Getting Science Ready Data

Science Ready Data

- The Sloan pipeline provides the observed spectra of astronomical sources.

- For extragalactic sources, there are two important steps to convert these to science-ready data.
  - Galactic extinction correction
  - Cosmological redshift correction

Galactic Extinction Corrections

- As with photometry, spectra from Sloan are impacted by foreground absorption from interstellar dust.
- We can correct for this using the same tools that we learned for photometry.
- Note that we will only correct for extinction due to interstellar dust in our own galaxy. There may be additional effects along the line of sight or in the object itself. This is often known as intrinsic reddening and can be difficult to correct for because of the unknown amount of dust and wavelength dependence.

Redshift corrections: the expanding universe

- Quasars and other extragalactic sources also have appreciable cosmological redshifts that impact the observed wavelength scale of the spectra.
- Given a known redshift, best obtained from spectra themselves by matching patterns of emission lines to their known wavelengths, we can correct for it.
- Note that cosmological redshift happens in addition to the Doppler shift from motion!

Redshift corrections: the expanding universe

- Cosmological redshift:

$$1 + z_{cosm} = \frac{\lambda_{stretched}}{\lambda_{emit}}$$

- Doppler shift:

$$1 + z_{doppler} = \frac{\lambda_{obs}}{\lambda_{stretched}}$$

- Combined effect:

$$1 + z = (1 + z_{cosm})(1 + z_{doppler})$$

Python tasks

1. Choose a quasar spectrum and correct it for Galactic extinction.
   - Use the sfdmap package to obtain the E(B-V) reddening at the RA,DEC position of the quasar.
   - Calculate the extinction in magnitudes, Av, assuming $A_V = 3.1 \times E(B-V)$
   - Translate the V-band extinction, Av, to all other wavelengths in your spectrum using a Fitzpatrick99 law (see the extinction package).
   - Calculate the extinction corrected flux using: $f_{\lambda,corr} = f_{\lambda,red} \times 10^{0.4 \times A_\lambda}$
     Or using the extinction.remove() function.

Python tasks

2. Shift the wavelength for this quasar to the rest frame using:

$$\lambda_{emit} = \lambda_{stretched}/(1 + z_{cosm})$$

3. Plot the observed spectrum and the extinction and redshift corrected spectra together on the same plot using different colors to inspect the result.