Solar Spectrum
Lab #6
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PHYS 4C

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Table of Contents

Introduction & Purpose

The purpose of this lab is to experimentally measure the absorption spectrum of sunlight. The corresponding compounds to this absorption spectrum will be identified and a simple error calculation for the hydrogen alpha line will be conducted.

Equipment

- A fiber optic cable
- A Vernier emissions spectrometer
- A Vernier LabQuest 2 box
- A USB cable
- A PC with LoggerPro

Procedure

1. Connect the fiber optic cable to the spectrometer
2. Connect the spectrometer via USB to the LabQuest 2.
3. Move the setup outside to collect data.
4. Tilt the tip of the fiber optic cable such that the intensities measured on the LabQuest do not exceed saturation.
5. Upload data to PC and export with LoggerPro
6. Save the data as a CSV file.

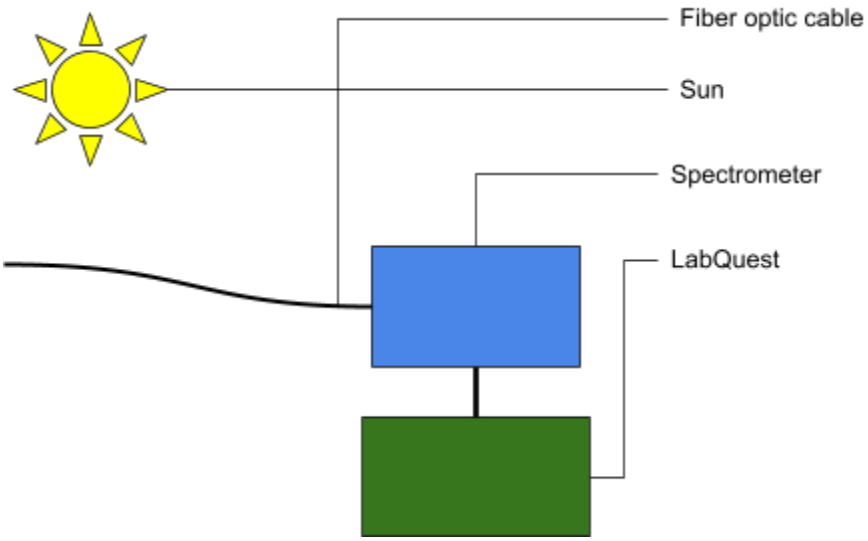

Figure 1: General lab setup

Data & Analysis

Peak Wavelength Finder

```
import pandas as pd
import matplotlib.pyplot as plt
from scipy.signal import find_peaks
import numpy as np

PROMINENCE = 0.09

data = pd.read_csv('solar.csv')
wavelengths = [i for i in data['Remote Data: Wavelength (nm)']]
intensities = [i for i in data['Remote Data: Intensity (rel)']]
x = [-1*i for i in intensities]

peaks, properties = find_peaks(x,prominence=PROMINENCE)
fig = plt.figure()
ax1 = fig.add_subplot()
ax1.set_title("Raw Data with Marked Absorptions")
ax1.set_ylabel("Intensity (rel)")
ax1.set_xlabel("Wavelength (nm)")

plt.plot(intensities)
for i in range(len(peaks)):
   plt.scatter(peaks[i],intensities[peaks[i]],s=60)
   plt.plot(np.zeros_like(intensities), "--", color="gray")
   print(wavelengths[peaks[i]])
plt.show()

fig = plt.figure()
ax1 = fig.add_subplot()
ax1.set_title("Absorption Lines")
ax1.set_xlabel("Wavelength (nm)")
for i in range(len(peaks)):
   plt.axvline(peaks[i])

plt.show()
```

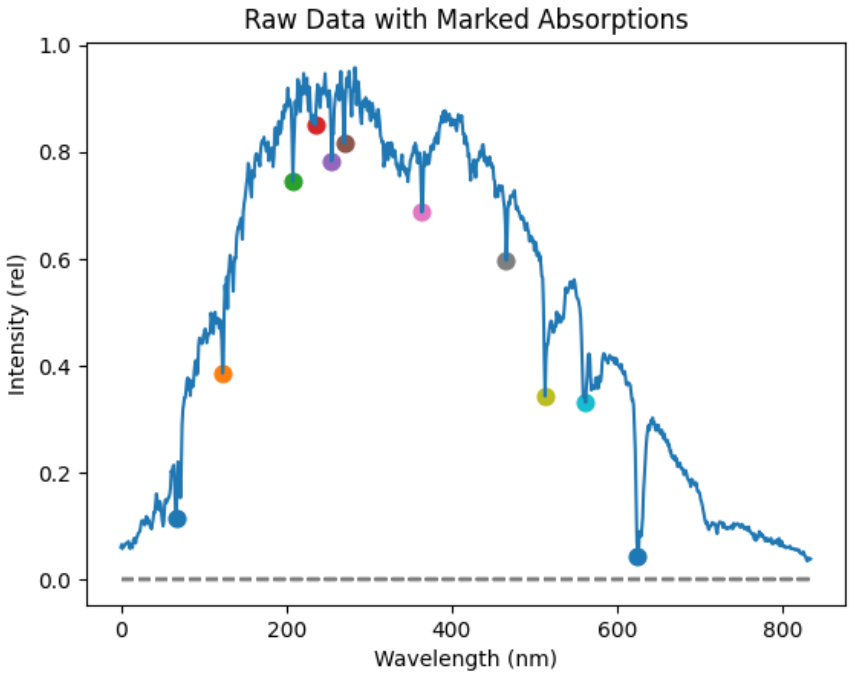

Figure 1: Raw data with programmatically derived dots to demark absorption lines

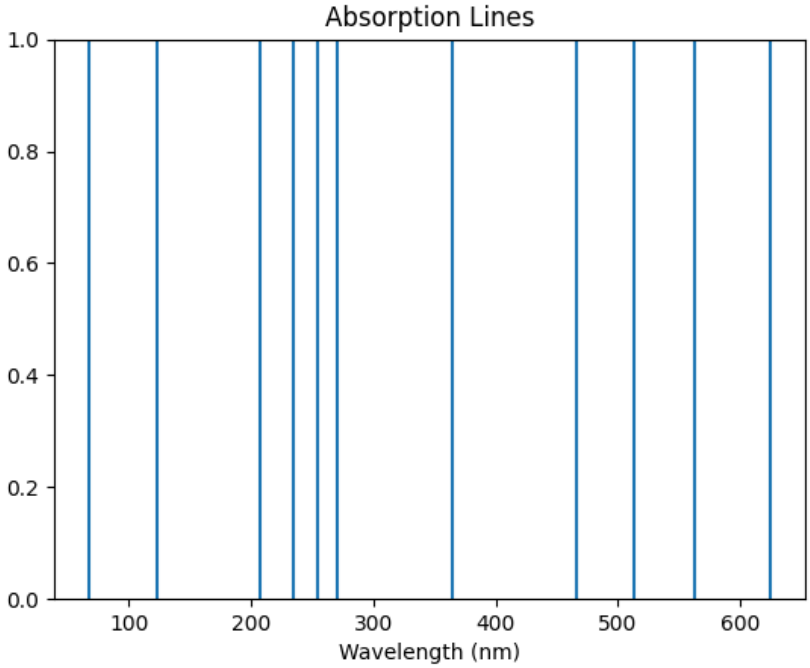

Figure 2: Programmatically derived absorption lines of sunlight

Compound	Wavelength
tO2	760
H2O	718.7
tO2	686.9
Ha	656
Na	588.7
Fe	525.9
Mg	516.1
Hb	503.1
CH	485.4
Ca	429.4
Ca	393.1

Table 1: Programmatically derived wavelengths corresponding to each compound's absorption line

How close is your value of Hydrogen alpha to the reference value (656.3 nm)? Give a % difference:

0.0457% (percent difference = difference / reference X 100%)

Conclusion

Error was relatively small for the hydrogen alpha absorption line at 0.0457%. The programmatic analysis of data minimized measurement errors and confirmation bias.