Baldwin Luminosites

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1 Baldwin plots

Hamann et al. (2017) provide::

f_{1450}, the flux in the uncorrected BOSS spectrum at 1450Å rest (10^{17} ergs s^{1} cm^{-2} $\mathrm{Å}^{-1}$) used to anchor the power-law continuum fits beneath C IV and N V , e.g. $f_\lambda = f_{1450}(\lambda/1450\text{Å})^{\alpha}$.
The quasar redshift and cosmology are also given.

```
from astropy.cosmology import FlatLambdaCDM

## Setting up the cosmology
cosmo = FlatLambdaCDM(H0=71, Om0=0.27, Tcmb0=2.725)

##  Luminosity = 4 * pi * (D_L^2) * F
##   where L  is in W  and  F is in W/m^2
##   D_L is Luminosity Distance

## Set-up the Luminosity Distance
DL      = cosmo.luminosity_distance(redshift)
DL_incm = DL.value * 3.08567758128e24

## DL in cm;  f in 10-17 ergs s-1 cm-2 A-1
Lum     = (4 * np.pi * (DL_incm*DL_incm) * 1e-17 * f_lam) * 1450.
log_Lum = np.log10(Lum)
```

2 Dyer et al. (2019)

2.2. Quasar Properties

Our analysis uses luminosity, spectral index, and C IV W_λ to explore the intrinsic spectral variability of quasars and to assess the impact of quasar variability on Lyman-α forest clustering studies. We compute L_{bol}, α_λ, and C IV W_λ from the spectrum of every epoch of every quasar. The median

$\log L_{\rm bol}$, α_λ, and C IV W_λ for each quasar are considered to represent the quasar's steady state properties.

The bolometric luminosity of each spectrum is estimated from the monochromatic luminosity at 1740 Å (i.e., the median flux in the range 1680 – 1800 Å) corrected for luminosity distance under a ΛCDM cosmology with $H_0 = 70\ {\rm km\,s^{-1}\,Mpc}$, $\Omega_M = 0.3$, and $\Omega_\Lambda = 0.7$. We approximate $L_{\rm bol} = A * L_{1740}$, where we compute the bolometric luminosity at 1450 Å with the correction factor suggested by Runnoe et al. (2012b,a) and determine the scaling factor $A = 4.28$ that minimizes the residual between the bolometric luminosities computed at 1740 Å and 1450 Å. We note that the analysis that follows uses the fractional change in luminosity, so the choice of scaling of monochromatic flux to bolometric luminosity does not impact any of the results.

The spectral index of each spectrum is determined by fitting a power law to the quasar continuum in the wavelength ranges 1680 – 1800 Å and 2000 – 2050 Å. These ranges were chosen for their lack of emission lines (except broadband iron which we assume is negligible) according to a high S/N composite spectrum (Harris et al., 2016). Every spectrum in our sample is observed over this wavelength range. Only unmasked pixels with flux within three standard deviations of the median are used for this fit to mitigate the influence of intervening absorption from the intergalactic medium.

To calculate C IV W_λ for each spectrum, we first estimate the continuum around C IV emission with a linear fit to the spectrum in the wavelength ranges 1450 – 1465 Å and 1685 – 1700 Å. We model the C IV emission using a double Gaussian fit to the continuum-subtracted spectrum over the wavelength range 1500 – 1580 Å. Only unmasked flux measurements within three standard deviations of the best fit are used. C IV W_λ is finally computed by taking the integral of the estimated emission flux relative to the estimated continuum flux over 1520 – 1580 Å.

References

Hamann F., et al., 2017, MNRAS, 464, 3431

Harris D. W., et al., 2016, AJ, 151, 155

Runnoe J. C., Brotherton M. S., Shang Z., 2012a, MNRAS, 427, 1800

Runnoe J. C., Brotherton M. S., Shang Z., 2012b, MNRAS, 422, 478