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ASTR 3800

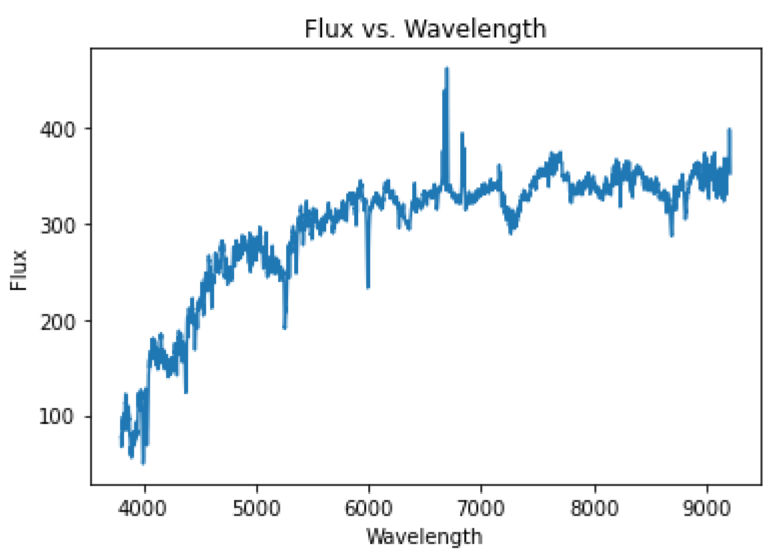
Final Project

Collaborators: Niki

Write Up

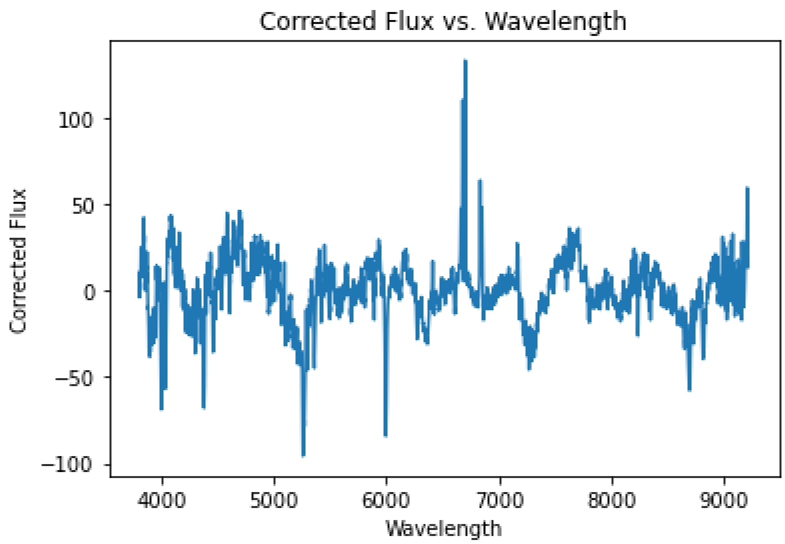
In this project, I'll use real galaxy spectrum data from the Sloan Digital Sky Survey (SDSS) in order to measure the redshift (doppler shift) of the flux/wavelength data from the galaxy. This is a hot topic in astronomy right now, as it shows real evidence to support the expansion of the Universe, and possible evidence for the existence of dark energy.

After loading in the spectrum data from the project files, I immediately sorted the data into 2 different flux and wavelength arrays, and plotted them against each other:

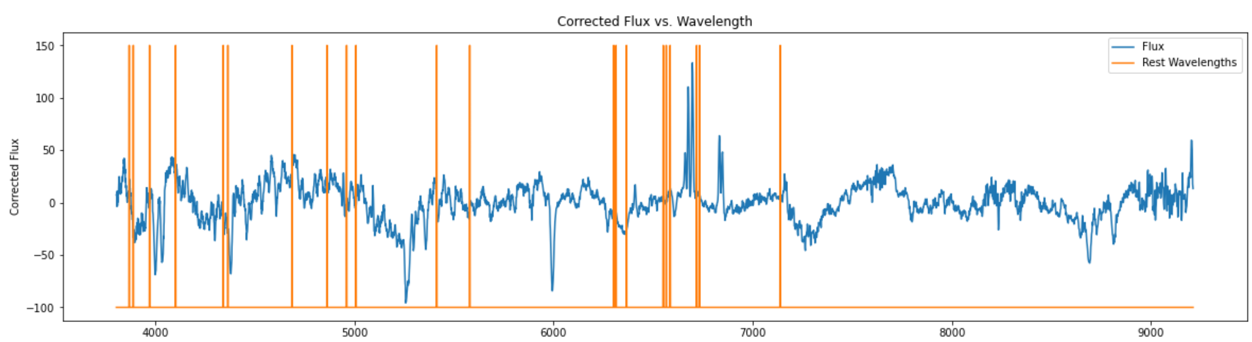


Notice how the graph has an upward trend at the beginning, but starts to level out at the end.

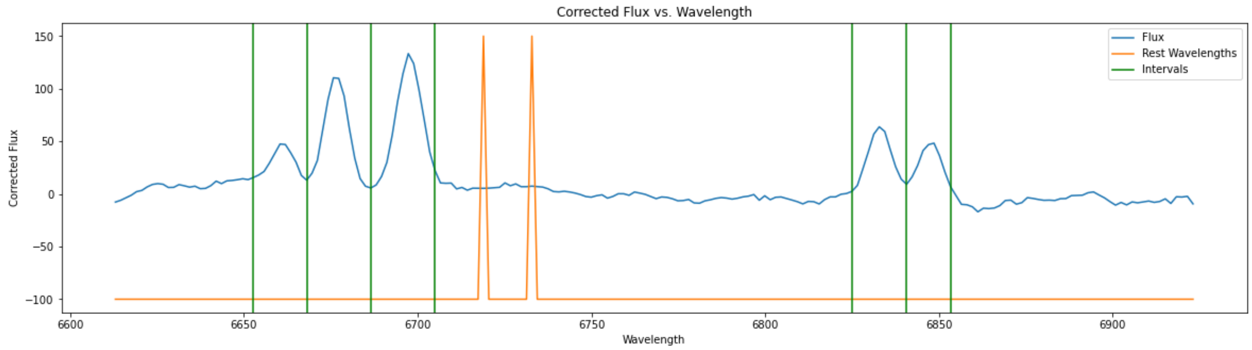
To account for this curve, I used np.polyfit() to adjust the data so it's more easy to look at and understand:



Next, I extracted the other project file data, which was an array of wavelength values where spectrums tend to have absorption/emission lines (H-alpha for example). I used these wavelength values to create a similar flux array, but that only peaks at those wavelength values:



I intended on using a cross correlation function in order to determine the maximum overlap between my two flux arrays, but for some reason I couldn't get it to work. Instead, I empirically determined five intervals of local maxima (where there was a particularly large spike/emission line):



Next, I used np.max() to calculate the wavelength value of each of the peaks, which told me the change in wavelength (from the rest wavelength to the redshifted wavelength) of the five spectrum lines.

Finally, I used the five red-shifted wavelengths with their associated rest wavelengths to calculate the redshift for the emission lines. The average redshift I calculated was 1.70% +/- 0.01%. What I found is that the redshifts strictly increase with wavelength, and the more spectral lines used, the larger the uncertainty in the redshift. This is counterintuitive, but I think the uncertainty would go down if we used a LOT more spectral lines, but since I only used five lines in this portion of the project, it makes sense that the uncertainty would go up as the number of spectral lines goes up, especially considering that the redshifts strictly increase with wavelength. This leads to significant systematic differences between using different spectral lines, as I would expect the redshift (and it's uncertainty) to decrease with lower wavelengths.

References

Data from http://www.sdss.org/dr12/spectro/

Comment

This final project was pretty cool! Unfortunately I didn't get my cross-correlation function to work, so I'm not super confident in my answer. Thanks for a fun and interesting semester!