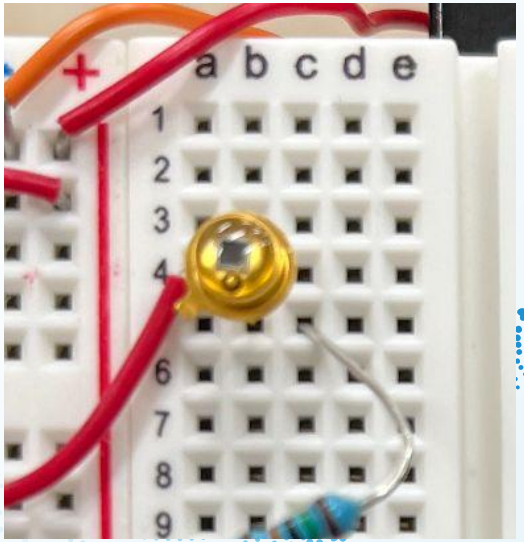
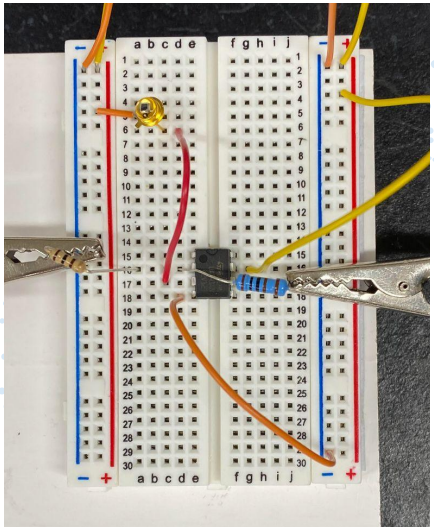
Setup and Procedure

Photodiodes

- Receives light, creates a voltage
  - Photovoltaic effect
- Must be powered
- Measures intensity of light, not wavelength



Assembling a Spectrometer

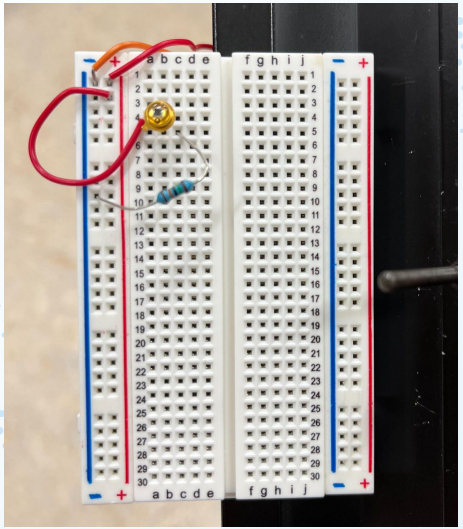


Initial design with op amp

General Design
- Powered by 9V battery
- Photodiode used to receive light
- Record intensity received by photodiode

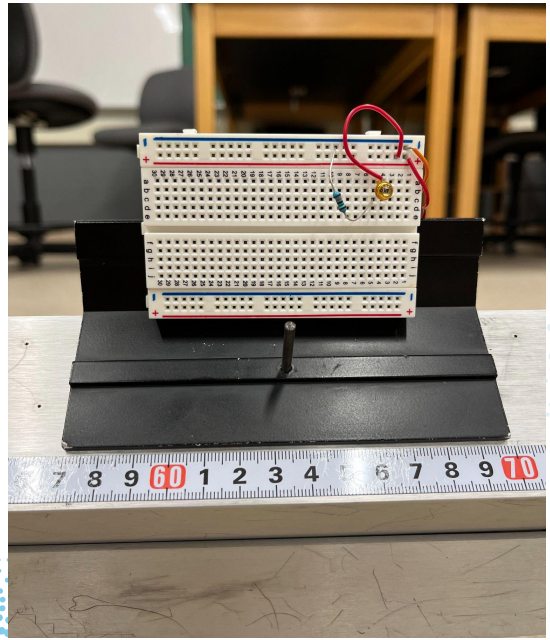
Initial Design
- Included op amp to lower environmental interference

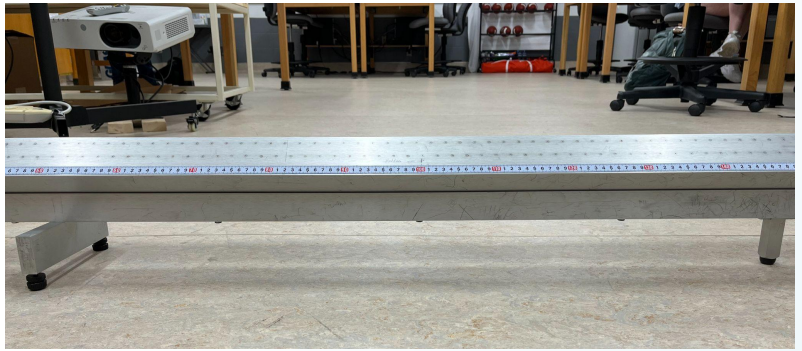
Final Design
- Included high-resistance resistor
- Same principle as op amp



Final circuit design

Use of an Airtrack





- Light source placed in front of airtrack
- Photodiode centered on source's center maximum
- Voltage measured with displacement from center maximum
- Higher voltage = higher intensity

Atomic Emission Setup

Blackbody Experiment
(Not pictured)

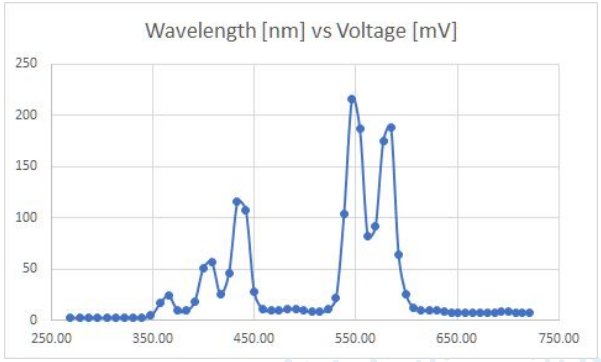
- Light bulb as light source
- Diffraction gradient placed in front to separate light waves
- Data recorded with multimeter

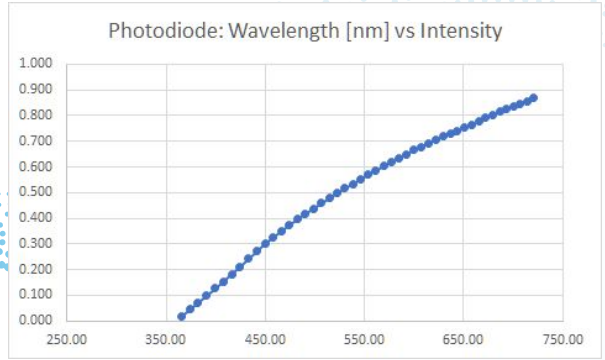
Atomic Emission Experiment

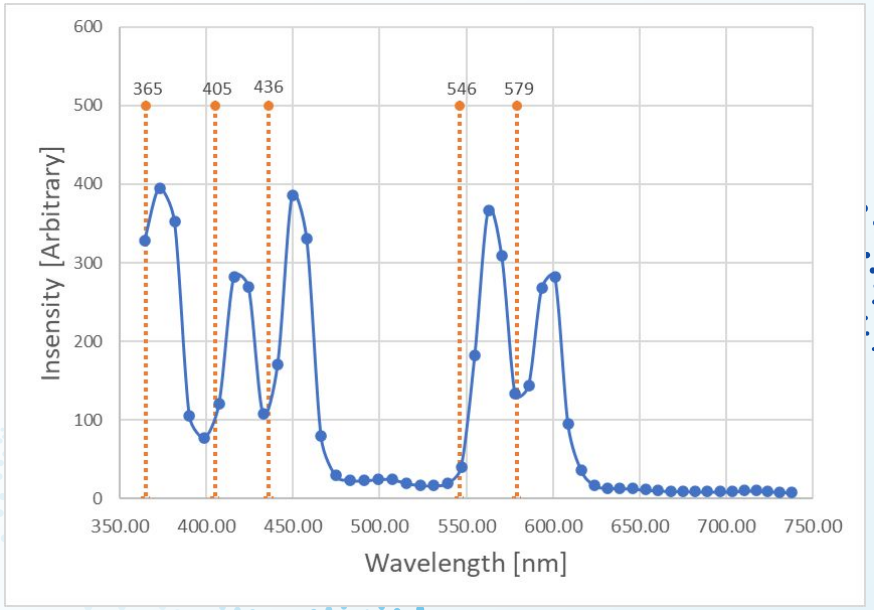
- Similar to blackbody experiment
- Used mercury gas tube
- Start recording data before visible light

Results

Mercury Spectrum

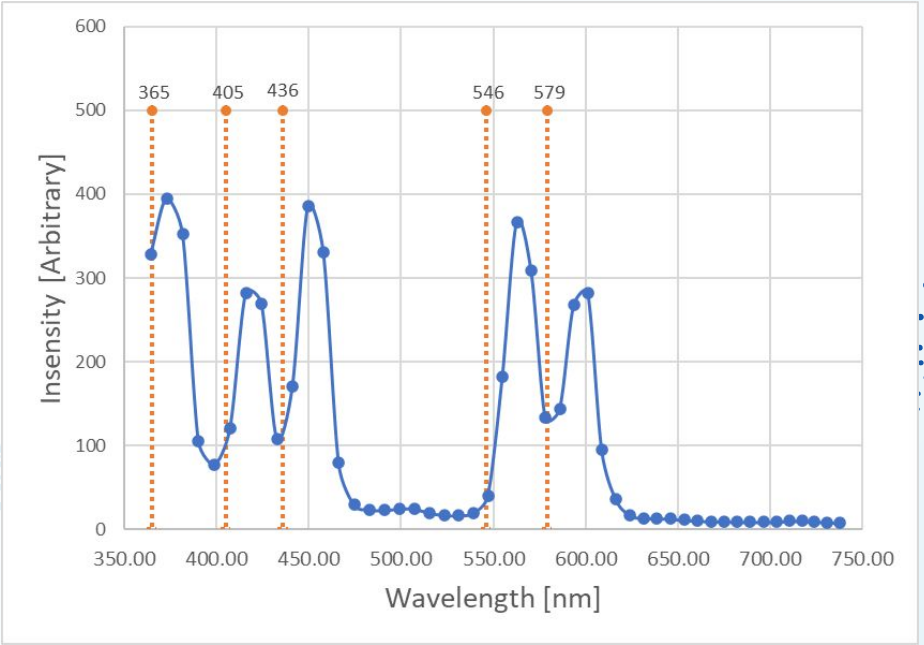




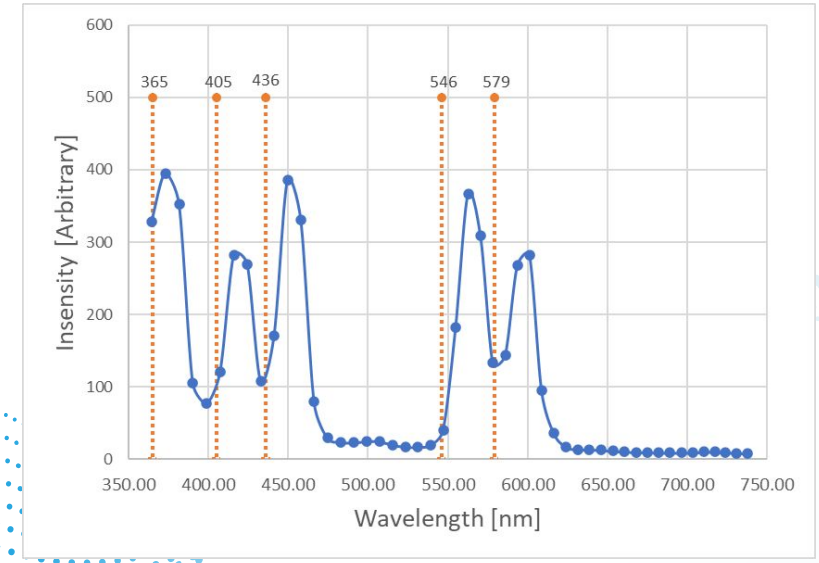


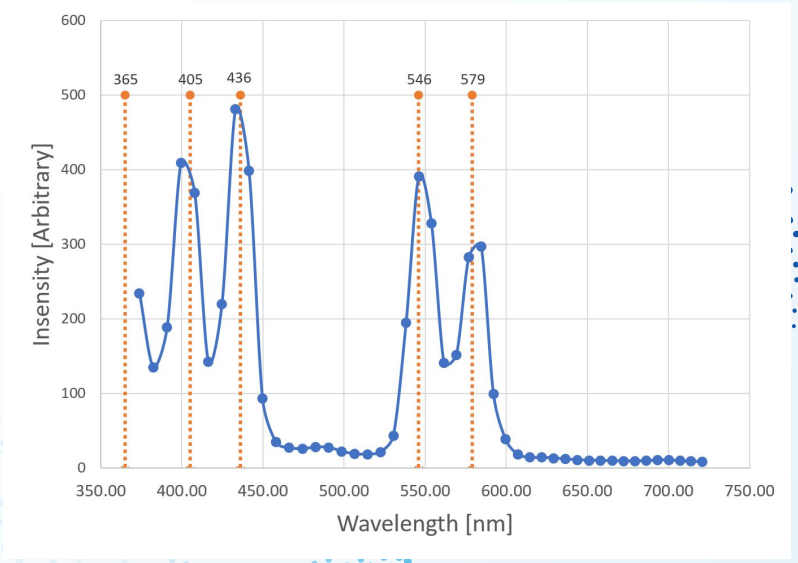
Mercury Spectrum

- Data appears to be offset
  - Our measured peaks are longer than the known peaks
- Beam from the mercury lamp was not centered on the lens
  - Determined an angular offset of about 0.01 radians
  - Subtracted offset from each angle measurement in our data

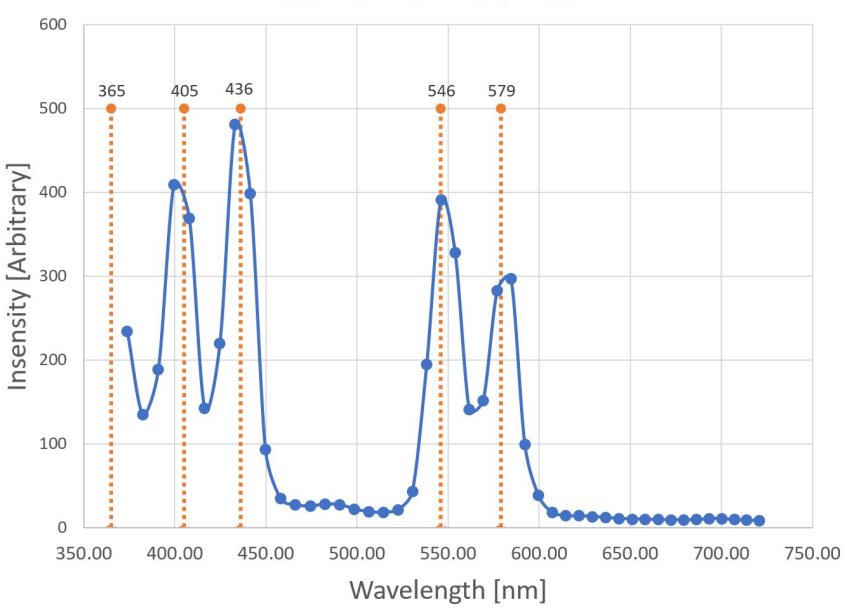


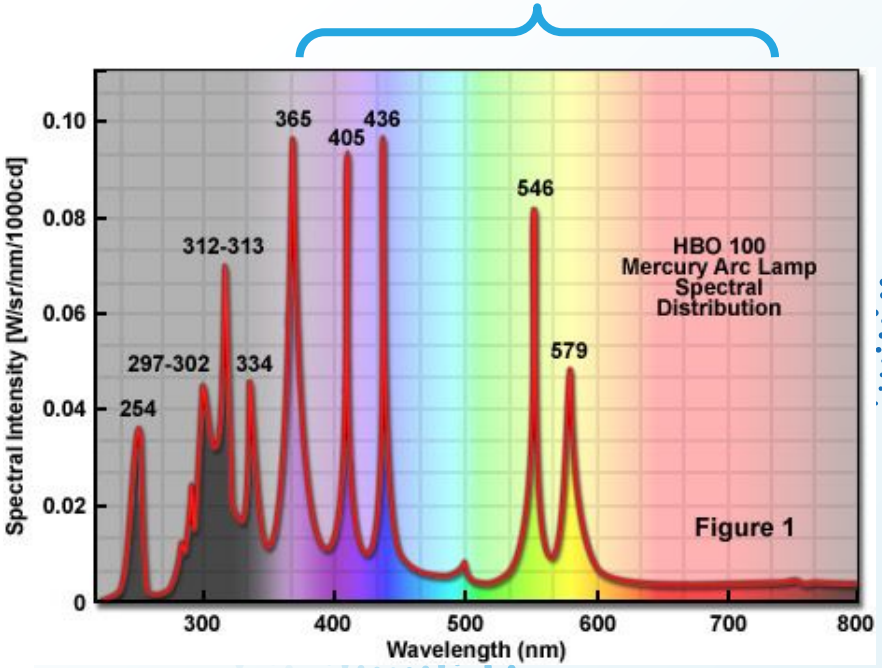
Mercury Spectrum





Mercury Spectrum





https://zeiss-campus.magnet.fsu.edu/articles/lightsources/mercuryarc.html

Next Steps

Eliminating Error

- Isolating the spectrometer to reduce noise
- Using a better aligned lens
- Reducing oscillations in the circuit

Next Steps

- Use a rotating mirror setup
- Making it more compact
- Using software to analyze/match a spectrum