PROGRAMMING AND DATA REDUCTION PROJECT 1
SPS 4020 ● Extragalactic Astrophysics ● Spring 2024
DUE March 7, 2024

In this first project you will download and analyze some data from the Sloan Digital Sky Survey. The objects you will analyze are galaxies, and you will be analyzing optical spectra on these galaxies. Below you will find instructions on how to proceed with the project.

1. Please download the data you'll be working on. Use the quasar 3C 273 as the center of your search cone, and download all galaxies within 10 arcmin that have Sloan spectra. You should find 31 such objects. You can download the data using the Sloan archive page http://cas.sdss.org/dr18/. You will need the RA and Dec coordinates of 3C 273 to get started; you can look this up using SIMBAD or NED.

   These are a variety of galaxies, at widely varying distances different types. Your job will be to reduce the data, classify them, and find redshifts.

2. The SDSS Data Analysis Pipeline for spectral data is documented at https://www.sdss4.org/dr17/spectro/pipeline/. Please take a detailed look at the pipeline, install any necessary tools, and reduce the spectra. You will not need to re-reduce the data – but you need the pipeline info to understand the data.

3. Classify all spectra. Make sure to note which objects are quasars, galaxies, star-forming, etc. Use as a guide the galaxy spectral types in this paper: https://academic.oup.com/mnras/article/420/2/1217/984180. Add to this information on the galaxies themselves – find images of the galaxies with Sloan and classify them as spirals or ellipticals. Do you find any correlations?

4. Find the redshift for all objects, and derive distances using the Hubble law. Plot a Hubble diagram for the galaxies. If you observe emission or absorption lines in the spectrum, find the widths of these lines in both wavelength and velocity, as well as their equivalent widths.

5. Write a paper on what you find and what it taught you.