

# Things that Might Interest Friends of Bev Wills

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With thanks to Sarah Gallagher (UWO), Karen Leighly (OU), Paul Hewett (IoA, Cambridge), Rachael Kratzer and Coleman Krawczyk (Drexel)

# Take Home Points

1. There is no such thing as a typical radio-quiet quasar. If you have ever compared a sample of RL quasars to RQ quasars, you need to do it again more carefully.

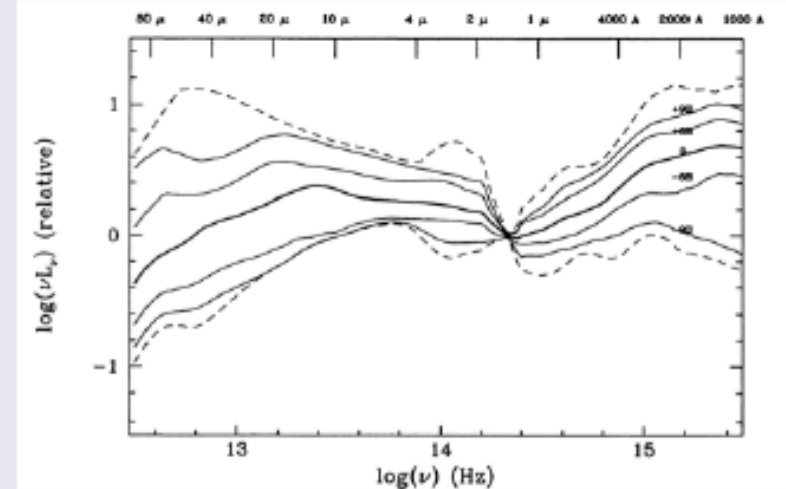
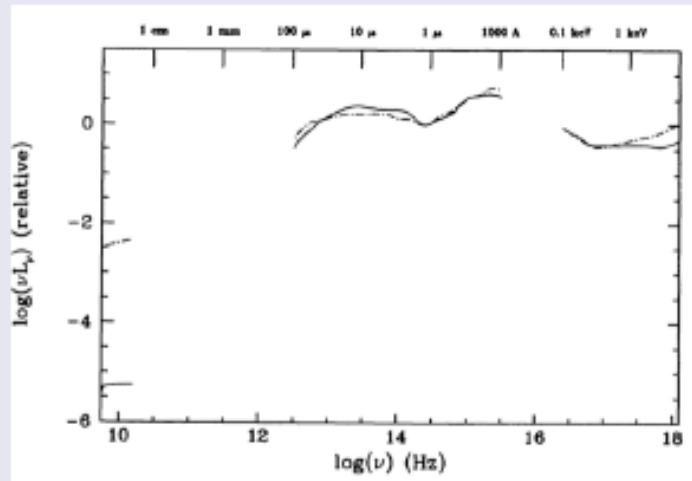
2. BH masses estimated from CIV using scaling relations are *catastrophically* wrong.

(Even yours)

3. Hard-Spectrum Quasars are **red**, BALQSOs are **blue**.

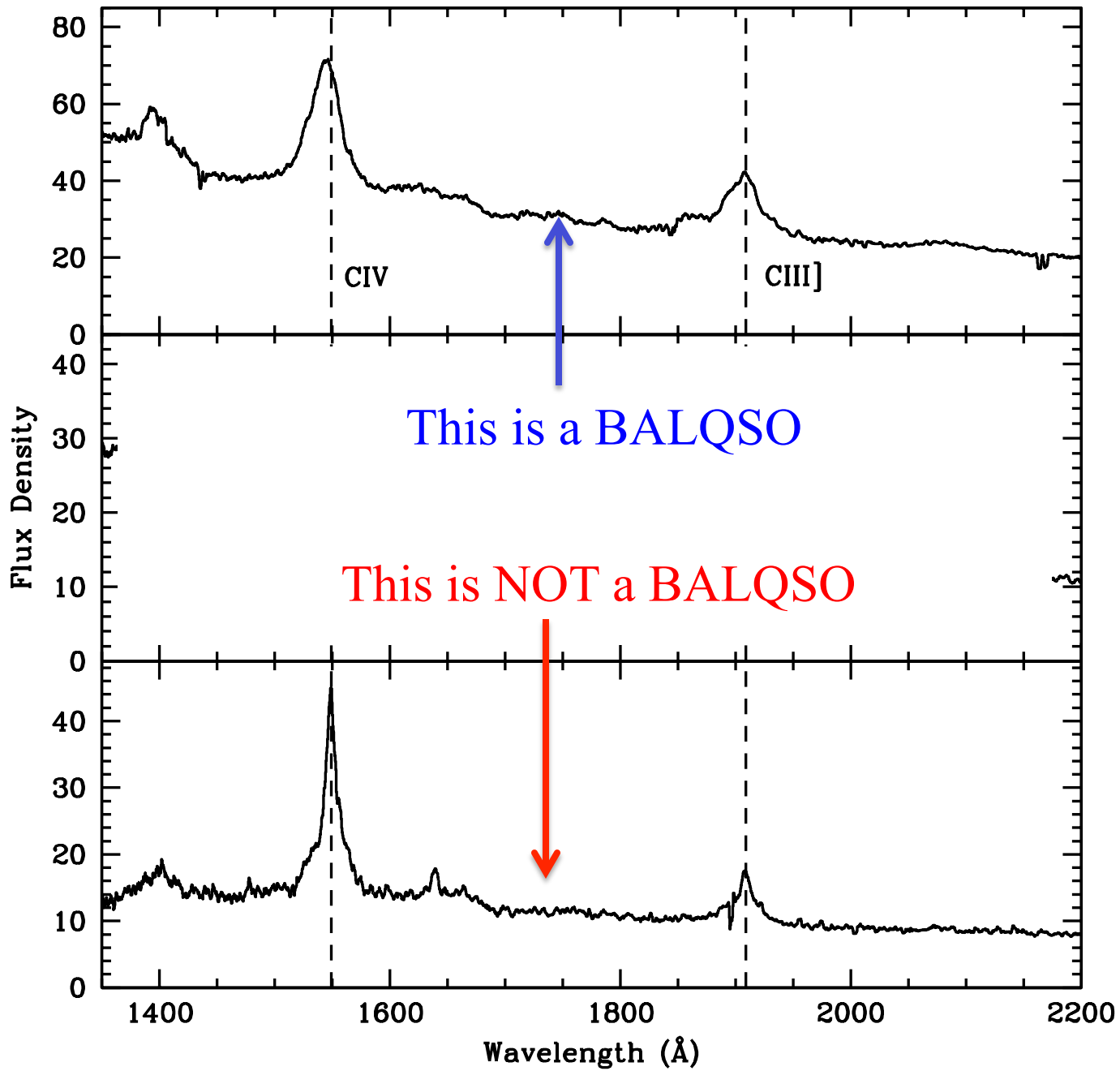
# Spectral Diversity

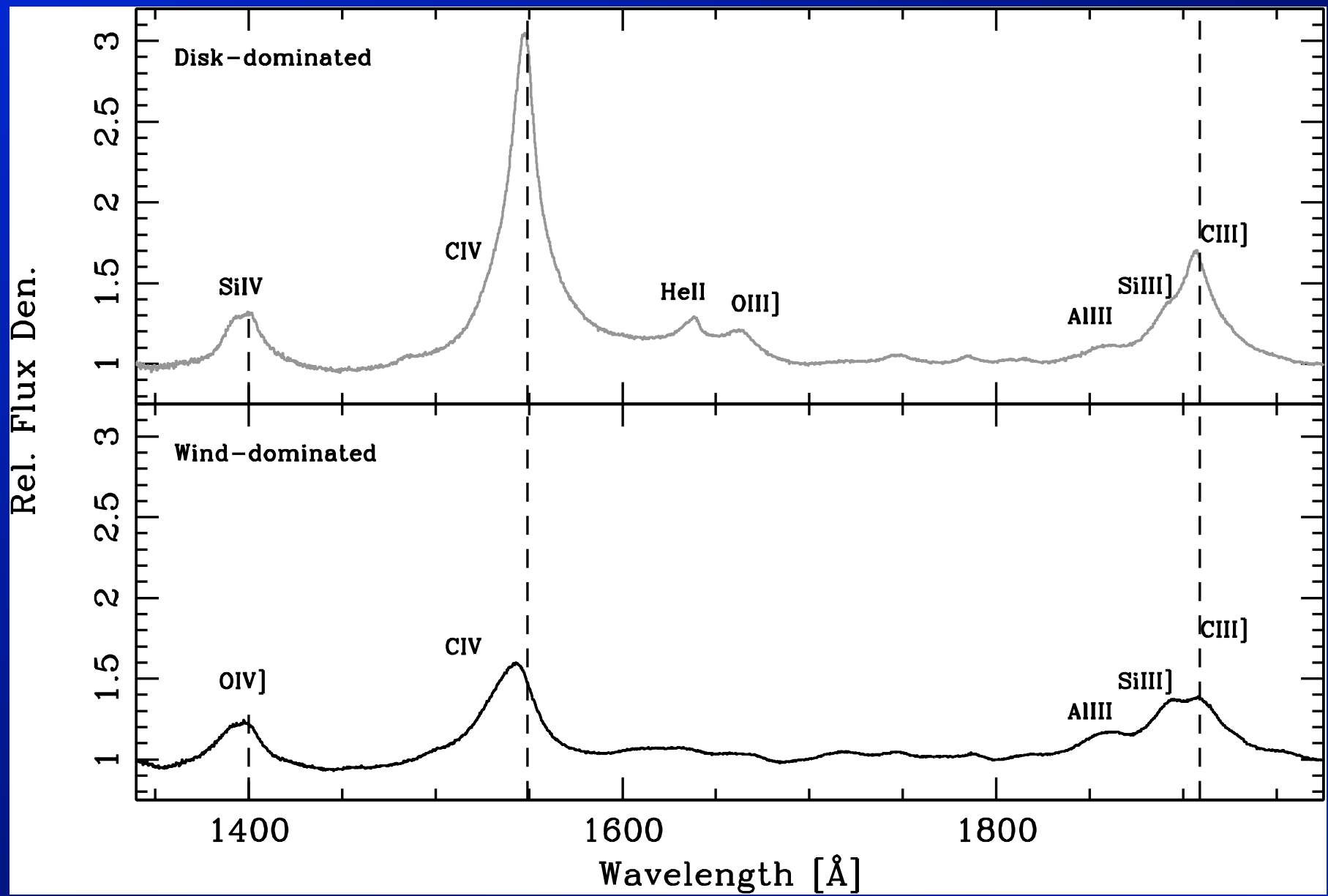
Elvis et al. (1994) mean SEDs and uncertainties



“...the large dispersion of shapes in individual objects means that the mean SED should be used only with caution, and that the variety of shapes should contain information about the physics of quasars.”

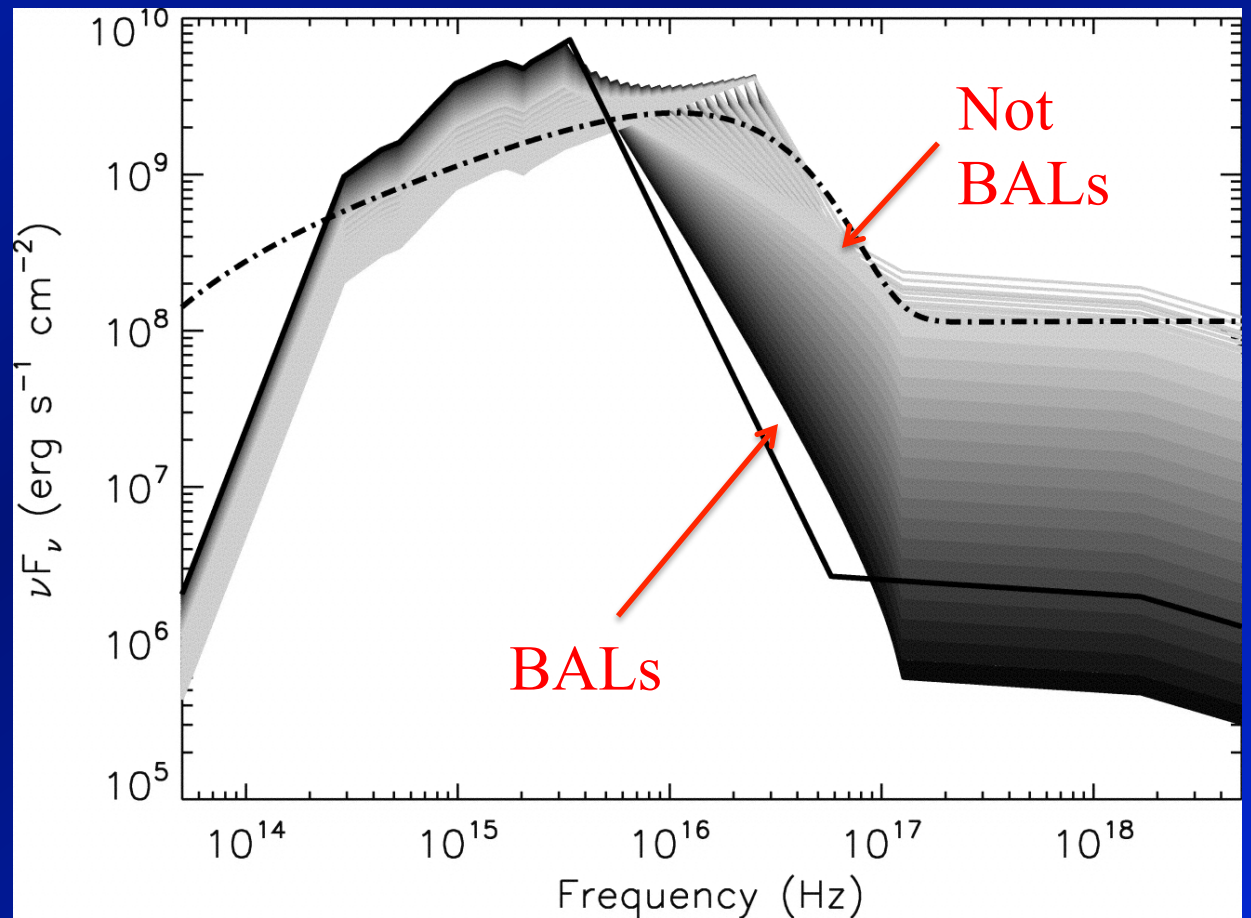
There is a mean quasar, but there is no standard quasar.





# A Range of Intrinsic SEDs

Differences in the SED underlie the differences in the emission AND absorption properties of quasars.

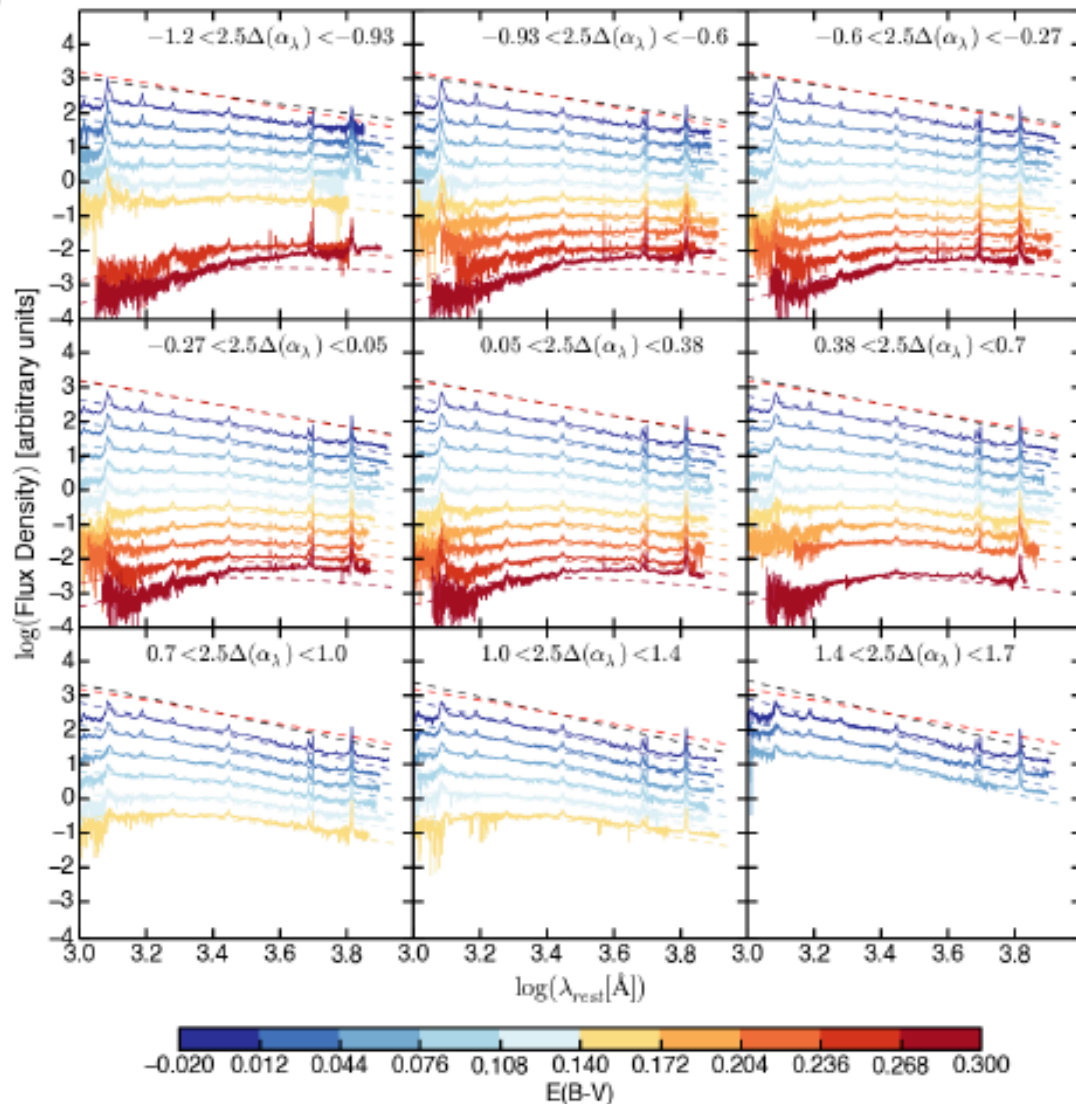


Leighly et al. 2007

# Distinguishing Red from Dusty

## SMC non-BAL

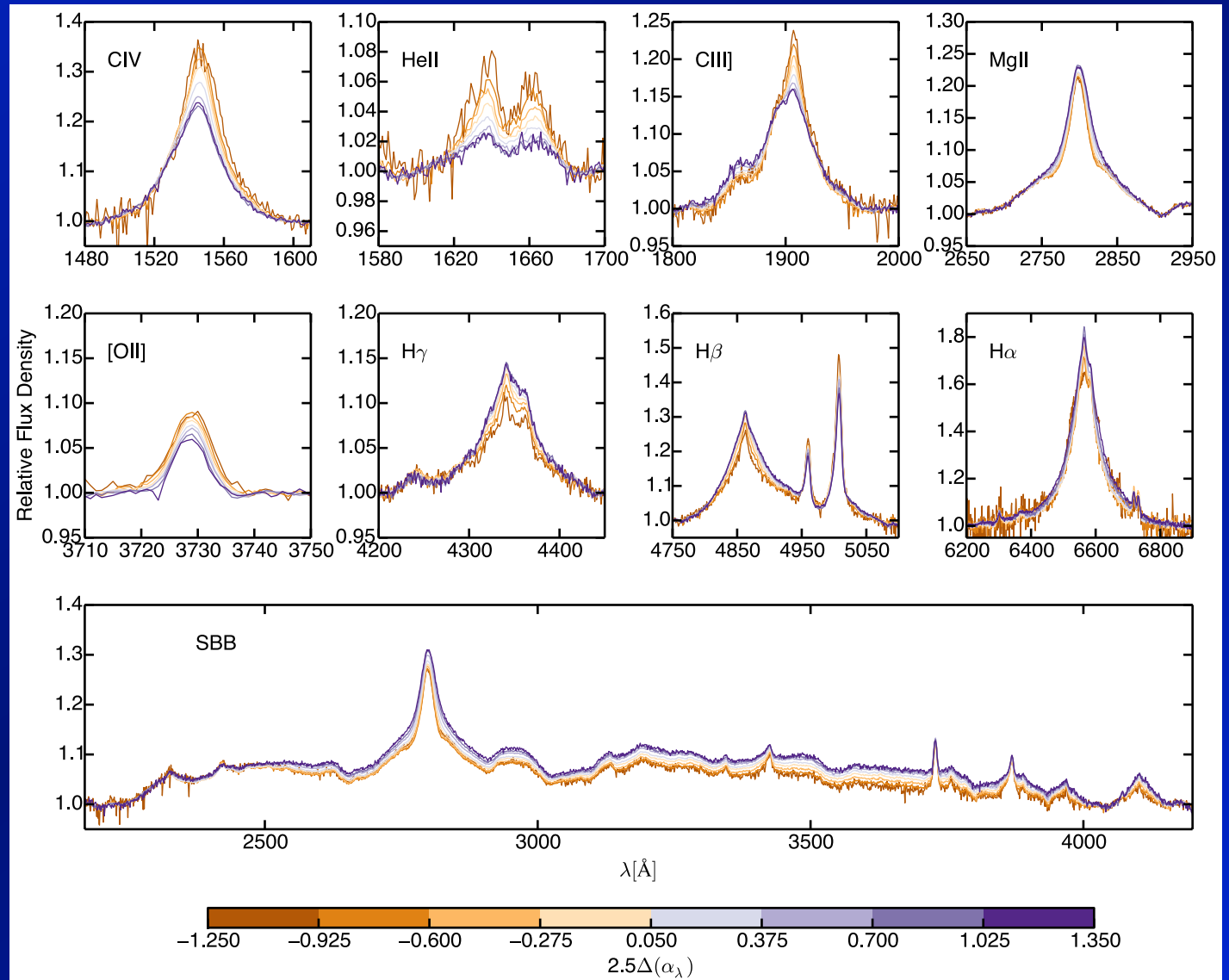
- Black: typical powerlaw in bin
- Red: modal powerlaw
- Colors: amount of reddening
- Dashed: fit based on photometry
- The fits based on the photometry track the spectra well



# Emission Lines as $f(\text{color})$

UV line differences due to SED.

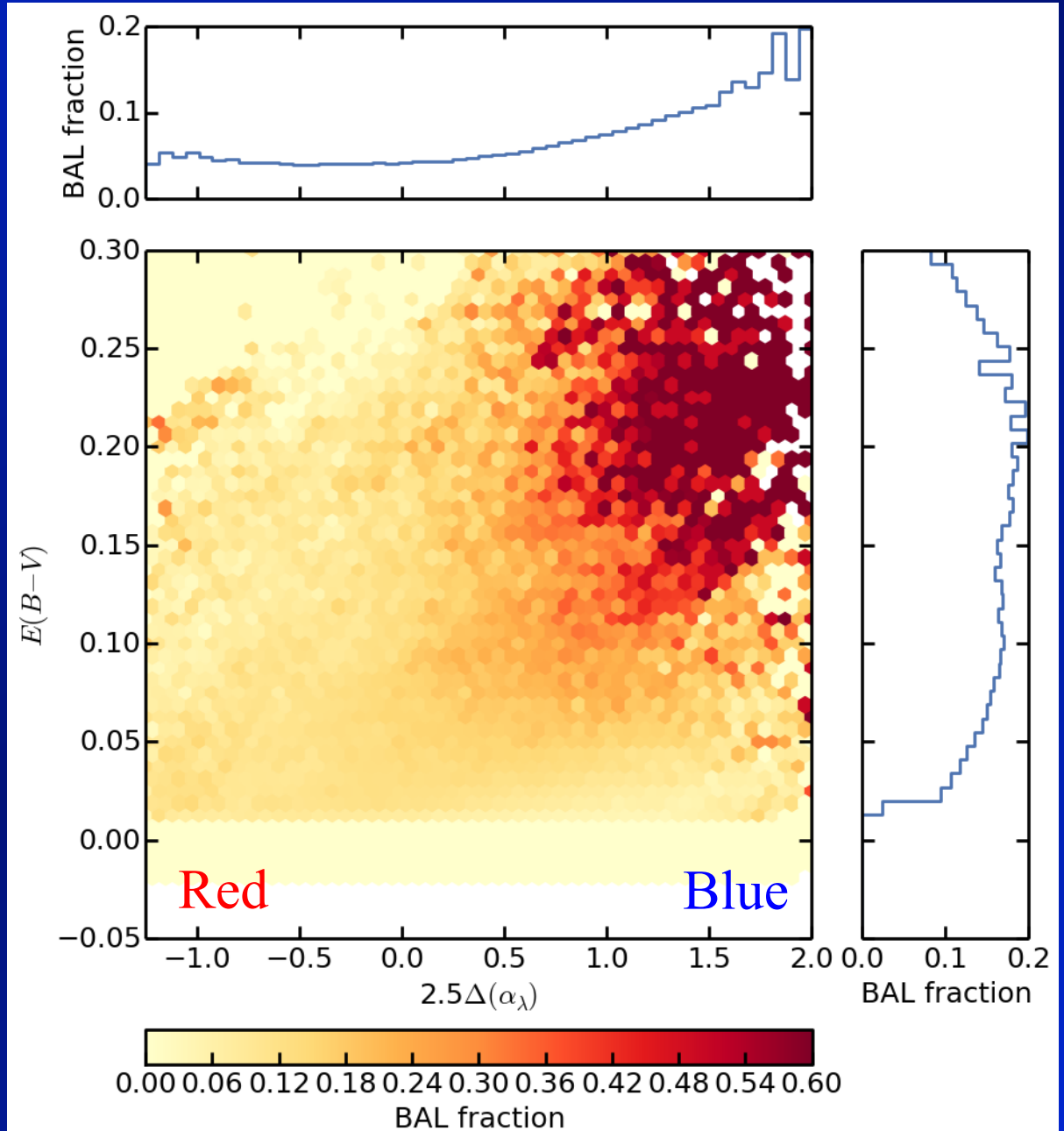
Optical due to host galaxy, BH mass, and/or inclination.



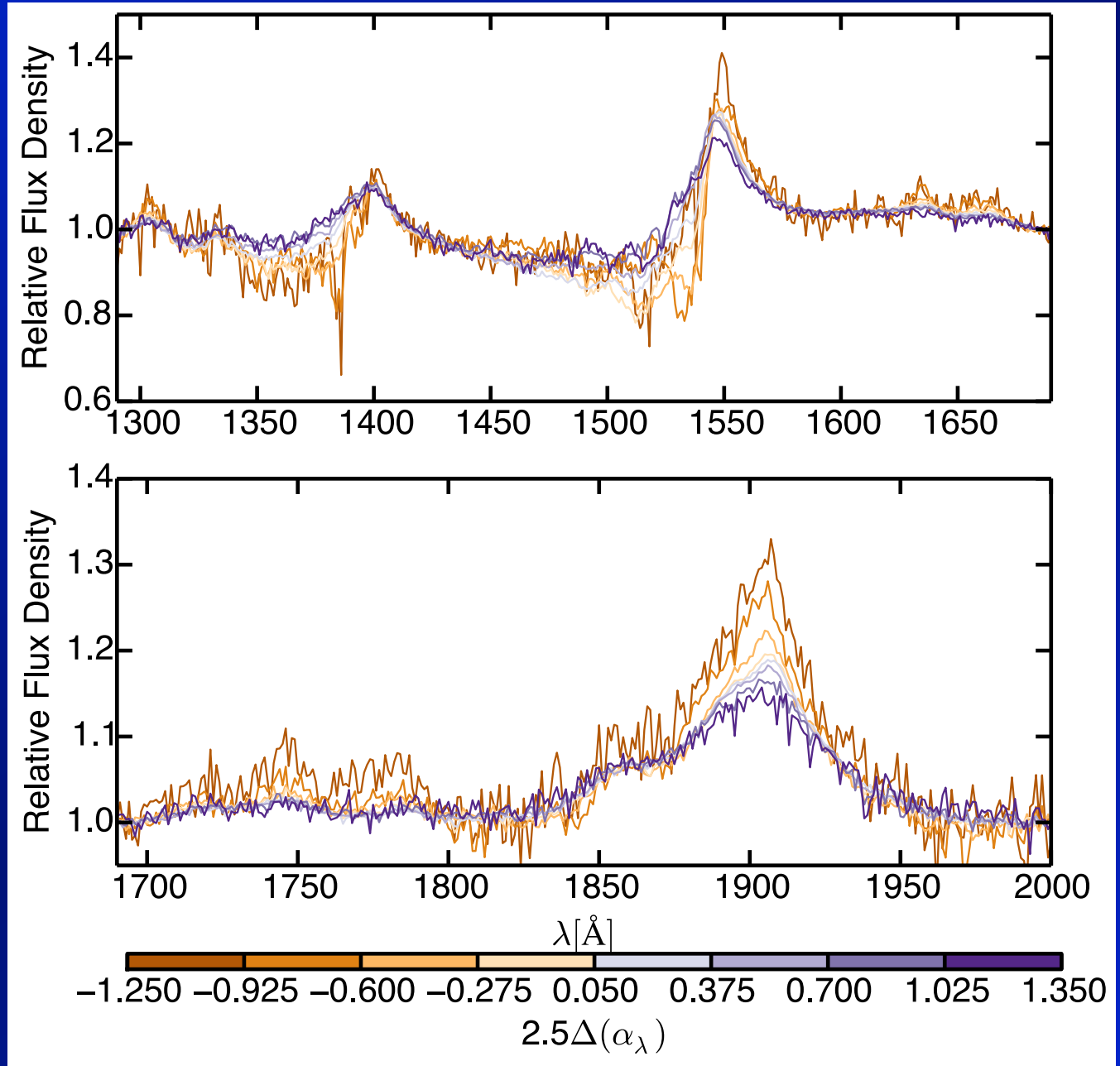


# BALQSOs are BLUE

They are  
very UV  
luminous  
quasars.



Mean  
BALQSOs  
as a function  
of UV color.



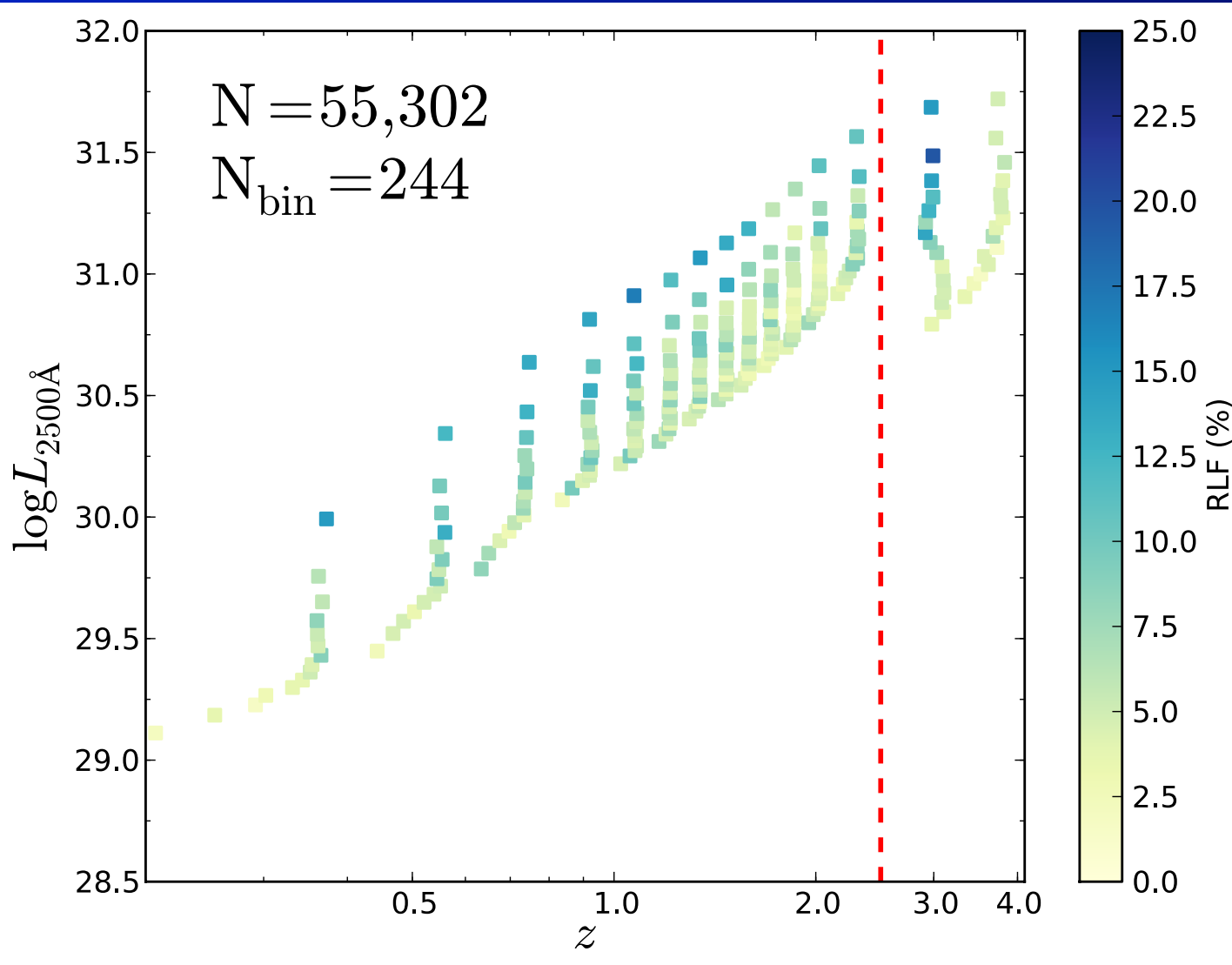
Krawczyk et al. 2014 (in prep); see also Baskin, Laor, & Hamann (2013)

# Predicting Radio-Loud Quasars

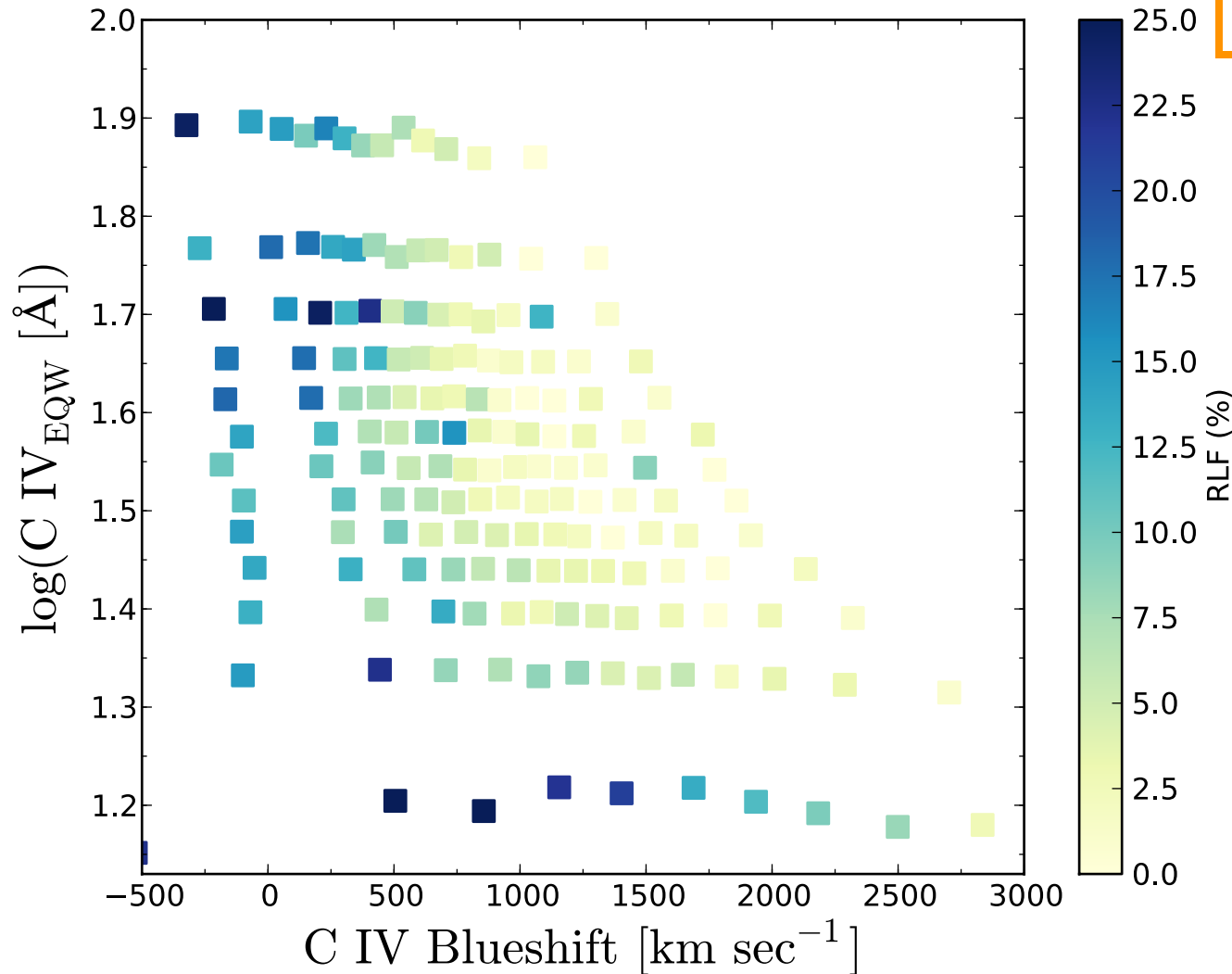
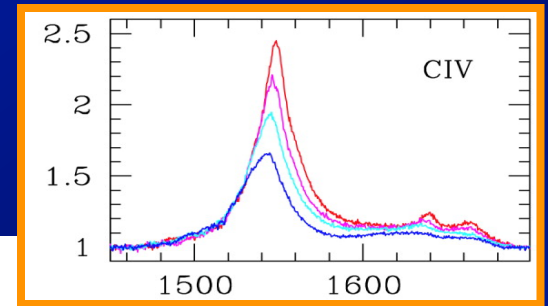
We all know that the Radio Loud fraction is  $\sim 10\%$ , but there is no way to predict whether an *individual* quasar will be radio loud based on its optical/UV properties.

What we *can* do is restrict the parameter space where RL quasars are found.

# RLF as $f(L, z)$



# RLF as $f(\text{CIV})$



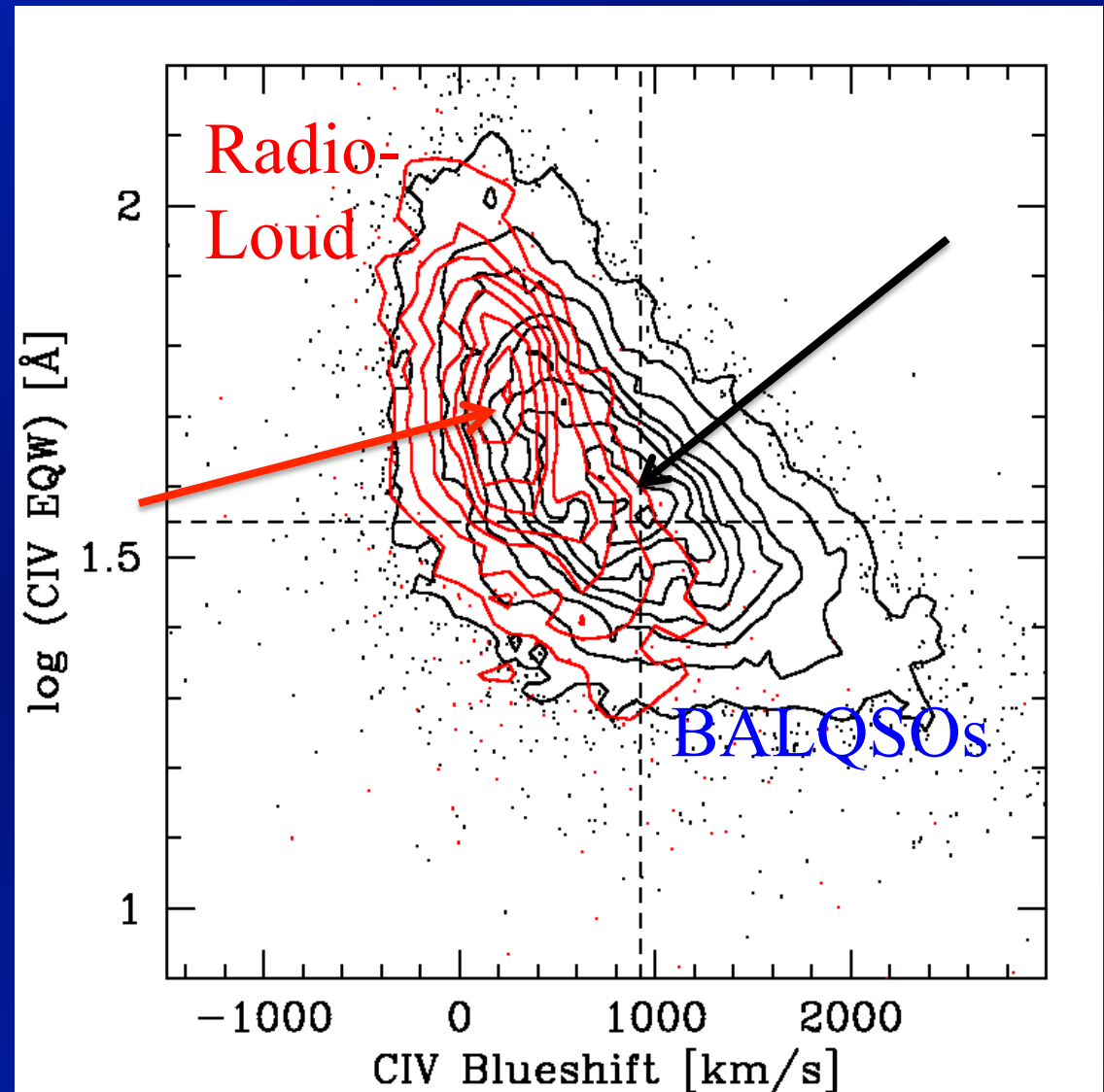
CIV acts as  
an EV1  
surrogate at  
high- $z$ ; see  
also Sulentic  
et al.; Wills  
et al. &  
collaborators

Kratzer &  
Richards 2014

# CIV Parameter Space

Generally speaking radio-loud quasars and BALQSOs live in opposite corners.

RLs do not occupy a unique parameter space.



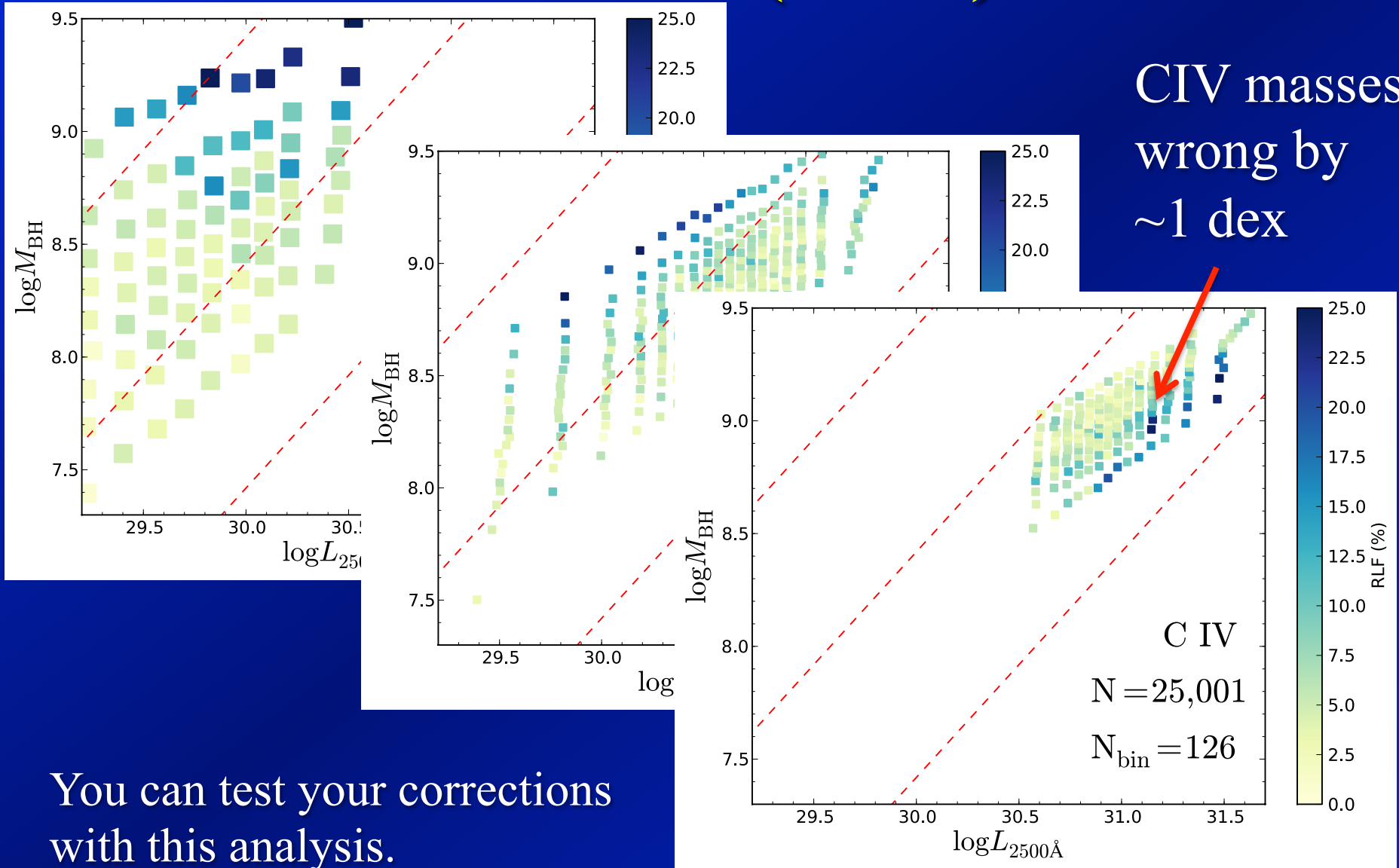
# No “Typical” Radio Quiet

Radio-loud quasars are drawn from the “hard-spectrum” population of RQs. In fact they are indistinguishable.

BALQSOs are drawn from the “soft-spectrum” population of RQs (with a larger than 20% covering fraction).

Shouldn't compare RL to RQ, but rather RL to HSRQ to SSRQ.

# RLF as f(Mass)





# Conclusions

1. There is no typical RQ quasar with which to compare RL.
2. CIV BH masses are wrong.
3. HSRQs are red.
4. SSRQs (BALQSOs) are blue.

