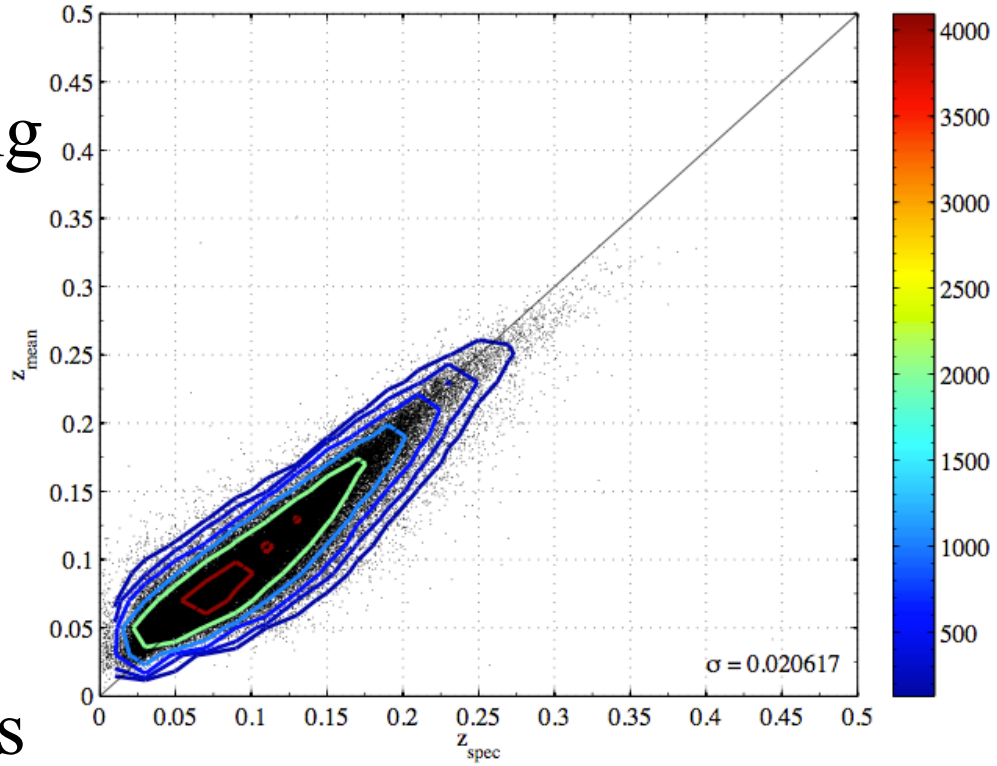
Photometric Redshifts

Photometric Redshifts

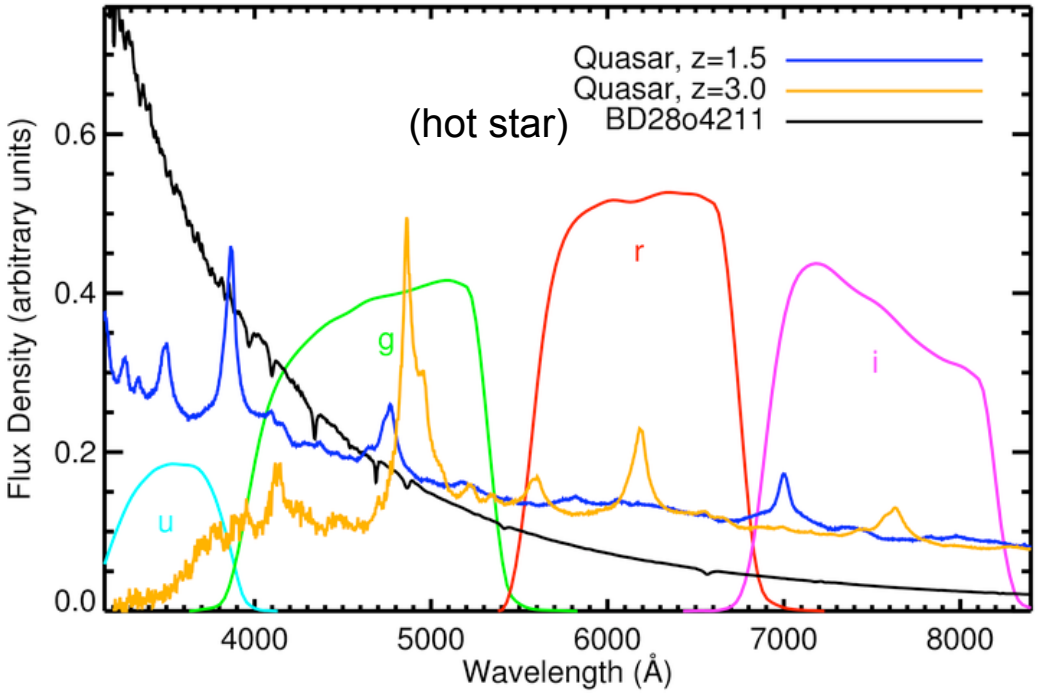
- In addition to using multi-wavelength imaging to classify objects (whether they are stars, galaxies, quasars etc.), colors can be used to determine redshifts for extragalactic sources



- This can be *very* useful as redshift is a measure of distance for extragalactic objects
  - redshifts derived from imaging are called *photometric*
- The figure depicts *FUVNUVugriz* photometric redshifts (z_{mean}) for galaxies with a spectroscopic redshift (z_{spec})

Photometric Redshifts

- Photometric redshifts can be derived because objects have different spectral slopes at different redshifts...



- ...and because different spectral features fall in different filters as a function of redshift
- Consider the two quasar spectra in the figure
  - The high redshift (z=3.0) quasar clearly has less flux in u-band than the lower redshift quasar...the z=3.0 quasar would thus appear redder in imaging

Python tasks

1. In my week 10 directory in Git is a file *qsos-ra180-dec30-rad3.fits* that contains the coordinates and redshifts for 316 quasars. The redshift in this file is called *zem*
   - retrieve the PSFFLUX entries for those quasars that are PRIMARY in the sweeps. Convert them to magnitudes.
   - Plot *g-r* (magnitudes) versus *zem*. Does *g-r* color strongly correlate with redshift for most quasars?
2. The Lyman Limit (below which no hydrogen transitions exist because electrons are stripped off the atom, ionizing it) is at 912 Angstroms. At a redshift of *zem*, the Lyman Limit shifts to a wavelength of 912(1+*zem*) Angstroms
   - determine at what *zem* the Lyman limit begins to enter the SDSS *g* filter and indicate this redshift on your plot

Python tasks

- What happens to *g*-*r* versus *zem* above the redshift where the Lyman Limit enters the *g* filter? Why?

3. Now plot *u*-*g* versus *g*-*r* for all of the quasars in the file

- Overplot *u*-*g* versus *g*-*r* in different colors for quasars in bins of 0.5 in redshift (i.e., plot *u*-*g* versus *g*-*r* for 0.5 < *zem* < 1.0 quasars in one color, for 1.0 < *zem* < 1.5 quasars in a different color etc.)
- Are quasar redshifts strongly correlated with differences in different colors? If so, then broadband flux differences can be used to infer redshift...similar techniques work for galaxy redshifts
- A redshift based solely on imaging measurements, without a full spectrum, is called a *photometric redshift*