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CSE 160

HW 7 Part I

3/1/17

*Circumgalactic Gas Flows that Drive Galaxy Formation and Evolution*

By Dustin Burnham

Summary:

1. How far does the circumgalactic medium (CGM) extend from its host galaxy? By analyzing the gas between the milky way and reference light source like a quasar, we can see heavy elements at a certain distance that are a part of a galaxy’s CGM. By locating this galaxy, we can use the coordinates to find the distance from the galaxy to the gas location giving a lower limit to the extent of a galaxies CGM.

Motivation and Background:

I do research in the astronomy department, and I am an astronomy major. The reason I chose this topic is because this is what I find interesting, it’s important to modern astronomy, and I thought it would be cool if I could tie my new knowledge of python to help answer questions from my datasets. In my research group, I analyze quasar spectrum, from the Hubble Space Telescope: Cosmic Origins Spectrograph, searching for systems of gas between the milky way and the quasar. The question of size of the CGM can tell us how gas flows in galactic structures, and thus help make clear how this affects galactic evolution.

Dataset:

I will use two data sets to calculate the lower limits of the CGM. One is the data that I have analyzed through research that is stored in a .json file, and the other is a data on website. I have analyzed quasar spectra with a Python GUI, saving the data in a .json file. This .json file contains the info of the identified elements like the element name, distance, column density, comments, rating, and others. Currently, there is some amount of code provided to my research group to make the data more readable, by turning the data into a data set organized by distance. I would like to pivot this data to be organized and filter the data by column density, giving good locations to look for galaxies. The filtered data will then be turned into a dictionary within a dictionary, with the key being the system and the value being a dictionary containing all of the info at that location.

This leads me to my second data set, which a list of objects from the SDSS DR7 website. This website contains information about galaxies in the general area of our data set. Here we can locate galaxies and look at their distances measured in redshift, the uncertainties in the distance, the galaxy ID, and the coordinates. Using a query, I was able to save the previously mentioned quantities into a csv. Using these data, I would like to cross reference these redshifts with the redshifts of systems of hydrogen. At this point I can make calculations to find the angular distance and actual distance, and make plots of the data from the coordinates of the matched pairs.

Galaxy Data from SDSS query:

specObjID ra dec z zErr

245953888996294656 153.1173 47.62363 0.162356 1.33051E-4

245670976484802560 153.1175 47.569511 0.162939 1.83449E-4

245670974278598656 153.12111 46.884929 0.165449 1.07673E-4

245670974035329024 153.13481 46.695356 0.038186 9.47037E-5

Sample of analyzed Data

{

"bad\_pixels": [],

"cmps": {

"z-0.00001\_CI": {

"A": null,

"Comment": "MW Cl",

"DEC": 0.0,

"Ej": 0.0,

"Name": "z-0.00001\_CI",

"Nfit": 16.3,

"RA": 0.0,

"Reliability": "a",

"Zion": [

6,

1

]

Methodology:

Start by reading in a .json file that contains the data. The data is obtained by analyzing a spectrum of a quasar using a python GUI that saves the data to a .json file. Convert this data into a list that contain the data for each element. At this point create a dictionary of hydrogen with the keys being the column densities, and the values being the redshift. Sort this dictionary by column density. Next create a dictionary of the systems with column density greater than 14 with redshifts mapping to elements found there. The second data set is acquired from the SDSS DR7 website query, and is a list of all galaxies and stars within a one-degree window of the analyzed object. This data set contains coordinates, object IDs, redshifts and redshift uncertainties. Store this data in a dictionary with the keys being an object ID mapping to a dictionary of the redshifts, redshift errors, and the coordinates. Finally, filter this list by comparing the redshifts of the galaxies with the redshifts of the hydrogen systems (Within some error), saving these galaxies into a new dictionary. With all the data filtered, the calculations can be done. Calculate the angular distance between each object and the analyzed object using the coordinates. Take these distances and calculate the actual distance between the analyzed object and each object, storing the info in a dictionary consisting of object IDs mapping to a dictionary consisting of redshift, redshift errors, and actual distance. Finally plot the systems of gas, and the objects corresponding to the system, and print the lower bounds of the CGM for each system.

Work Plan:

* Organize Data from Spectrum
  + Scrub and Organize
    - Time: 3 hours
* Access Data from SDSS DR7
  + Organize Data to be usable
    - Time: 3 hours
* Make Calculations of distances
  + Angular Distance
    - Time: 1 hour
  + Actual Distance
    - Time: 1 hour
* Plot Results
  + Time: 1 hour
* Print Results

Questions:

1. I still am wondering if this enough work for the final project. I estimate that I will need to write around 10 functions.