Structure and orientation of BLR in quasars

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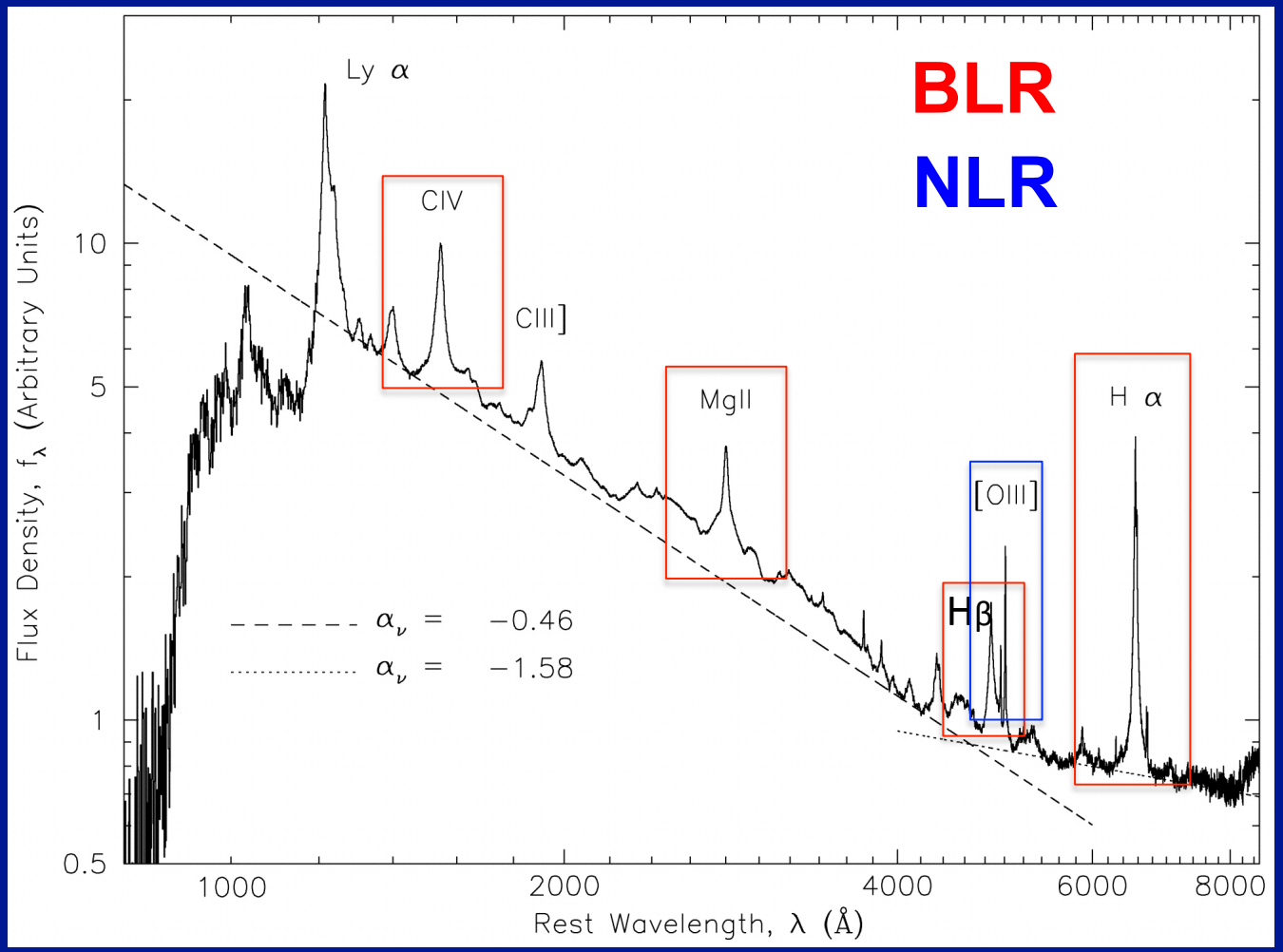
AGN Unified Model: inner components



VandenBerk et al. 2001

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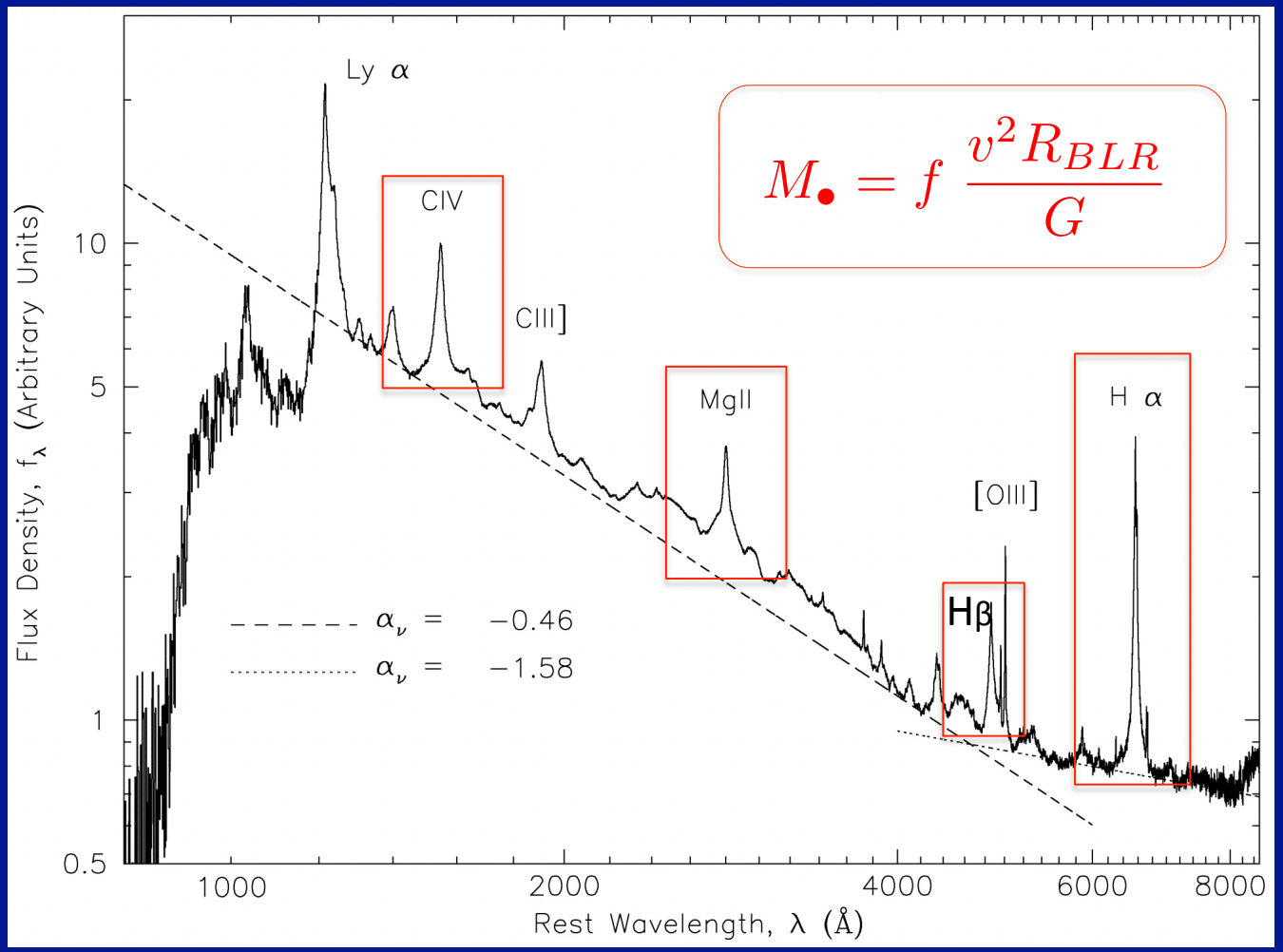

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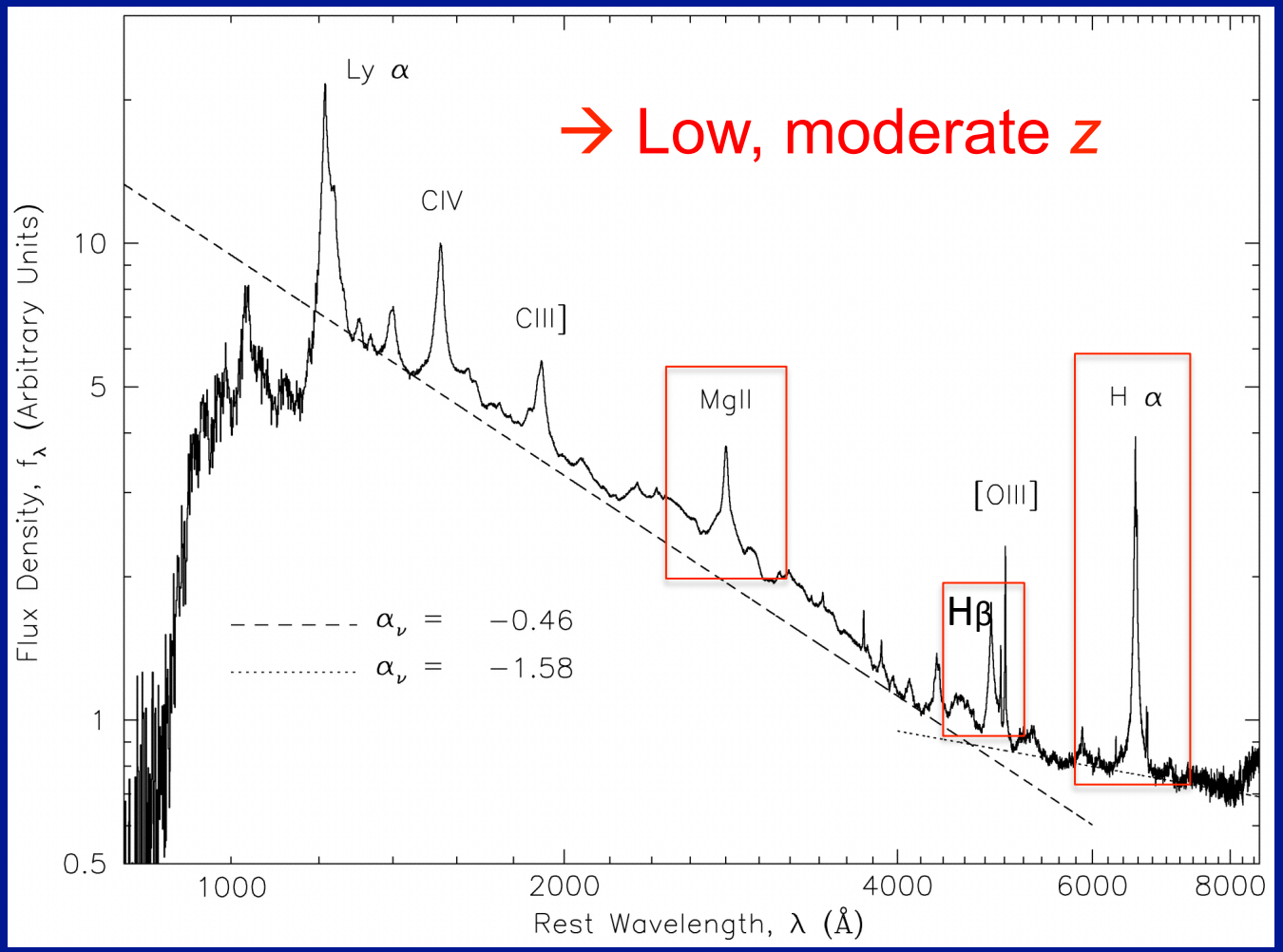


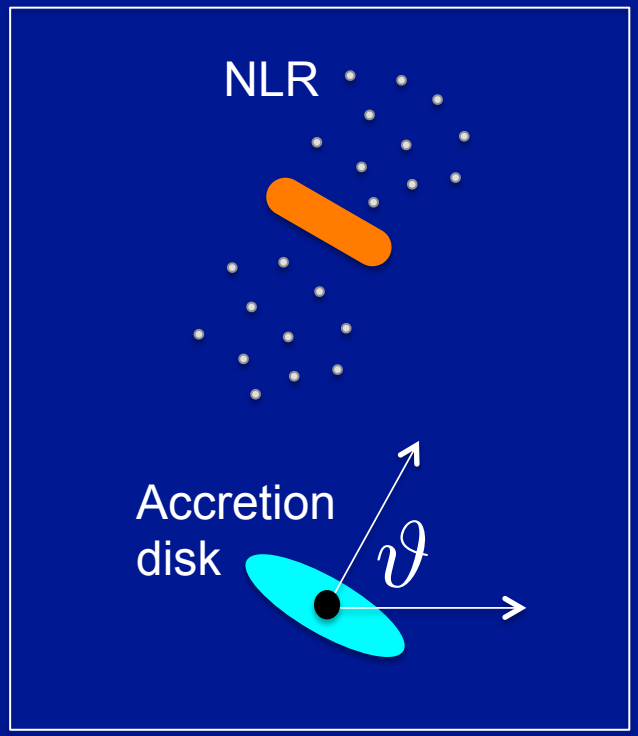
[OIII] vs Broad Lines

Hb, Ha, MgII

Susanna Bisogni
Guido Risaliti
Alessandro Marconi
(Università di Firenze, INAF OAA Arcetri)

EW[OIII]: quasar orientation indicator

Risaliti, Salvati, Marconi 2011



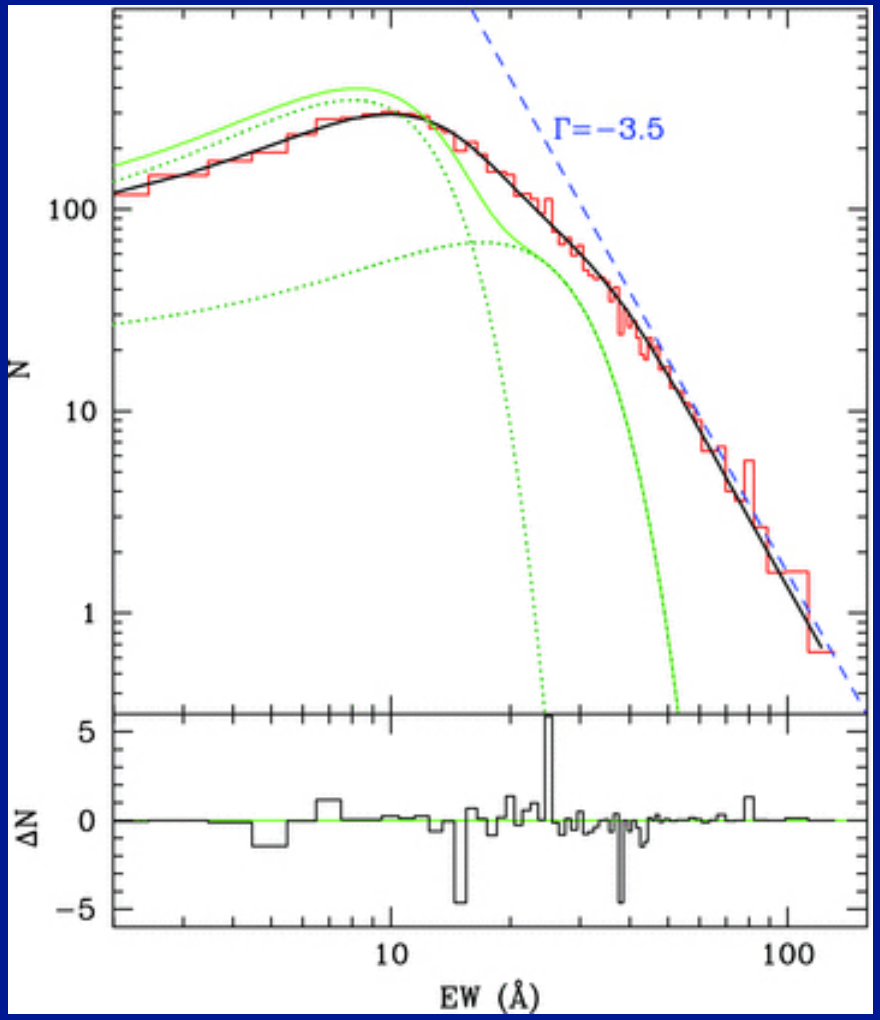
$L_{[OIII]}$ ISOTROPIC

$$L_{DISK_{obs}} = L_{DISK_{int}} \cos\vartheta$$

$$EW_{[OIII]} \propto f(\vartheta)$$

EW[OIII]: quasar orientation indicator

Risaliti, Salvati, Marconi 2011

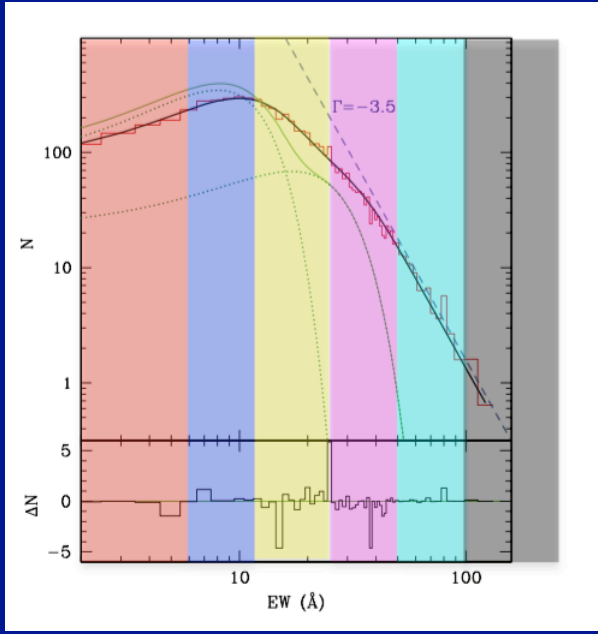


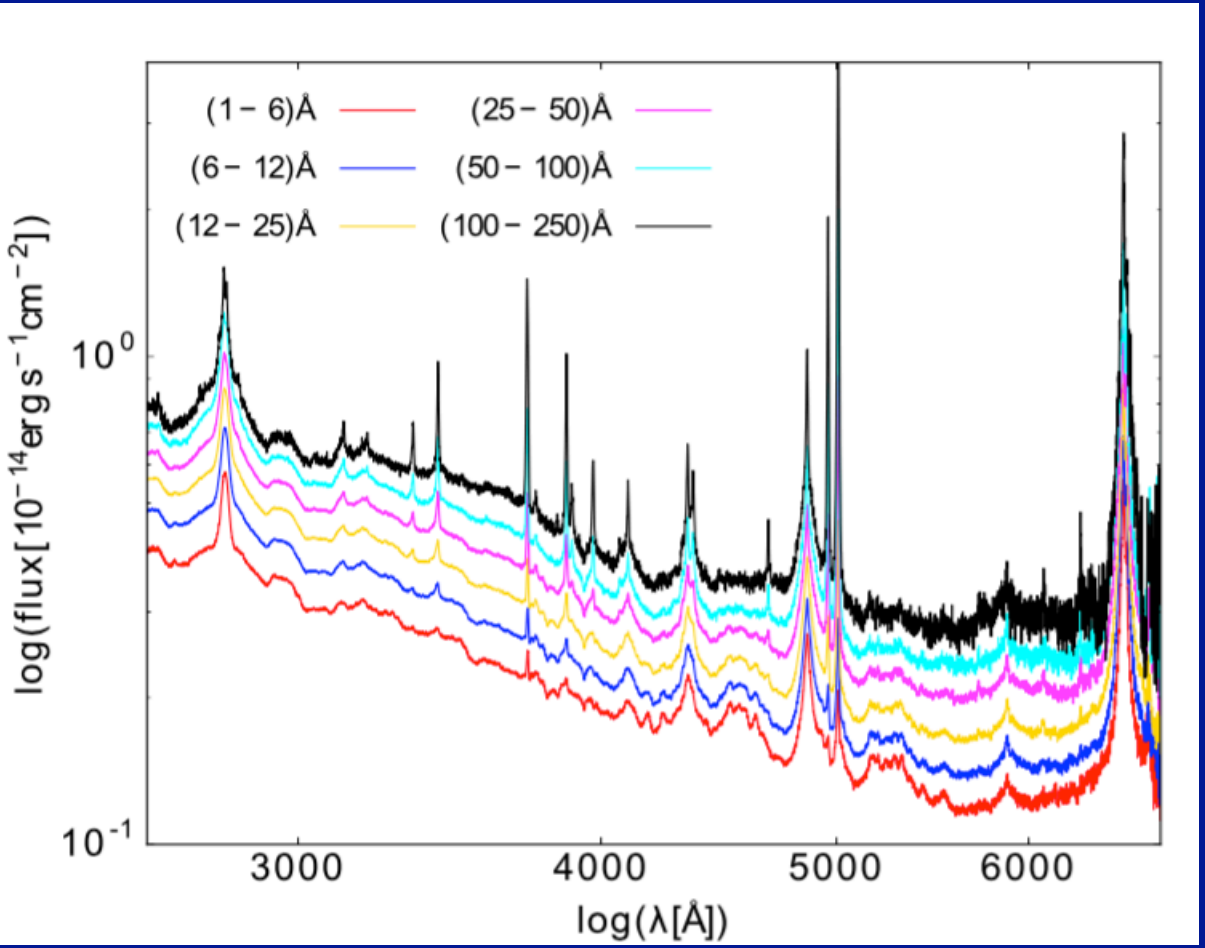
- Low EW[OIII]
  → Mostly *face-on* sources
- High EW[OIII]
  → *Edge-on* sources
- BLR → disk-shaped

EW[OIII]: quasar orientation indicator

Bisogni, Marconi, Risaliti 2016

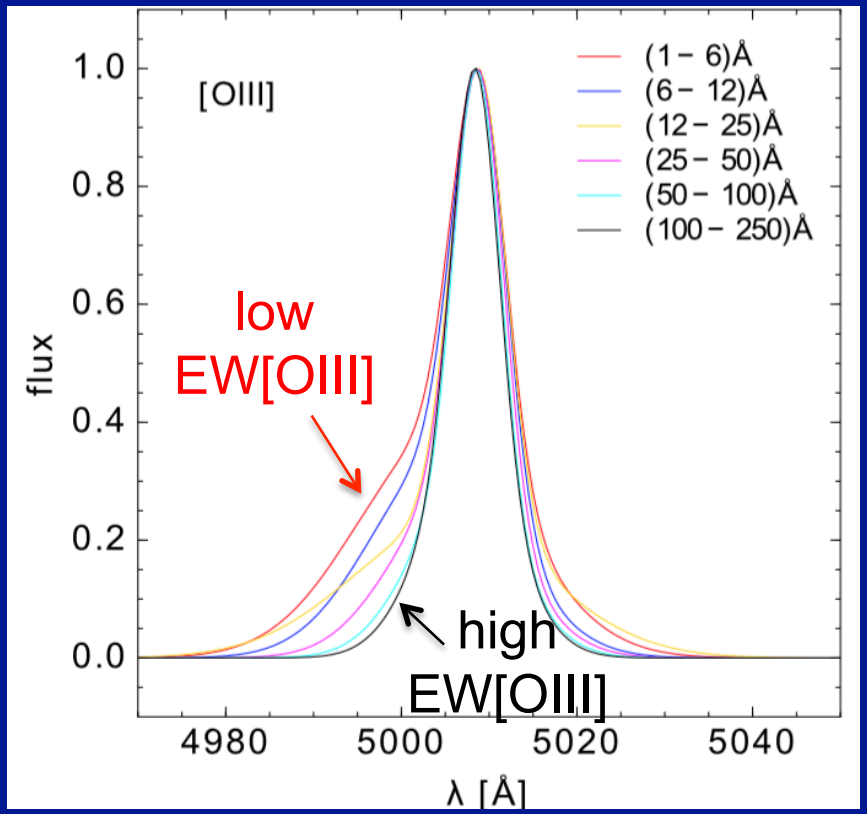
12000 blue objects
from SDSS DR7

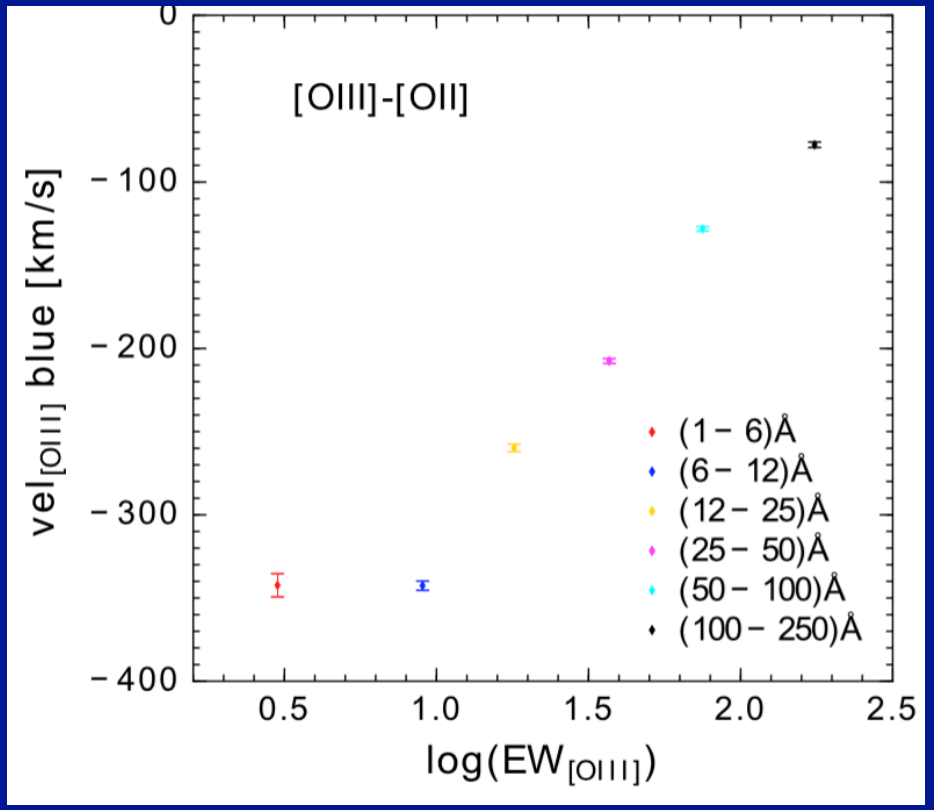




EW[OIII]: quasar orientation indicator → Narrow Lines

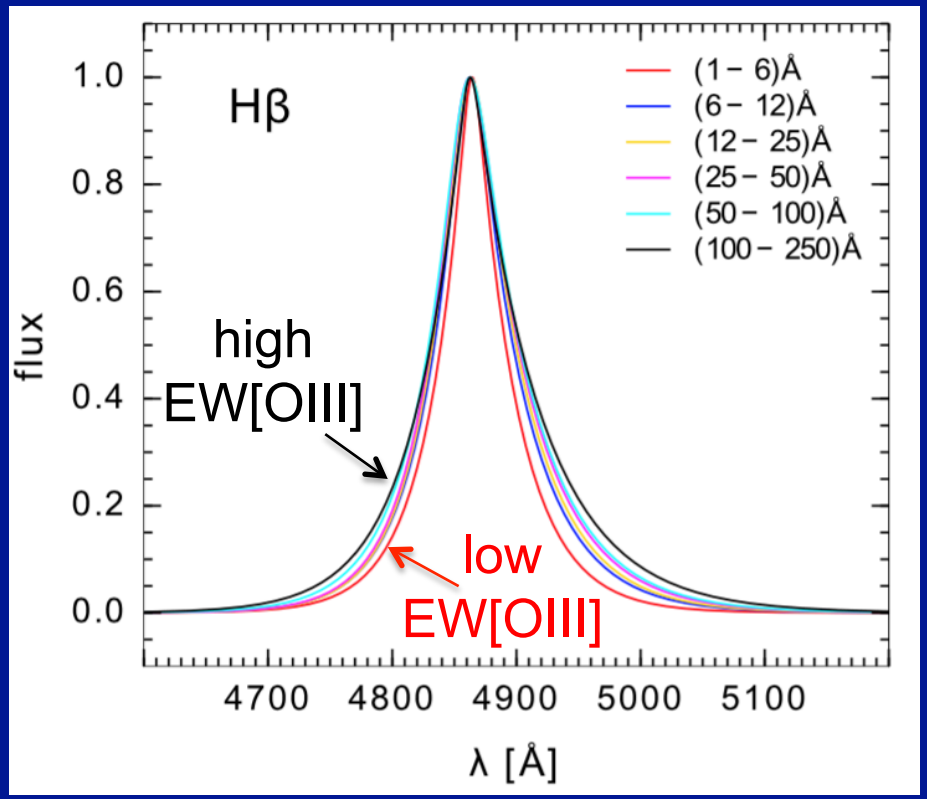
Bisogni, Marconi, Risaliti 2016

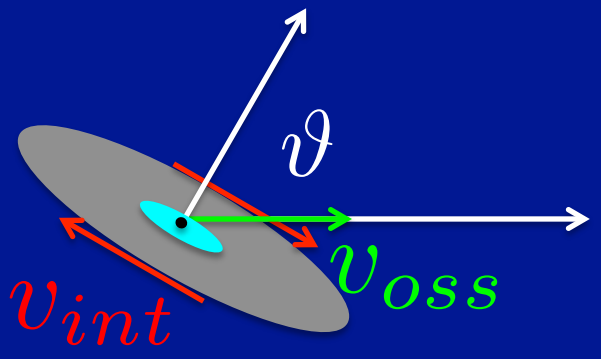




EW[OIII]: quasar orientation indicator → Broad Lines

Bisogni, Marconi, Risaliti 2016

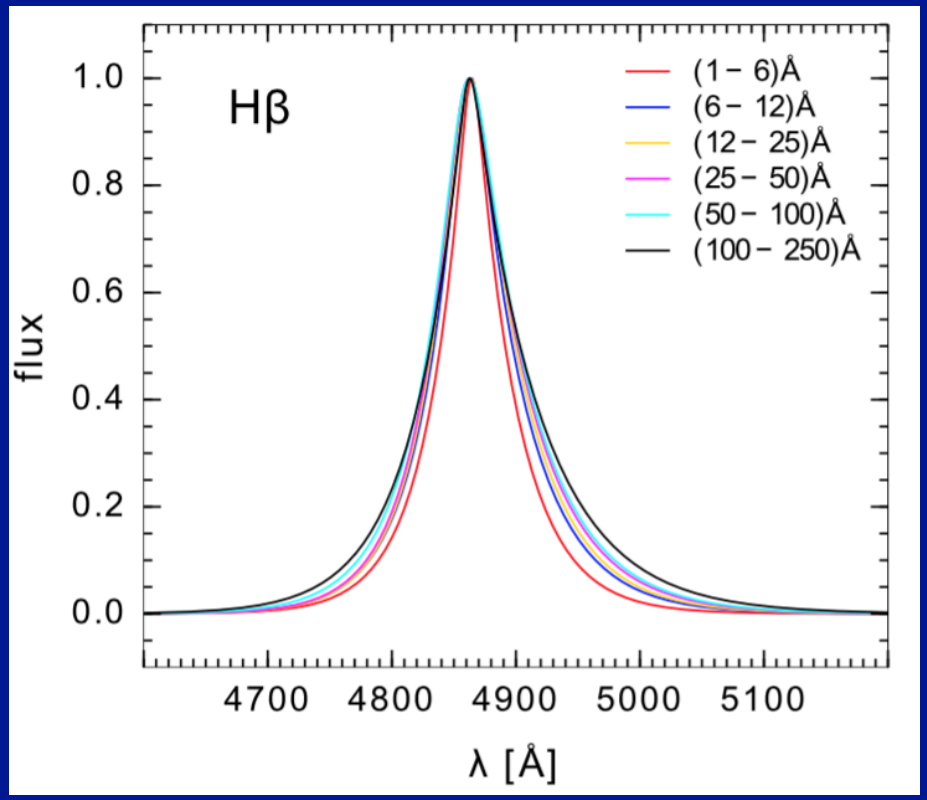


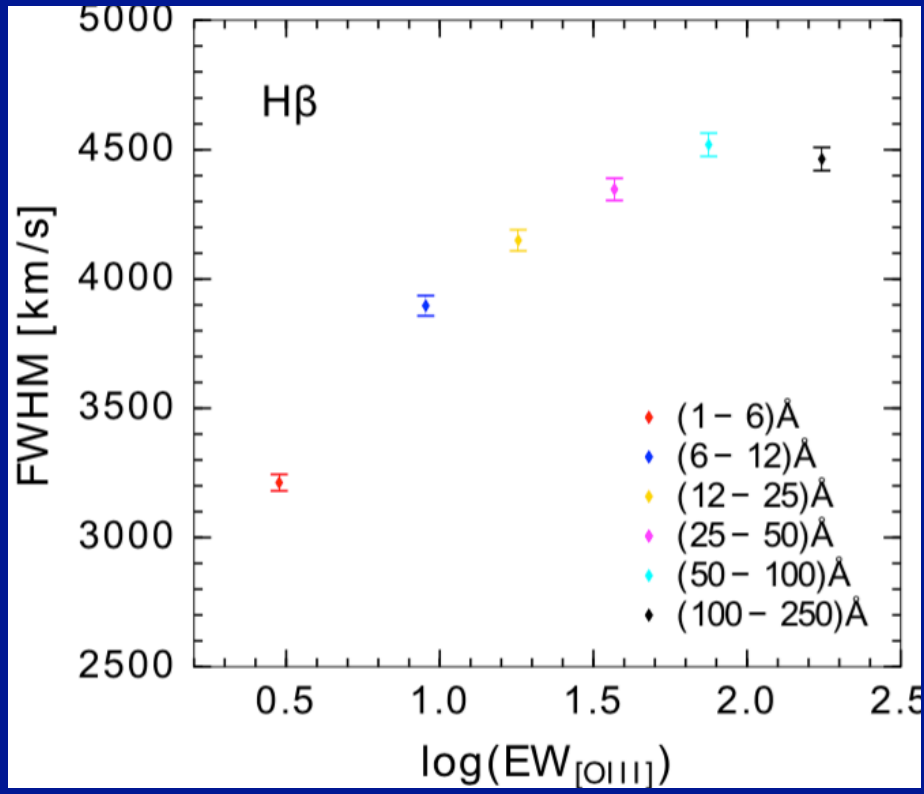


$$v_{oss} = v_{int} \sin \vartheta$$

EW[OIII]: quasar orientation indicator → Broad Lines

Bisogni, Marconi, Risaliti 2016



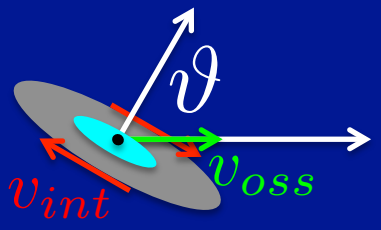


EW[OIII]: quasar orientation indicator Implications

Knowing source orientation allows to:

- Connect emissions shape to geometry
  → morphological study of unresolved, inner regions

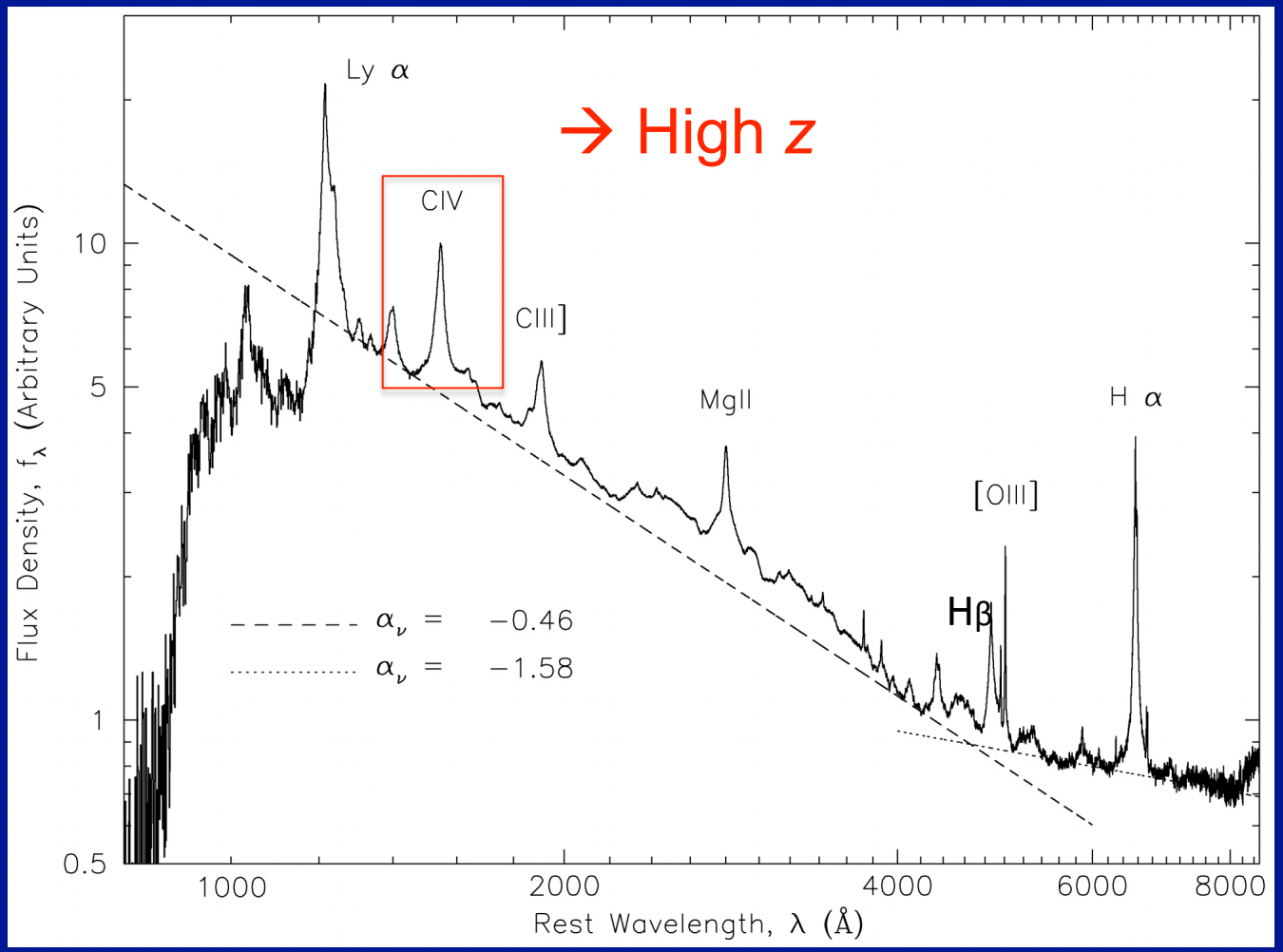
- Correct virial mass estimations for non edge-on sources



$$M_\bullet = f\frac{v_{int}^2 R_{BLR}}{G} = f\frac{(\frac{v_{oss}}{\sin i})^2 R_{BLR}}{G}$$

- Many other implications we are still working on!

AGN Unified Model: inner components

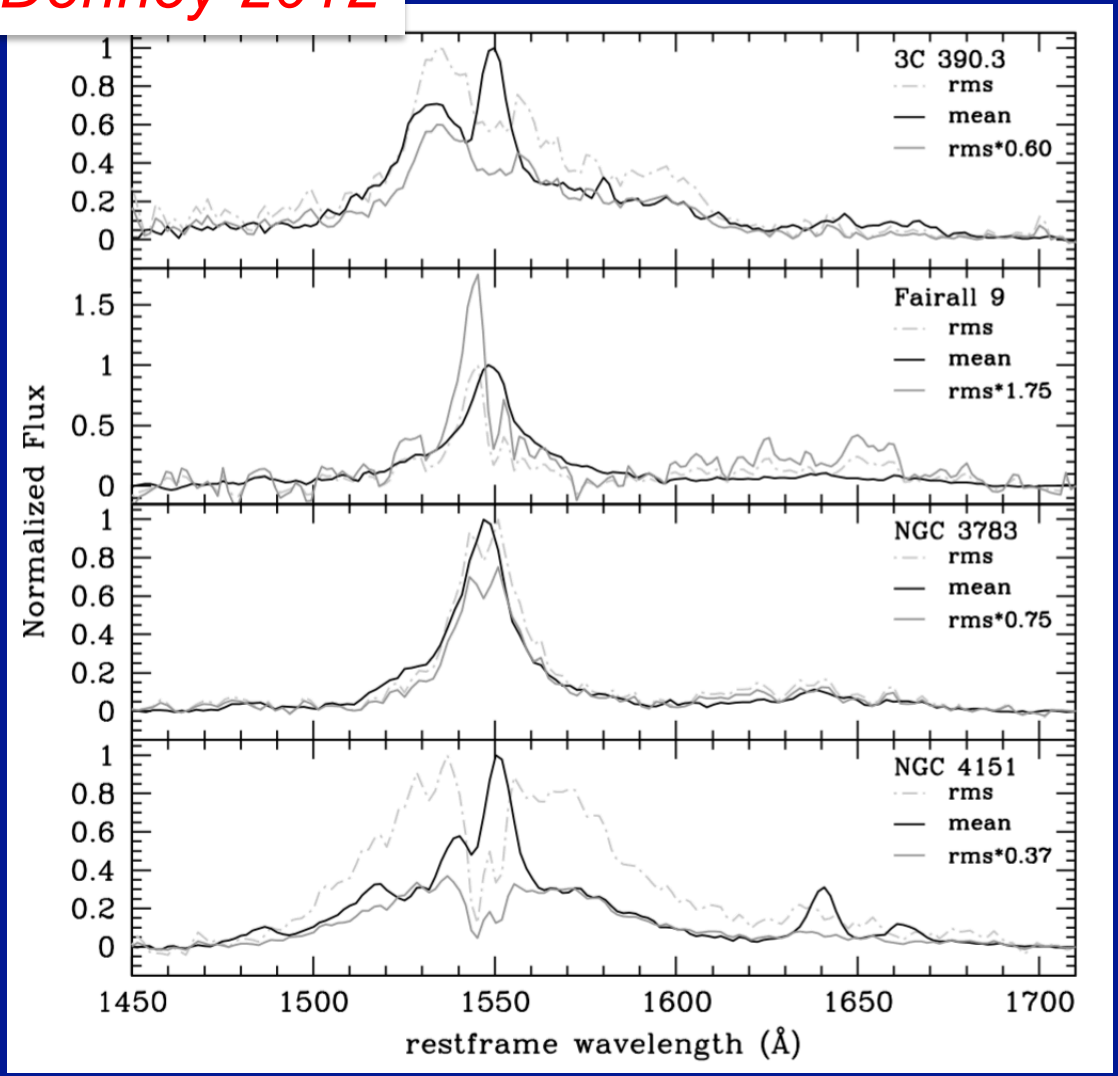


[OIII] vs Broad Lines
CIV

Susanna Bisogni
Kelly Denney
Brad Peterson
(Ohio State University)

CIV virial estimator???

Denney 2012



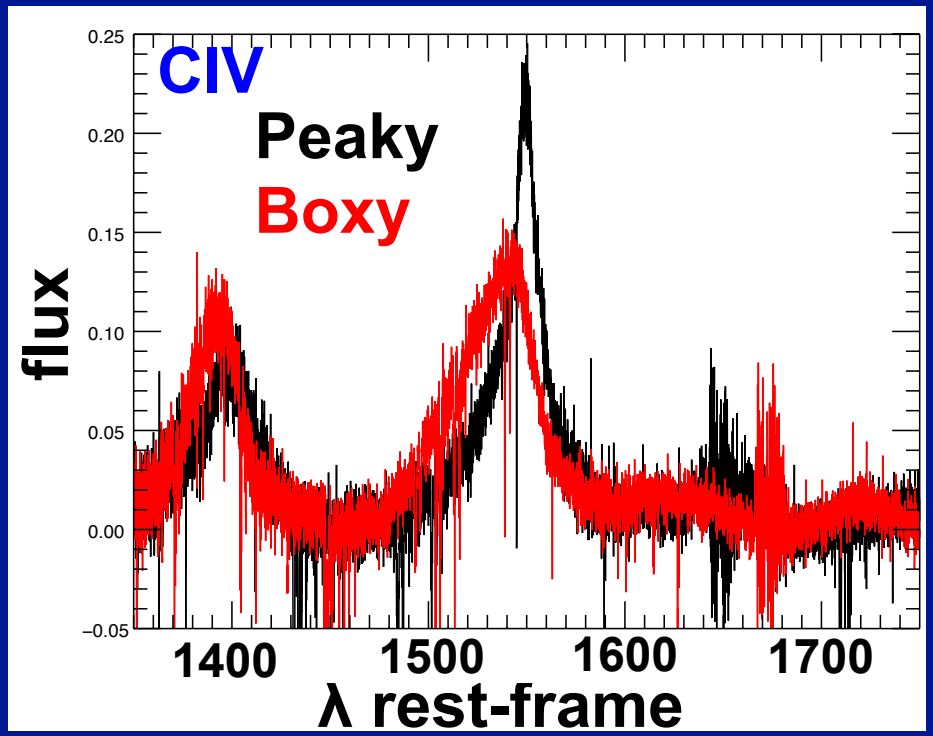
$$M_\bullet = f\,\frac{v^2 R_{BLR}}{G}$$

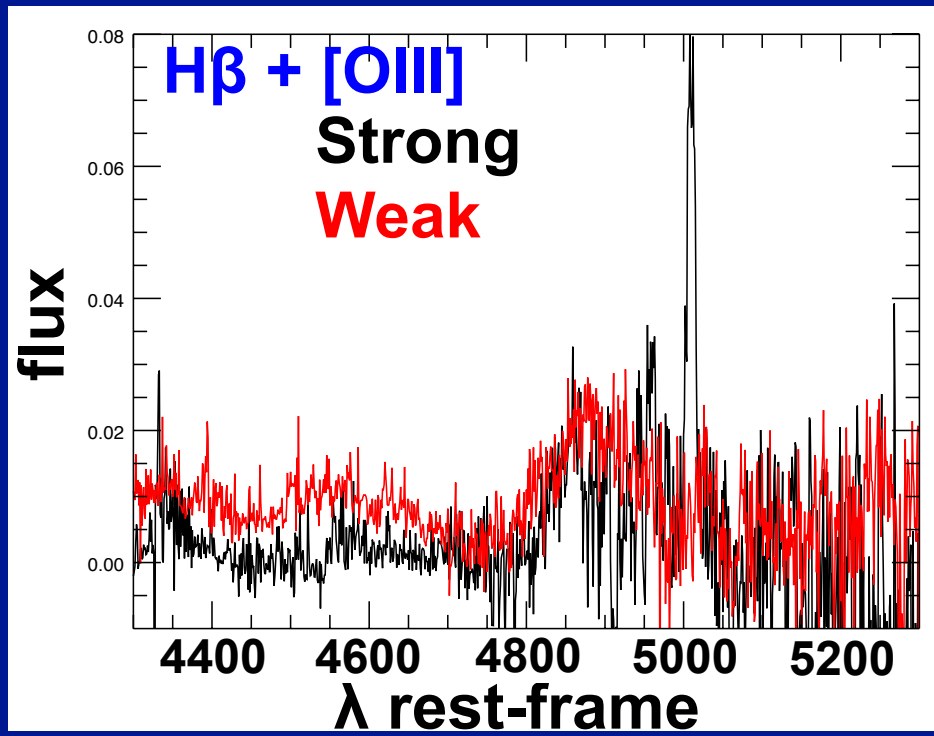
v^2 = linewidth
→ is a line of sight velocity,
not only gas in virial condition!

CIV-[OIII] connection

- [OIII] intense → CIV peaky and symmetric
- [OIII] weak or absent → CIV boxy and blueshifted

Bisogni, Denney, Peterson in prep.





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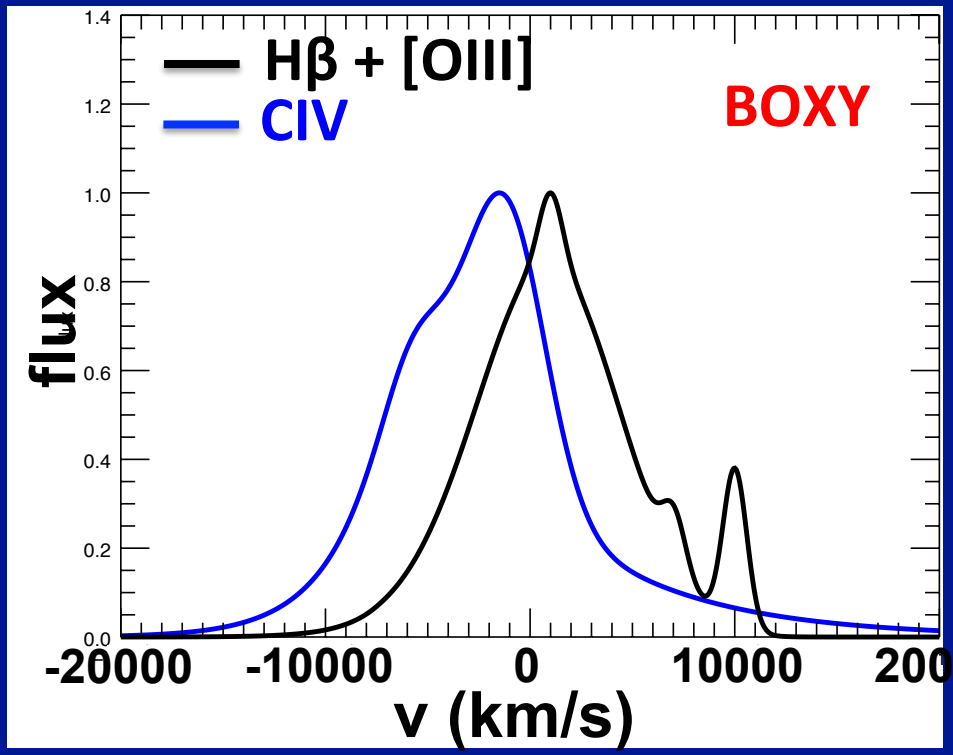

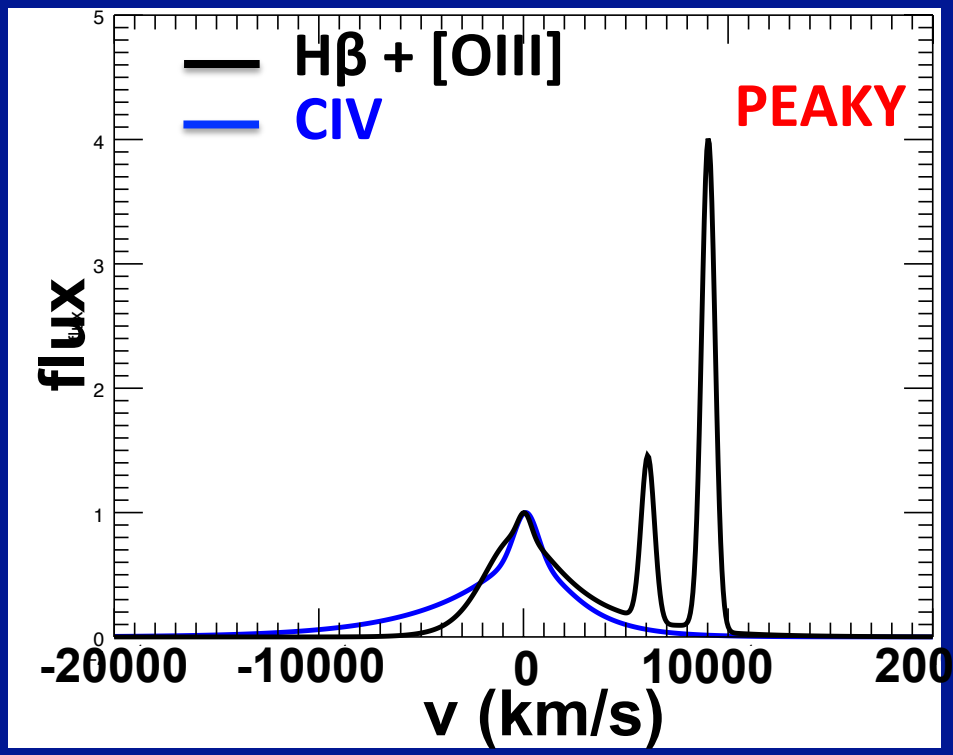

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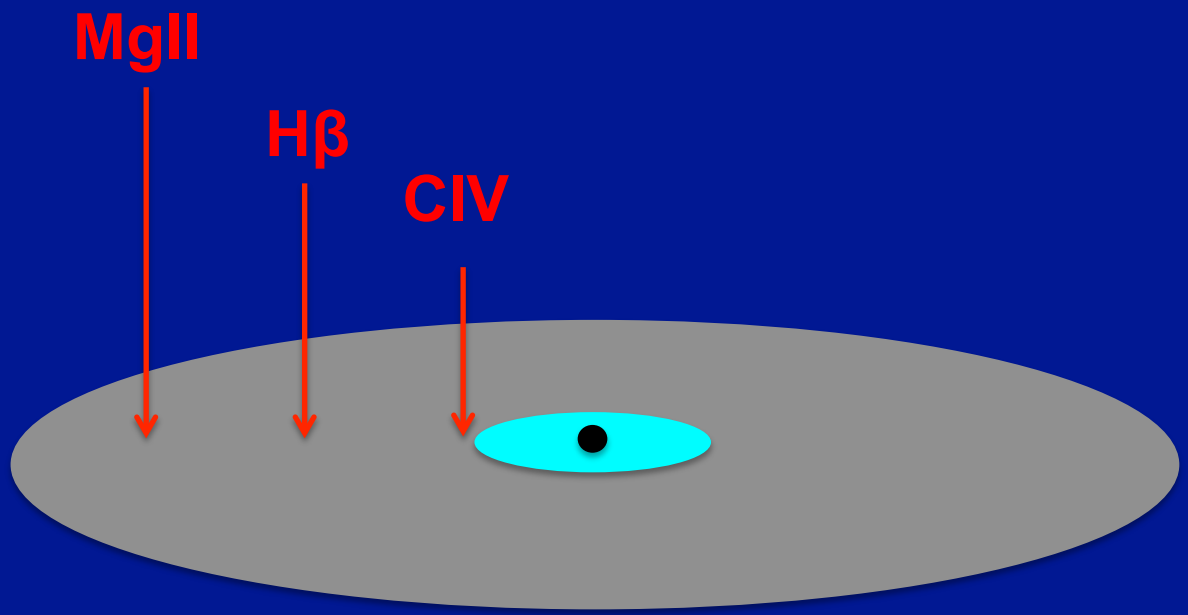

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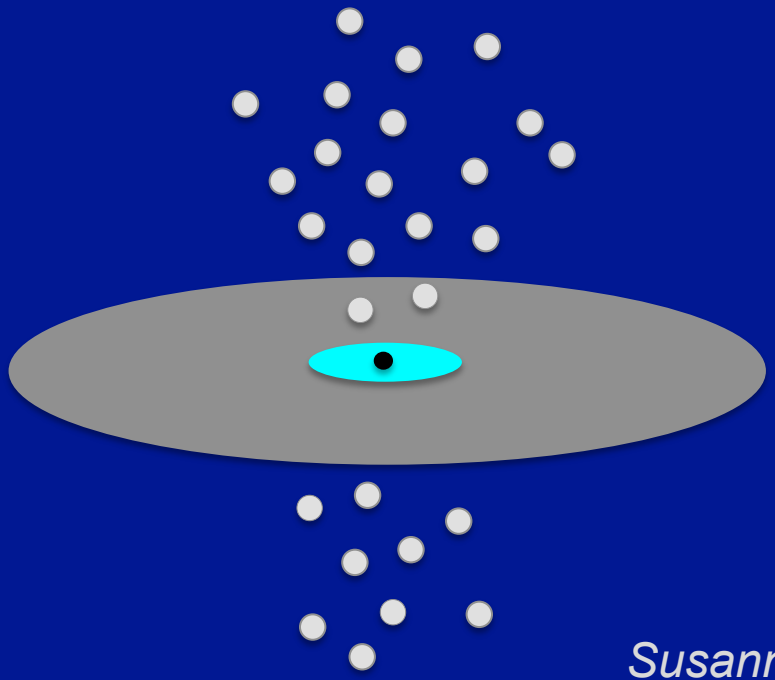
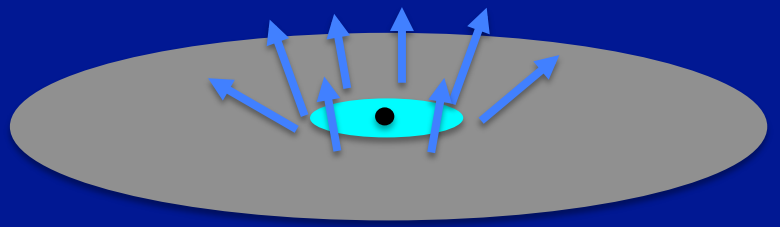
Bisogni, Denney, Peterson in prep.

Peaky CIV → NO outflow,
NLR present!



Boxy, blueshifted CIV →
OUTFLOW,
NO NLR!



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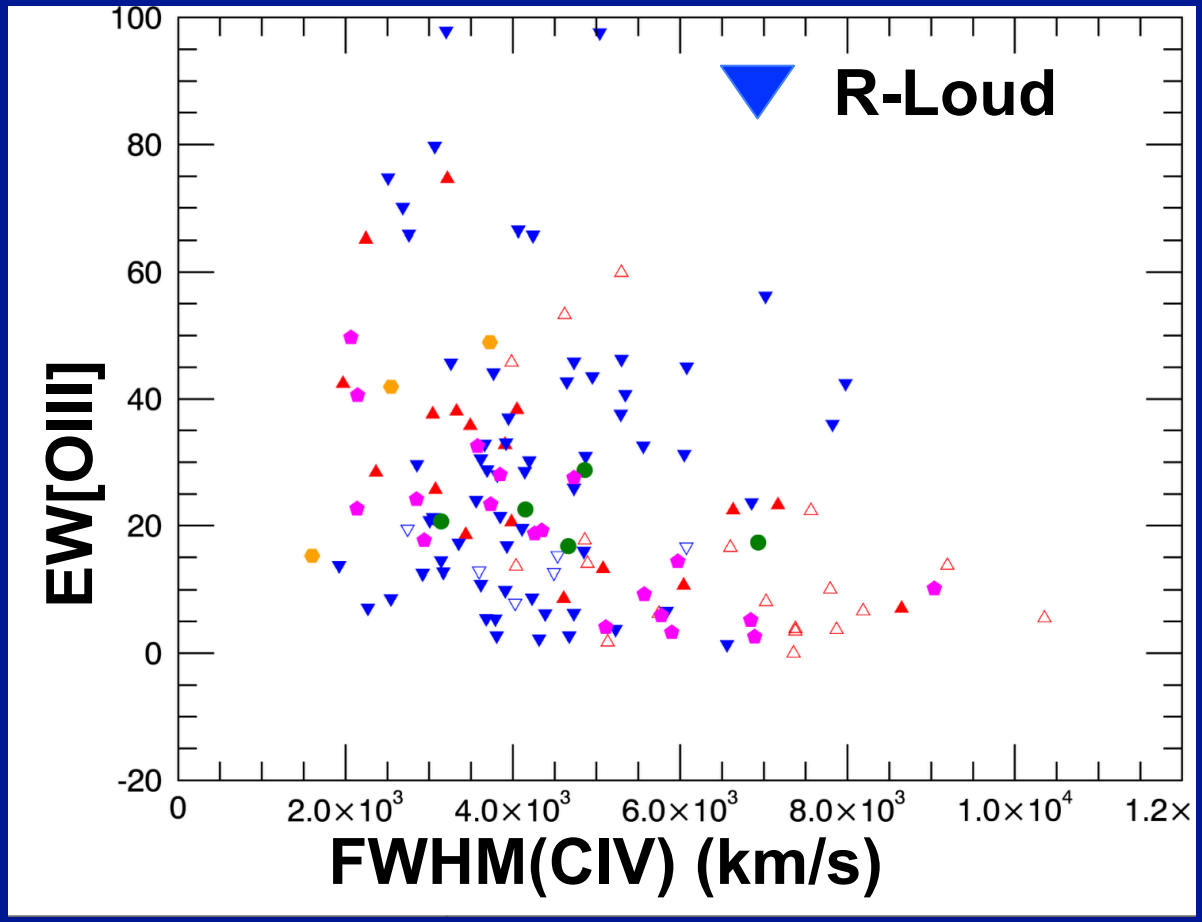
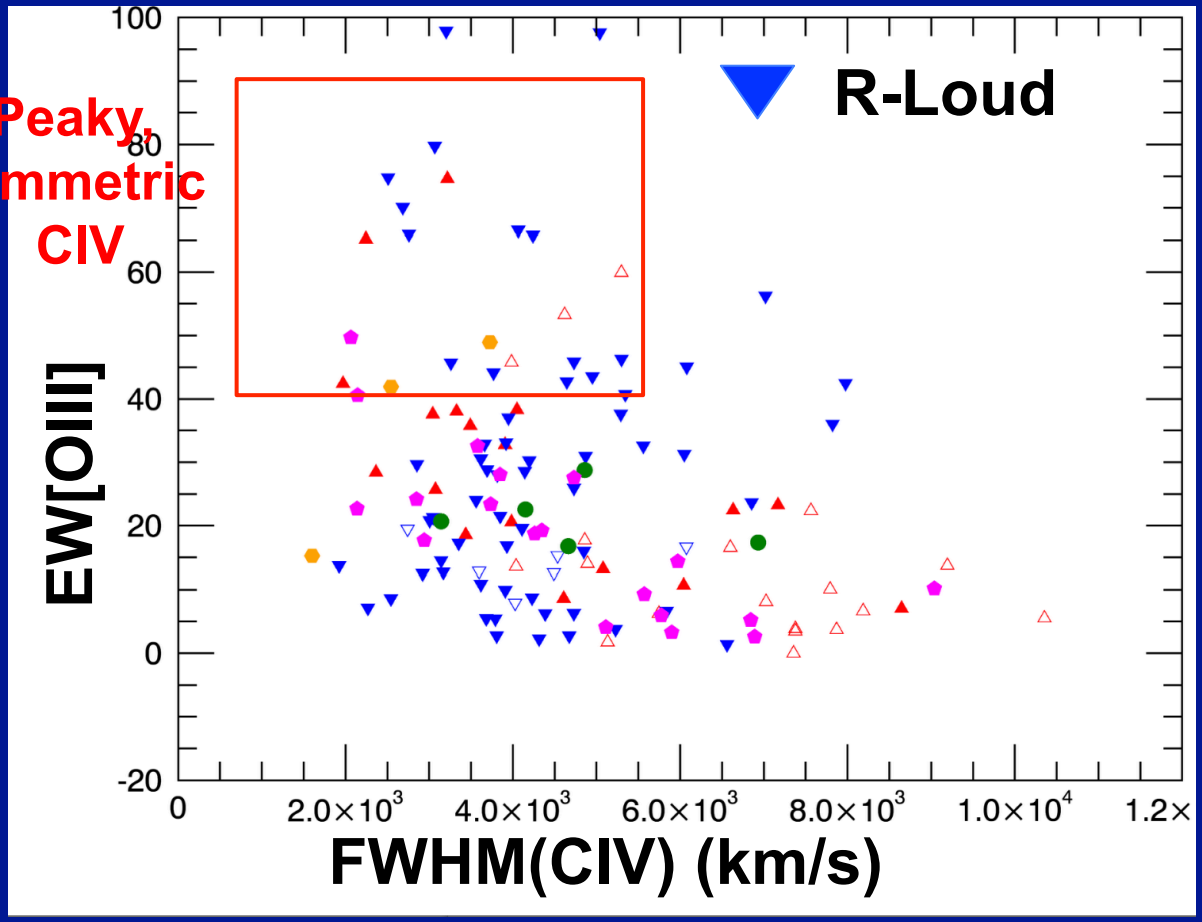


CIV-[OIII] connection

FWHM(CIV) must have a tight correlation with FWHM(Hβ) and should not depend on [OIII] behaviour!



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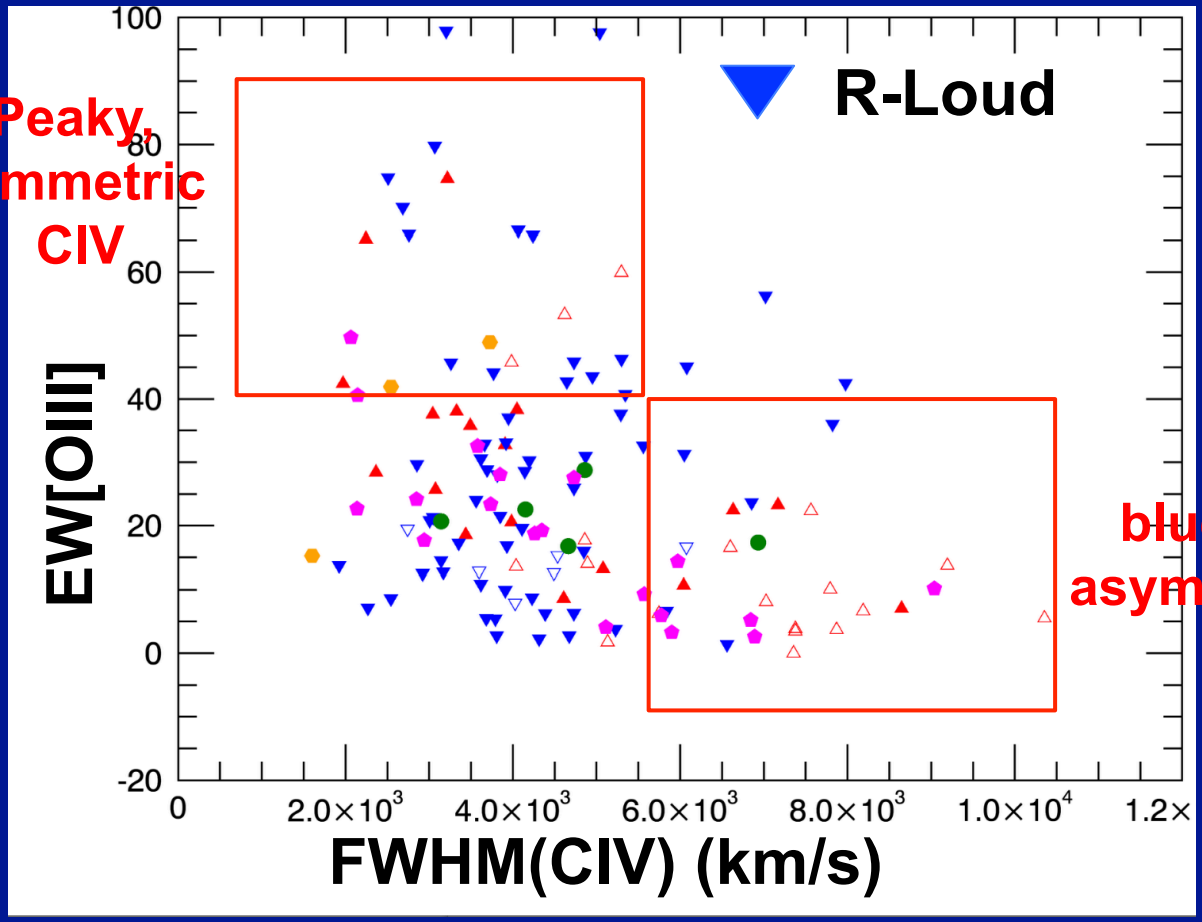
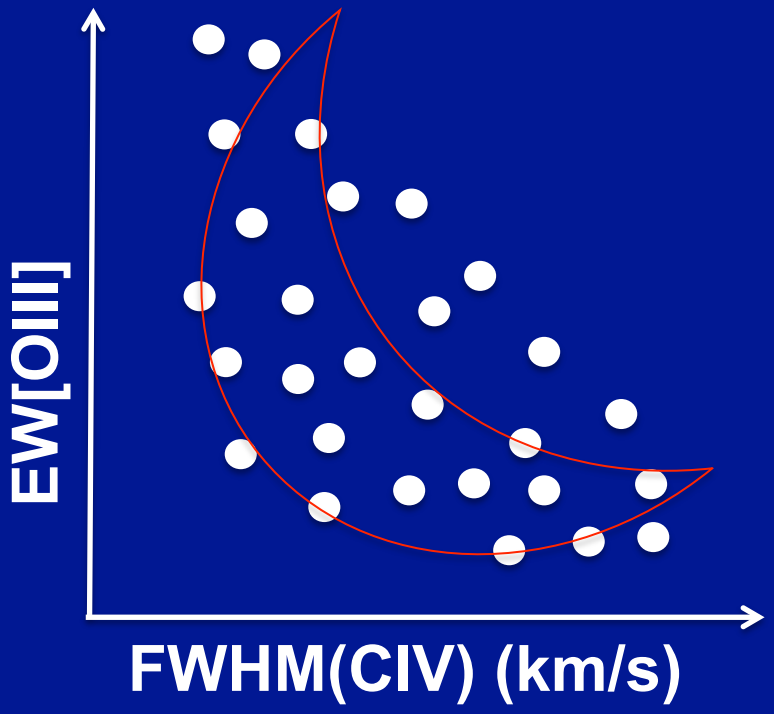
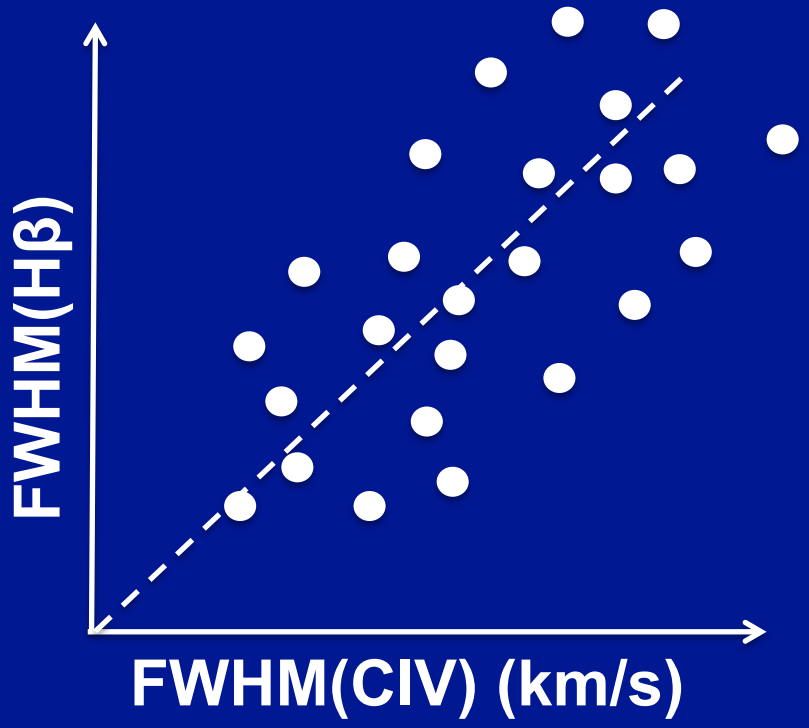


CIV-[OIII] connection: goal

Bisogni, Denney, Peterson in prep.





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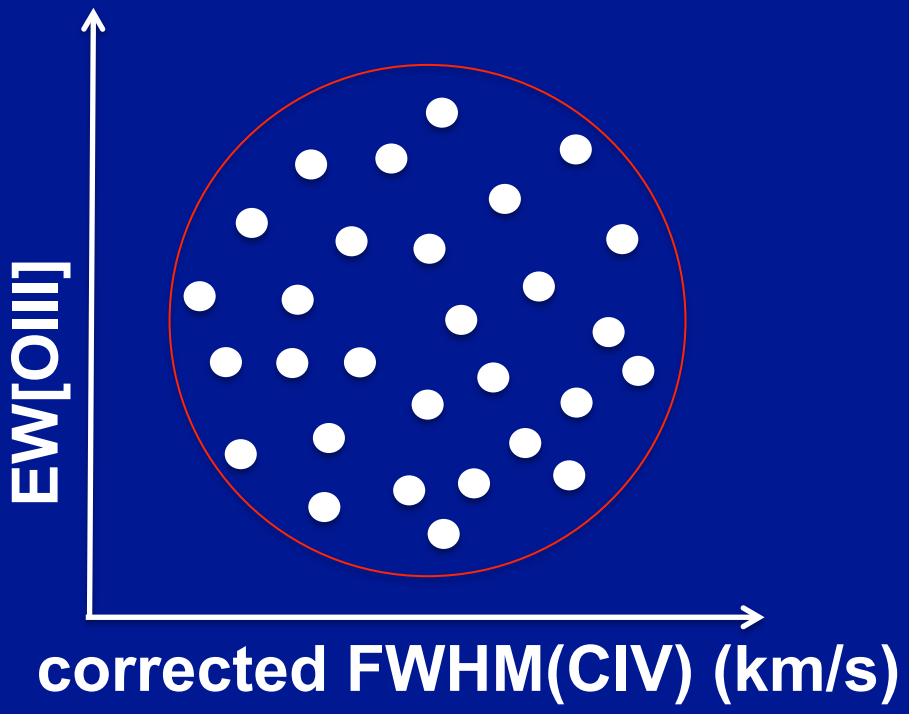

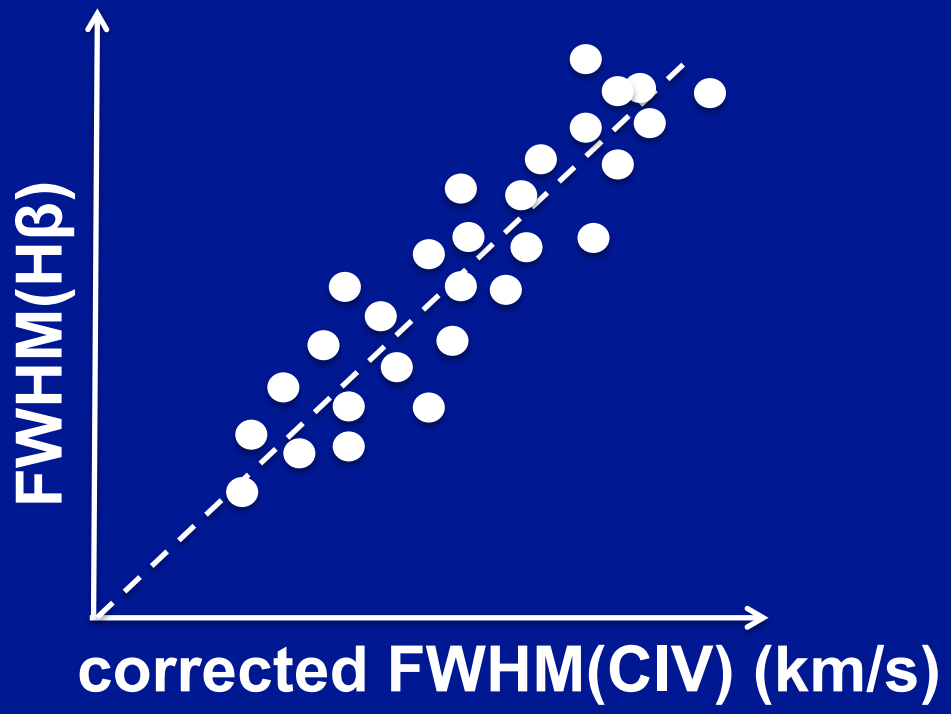

→ corrected FWHM(CIV)

CIV-[OIII]: PCA and correlations

Bisogni, Denney, Peterson in prep.

- Measuring CIV-[OIII] profiles properties: - FWHM
  - asymmetric indexes
  - centroids
  - …

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- Finding drivers of CIV-[OIII] connection via PCA and Spearmann correlation coefficients of measured properties

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- Finding good representations of: - CIV peakiness $f(peak)$
  - CIV blueness $f(blue)$

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→ correct FWHM(CIV):

$$\mathrm{FMHM(H}\beta) = \mathrm{FWHM(CIV)} \cdot \frac{f(peak)^{\alpha}}{f(blue)^{\beta}}$$

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[OIII] vs Broad Lines: Conclusion

Using UV/optical emission lines in a mutual framework to infer information on:

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Using UV/optical emission lines in a mutual framework to infer information on:

- Geometry and dynamics of the emitting regions

EW[OIII] : BLR disk-shaped

[OIII] - CIV : Outflows in the accretion disk - inner BLR
→ inhibition of NLR

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Using UV/optical emission lines in a mutual framework to infer information on:

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  → inhibition of NLR

- Correction of virial mass estimations

  EW[OIII] : Hβ, Hα, MgII, (CIV as well..) for the orientation effects

  [OIII] - CIV : CIV for the contaminating components