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Structure and orientation of BLR in quasars

Susanna Bisogni

Guido Risaliti

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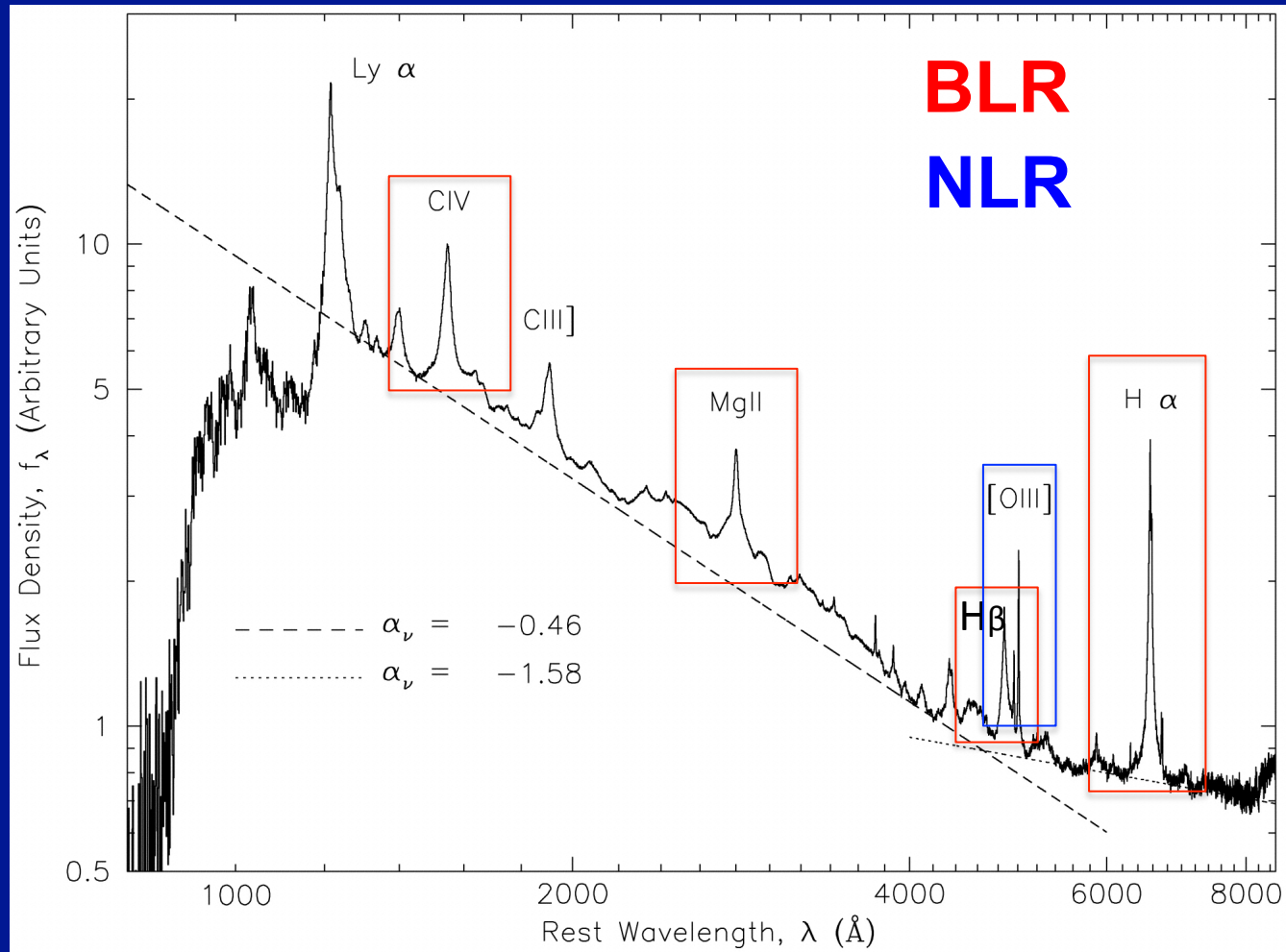
Kelly Denney

Brad Peterson



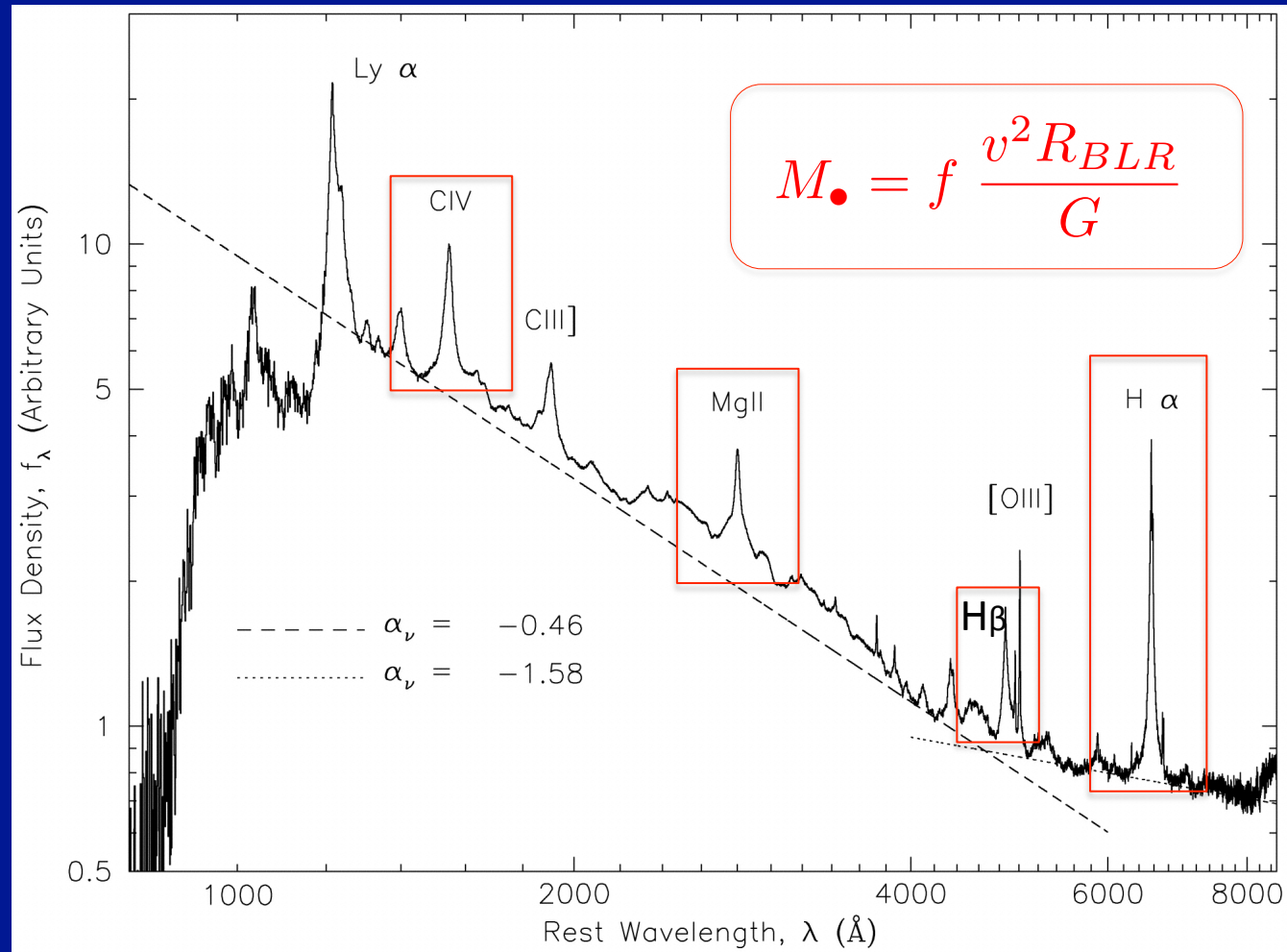
*Università degli Studi di Firenze
INAF, Osservatorio Astrofisico di Arcetri*

AGN Unified Model: inner components

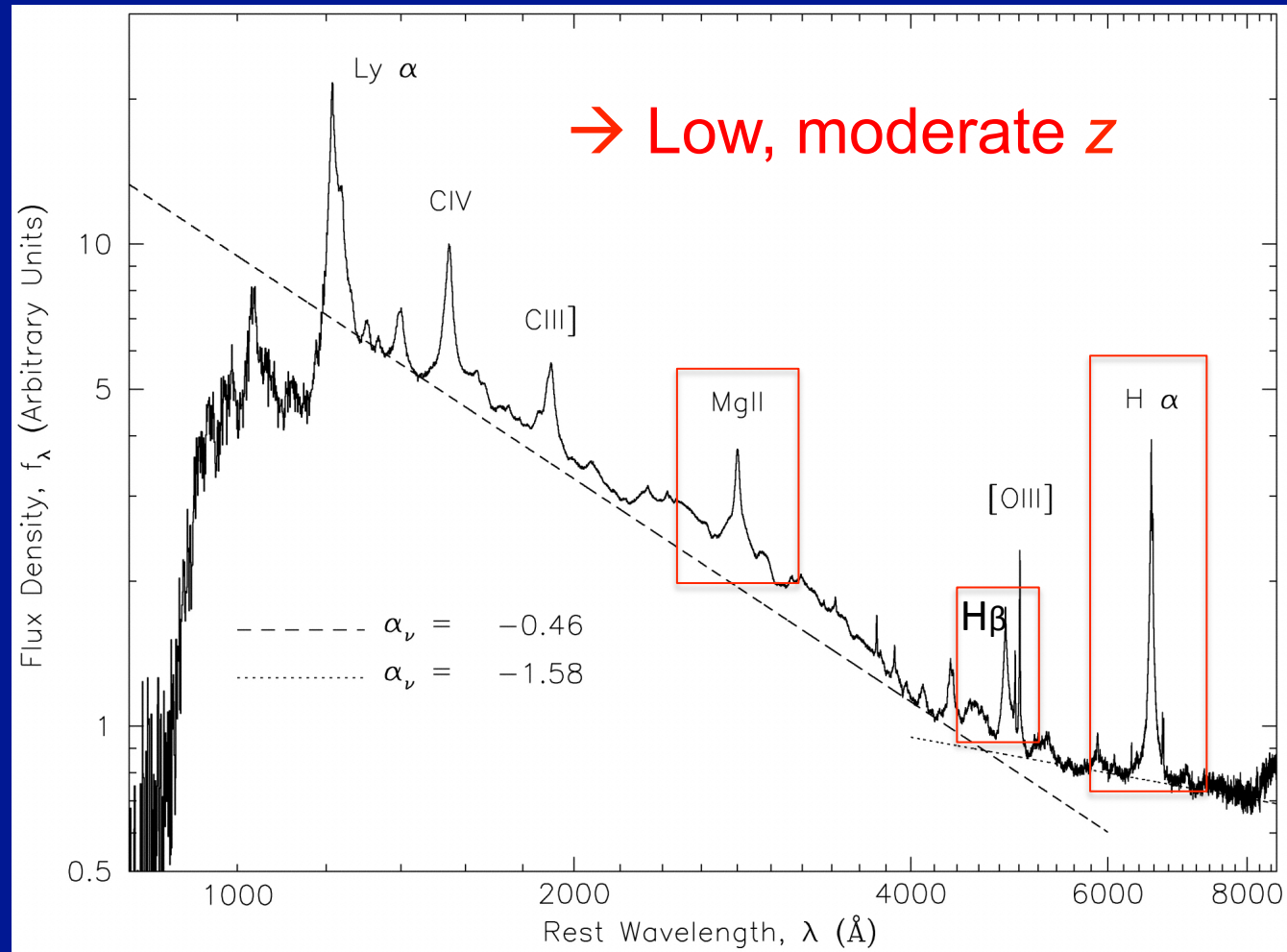


VandenBerk et al. 2001

AGN Unified Model: inner components



AGN Unified Model: inner components



[OIII] vs Broad Lines

H β , H α , MgII

Susanna Bisogni

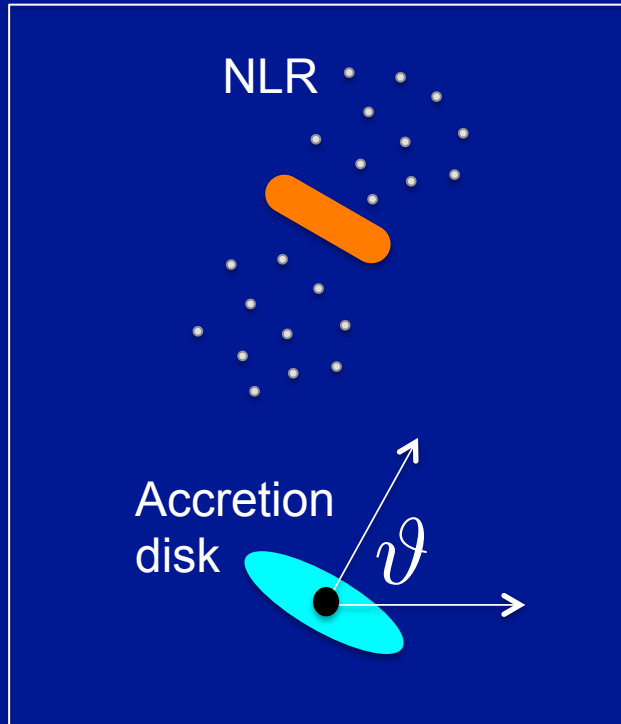
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EW[OIII]: quasar orientation indicator

Risaliti, Salvati, Marconi 2011

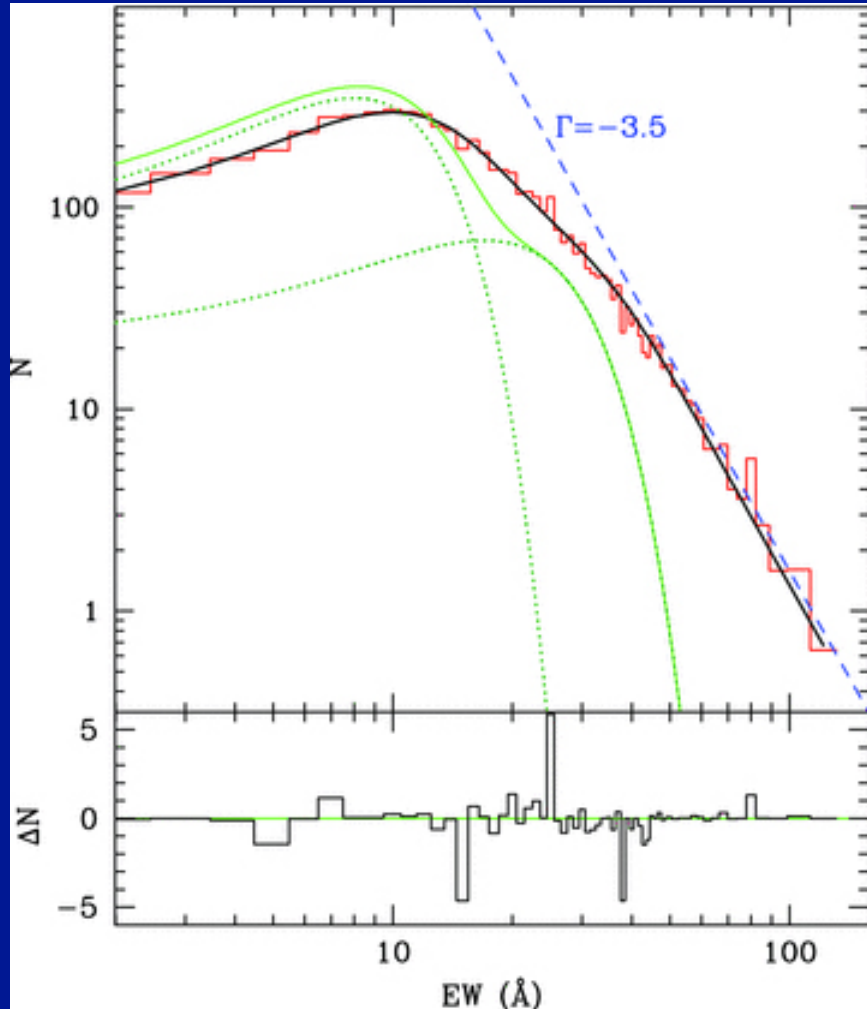


$$L_{[OIII]} \text{ ISOTROPIC}$$
$$L_{DISK_{obs}} = L_{DISK_{int}} \cos \vartheta$$

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

EW[OIII]: quasar orientation indicator

Risaliti, Salvati, Marconi 2011

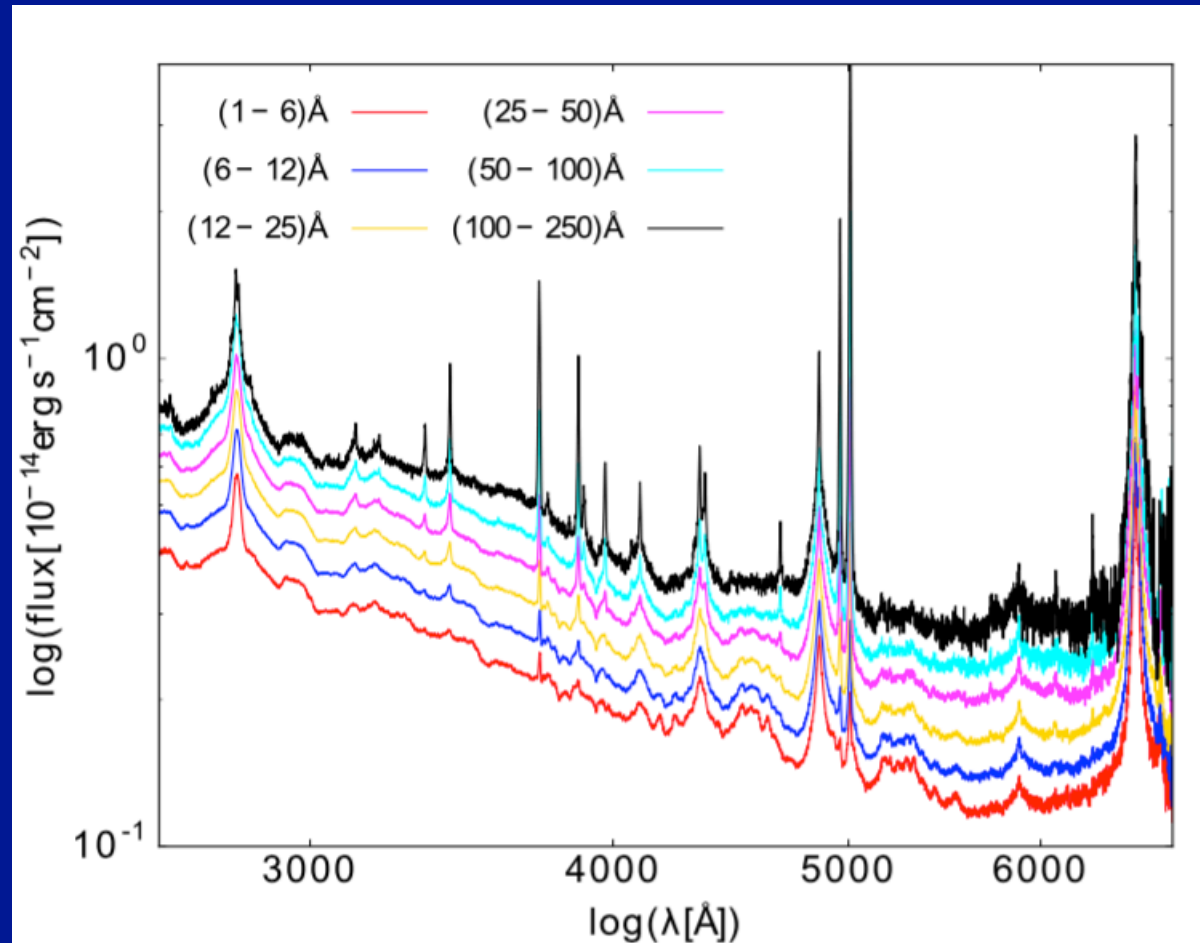
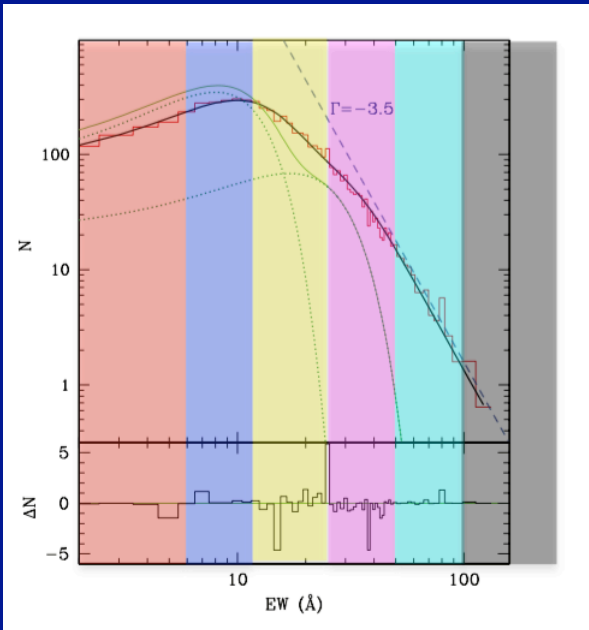


- Low EW[OIII]
→ Mostly *face-on* sources
- High EW[OIII]
→ *Edge-on* sources
- BLR → disk-shaped

EW[OIII]: quasar orientation indicator

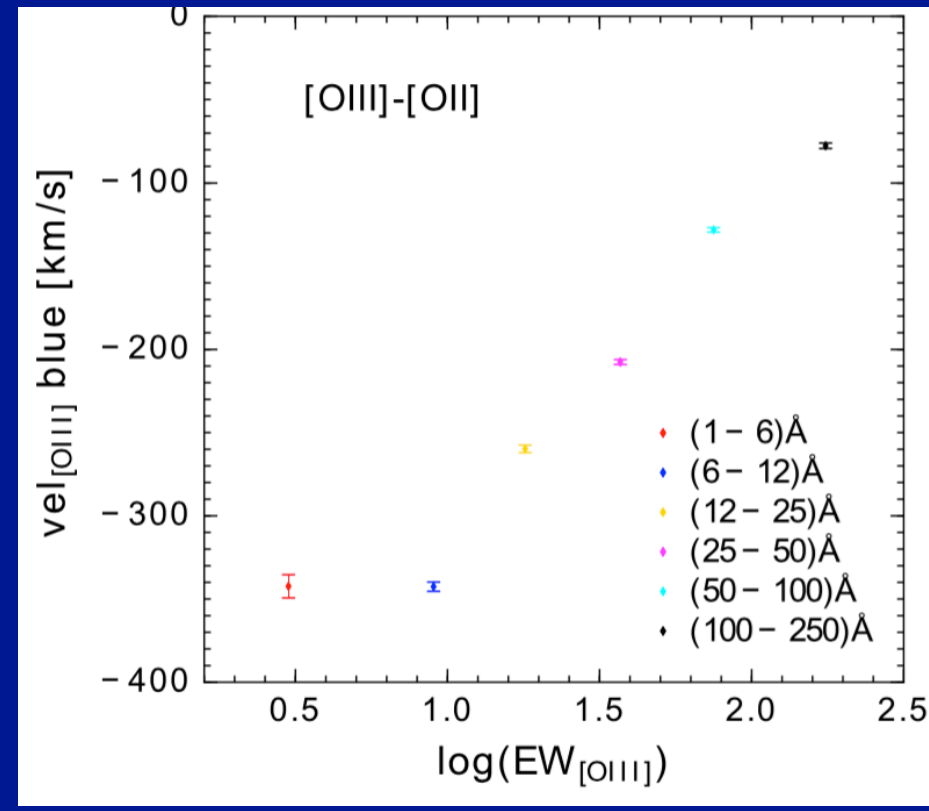
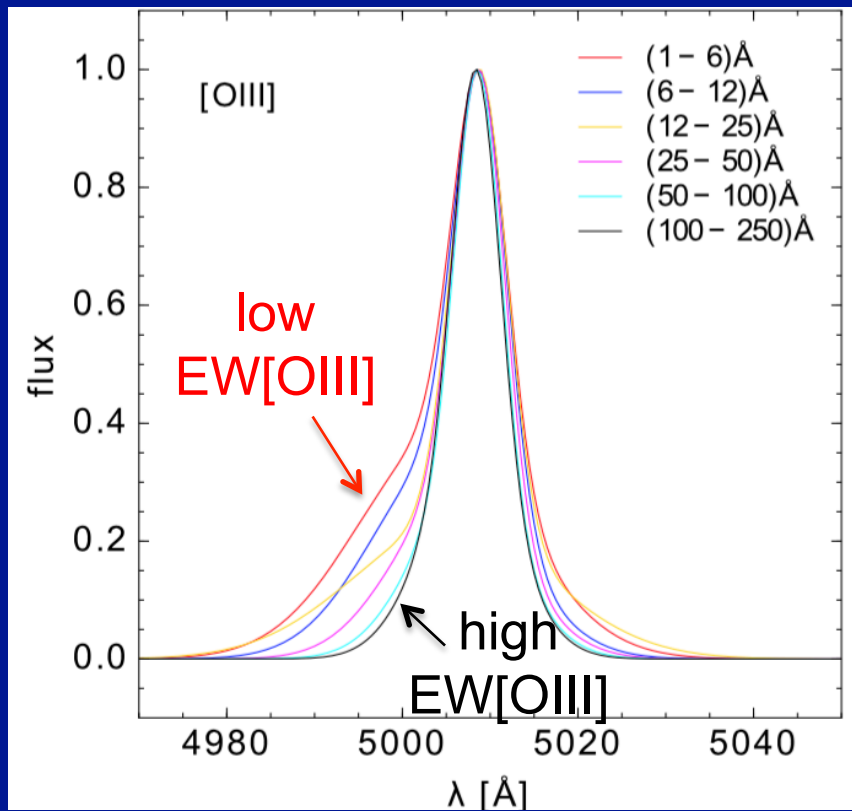
Bisogni, Marconi, Risaliti 2016

12000 blue objects
from SDSS DR7



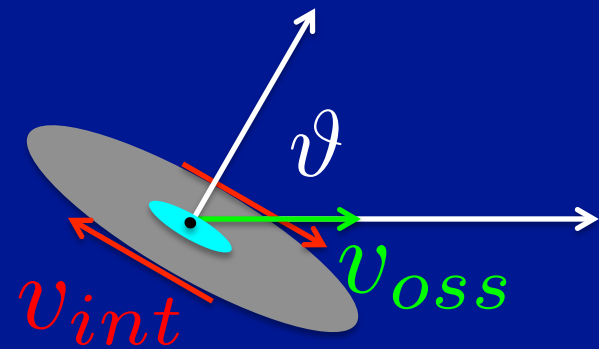
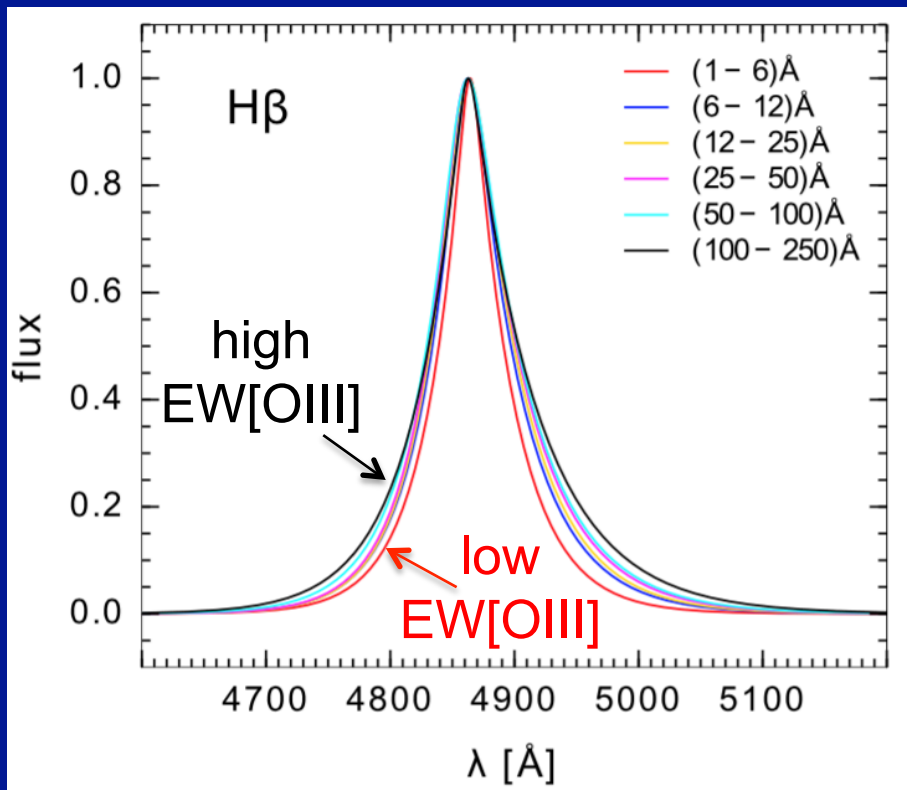
EW[OIII]: quasar orientation indicator → Narrow Lines

Bisogni, Marconi, Risaliti 2016



EW[OIII]: quasar orientation indicator → Broad Lines

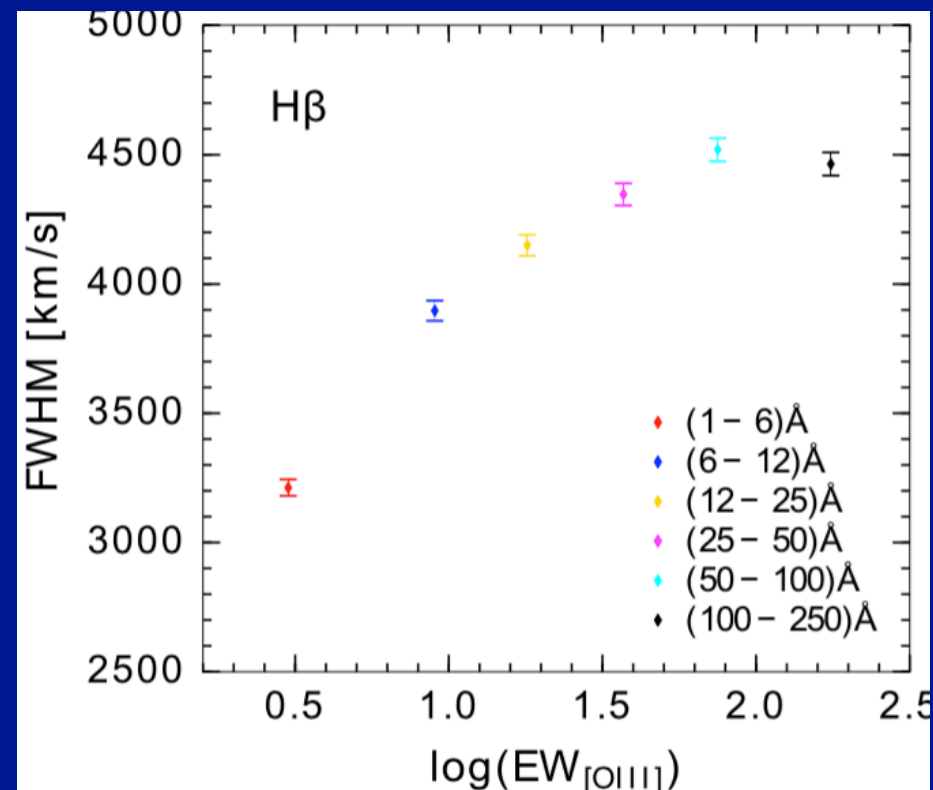
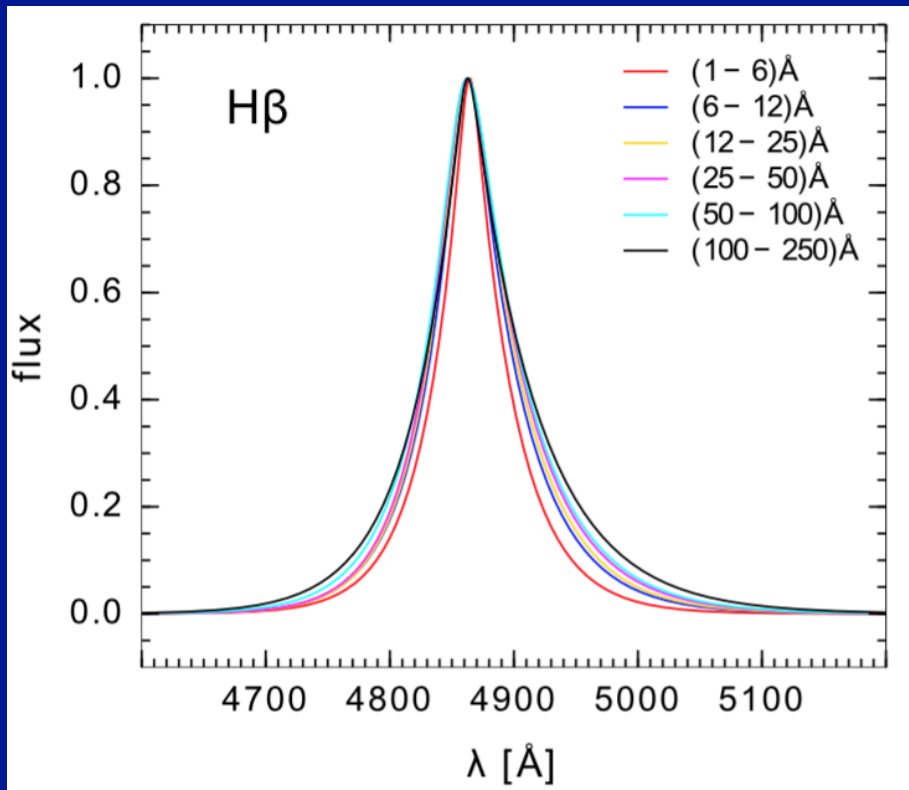
Bisogni, Marconi, Risaliti 2016



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

EW[OIII]: quasar orientation indicator → Broad Lines

Bisogni, Marconi, Risaliti 2016

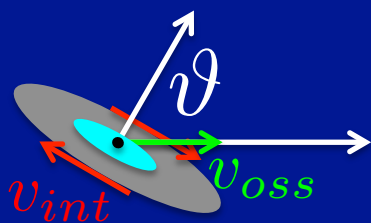


EW[OIII]: quasar orientation indicator

Implications

Knowing source orientation allows to:

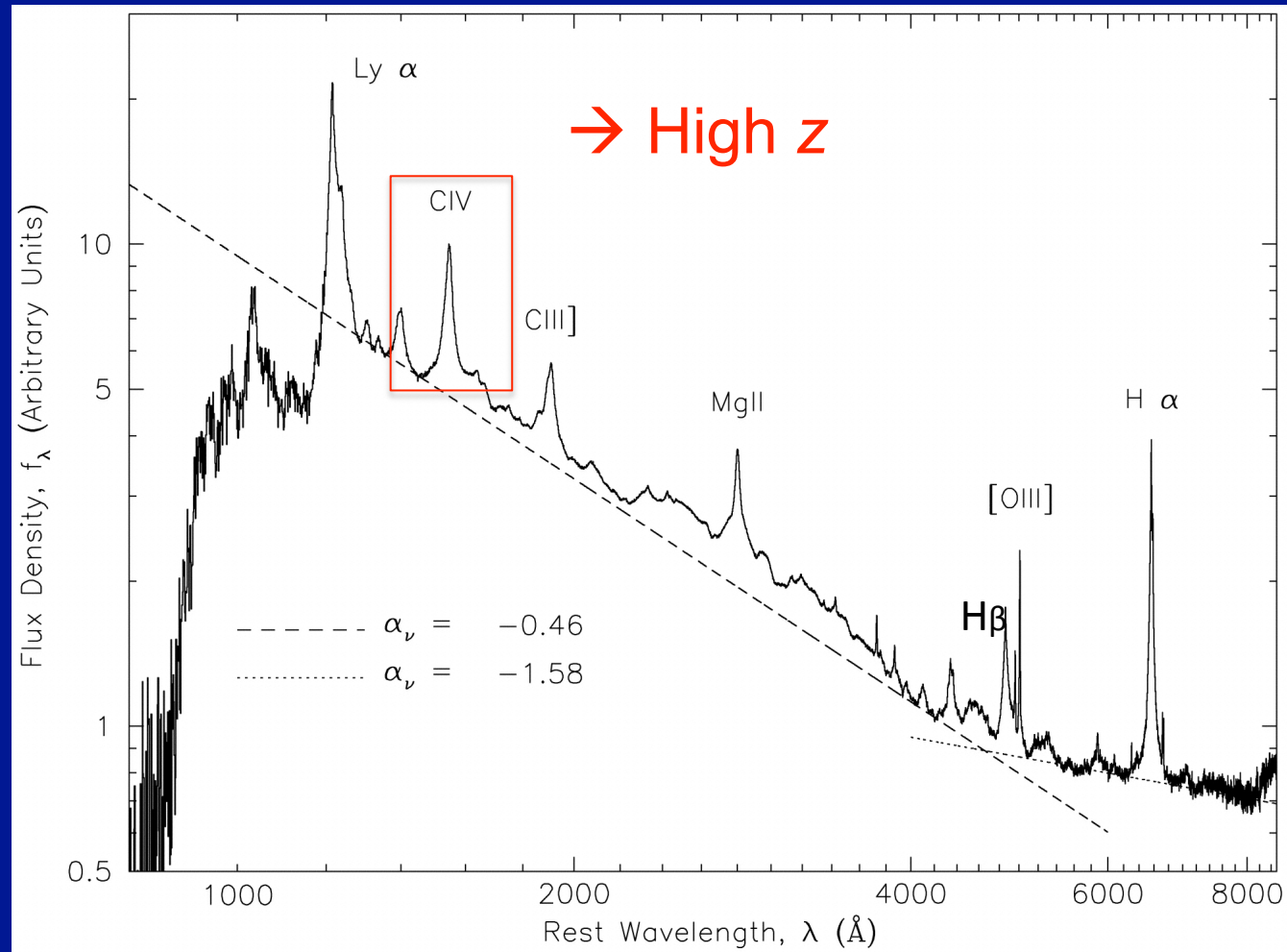
- Connect emissions shape to geometry
→ morphological study of unresolved, inner regions
- Correct virial mass estimations for non edge-on sources



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

- Many other implications we are still working on!

AGN Unified Model: inner components



[OIII] vs Broad Lines

CIV

Susanna Bisogni

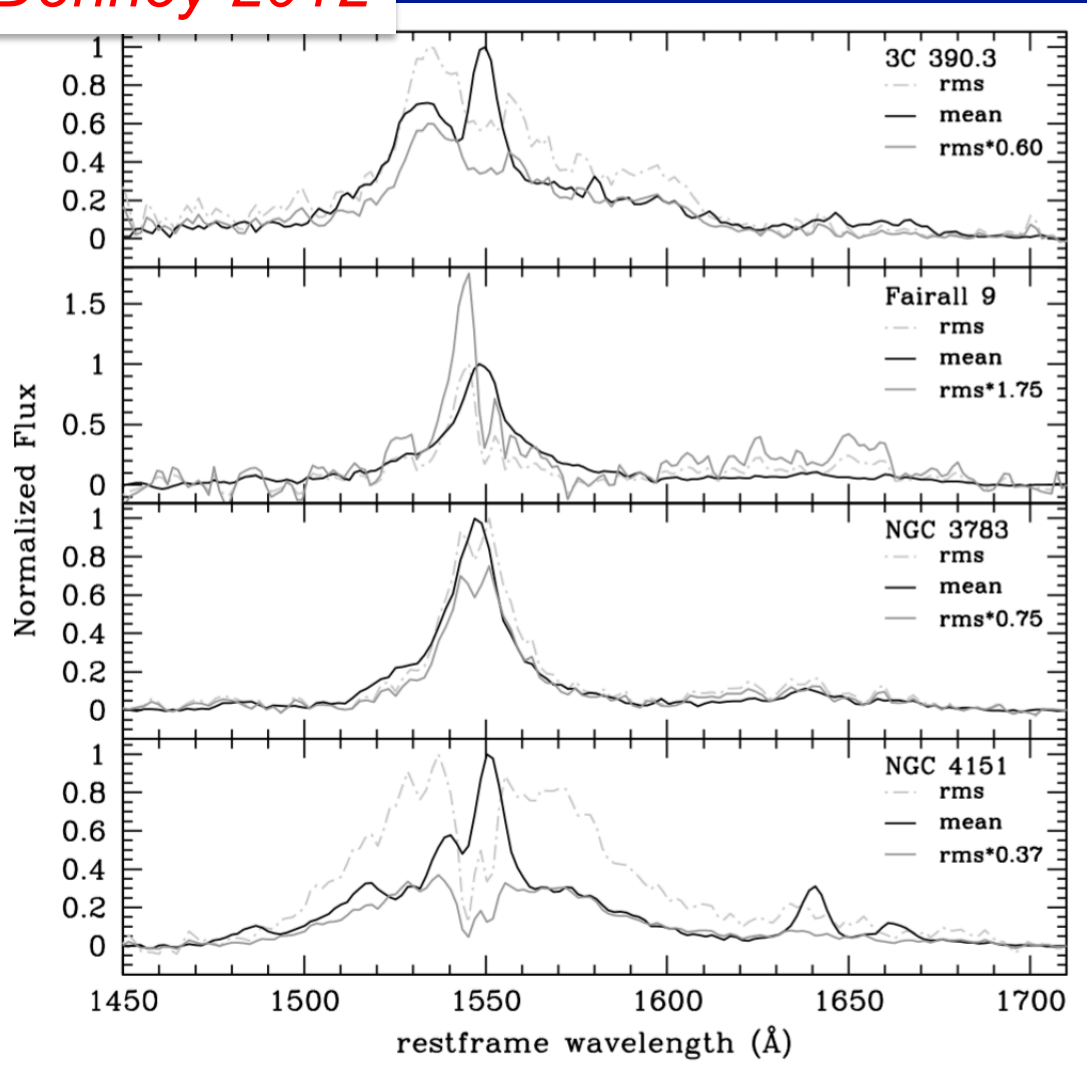
Kelly Denney

Brad Peterson

(Ohio State University)

CIV virial estimator???

Denney 2012



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

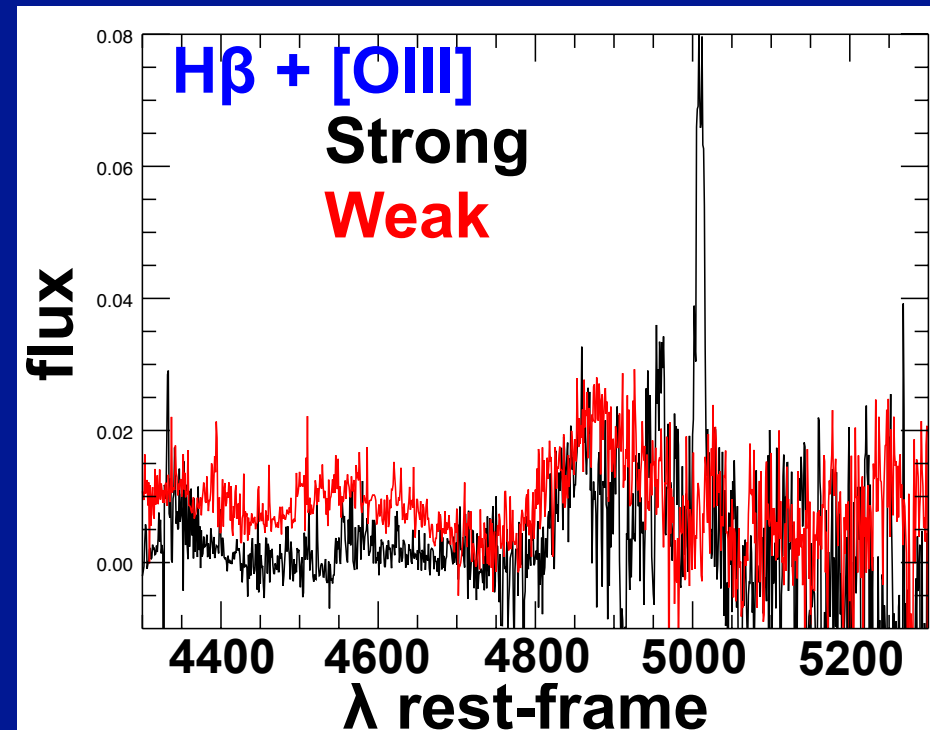
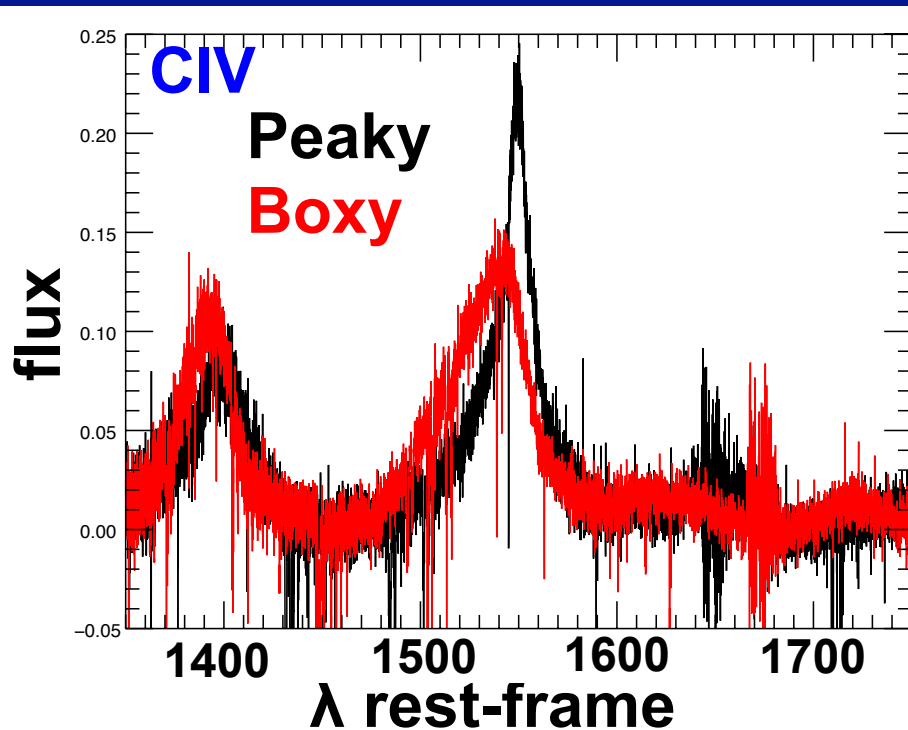


v^2 = linewidth
→ is a line of sight
velocity,
not only gas in virial
condition!

CIV-[OIII] connection

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

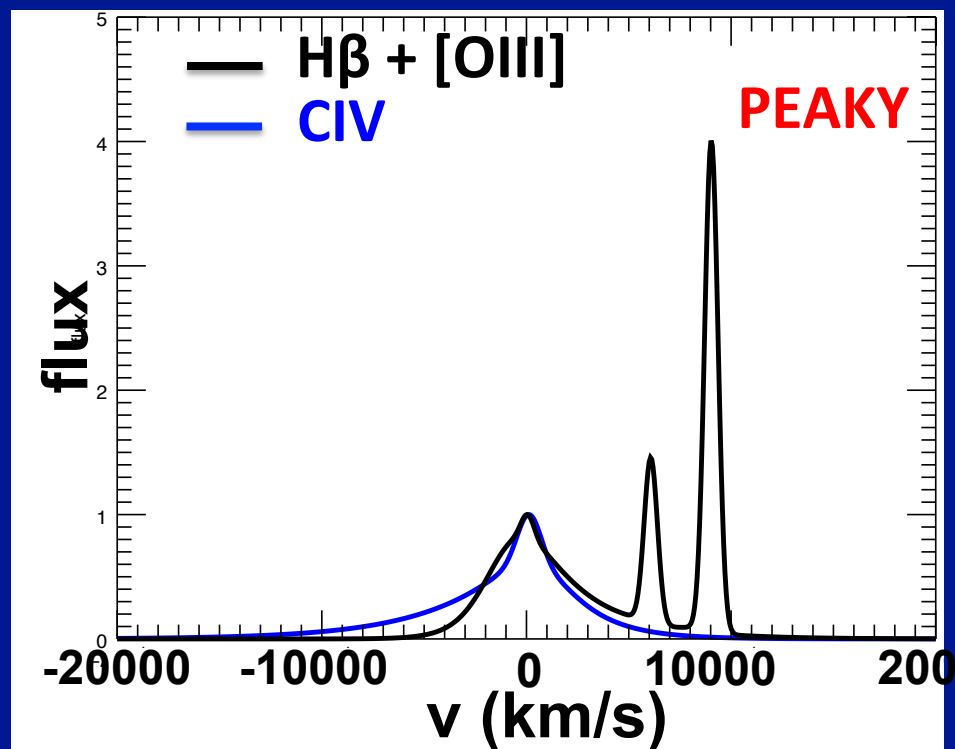
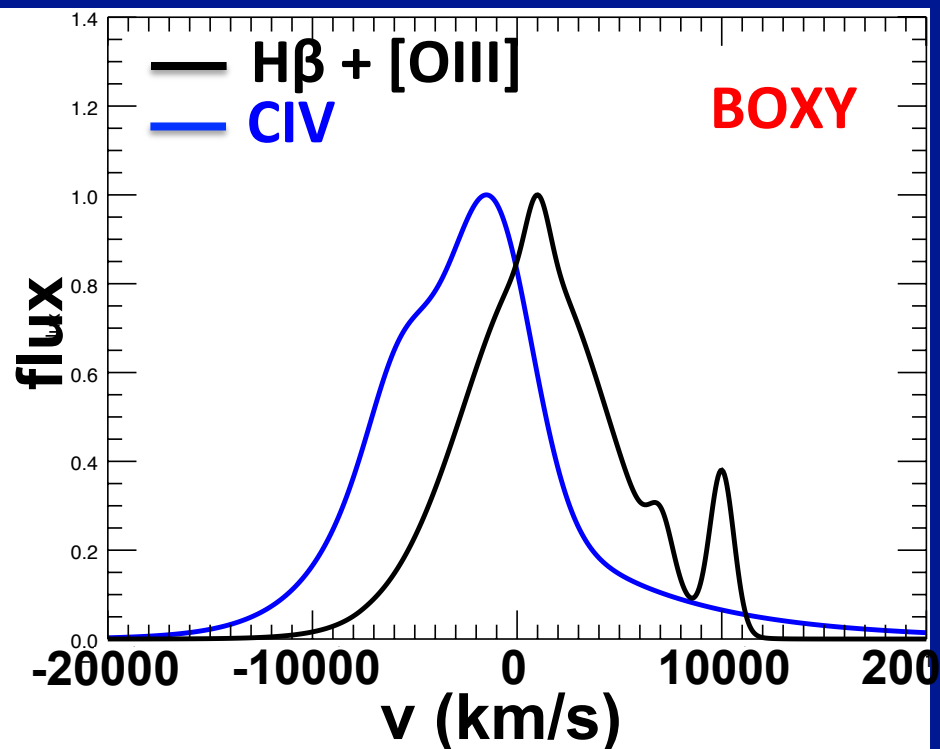
Bisogni, Denney, Peterson in prep.



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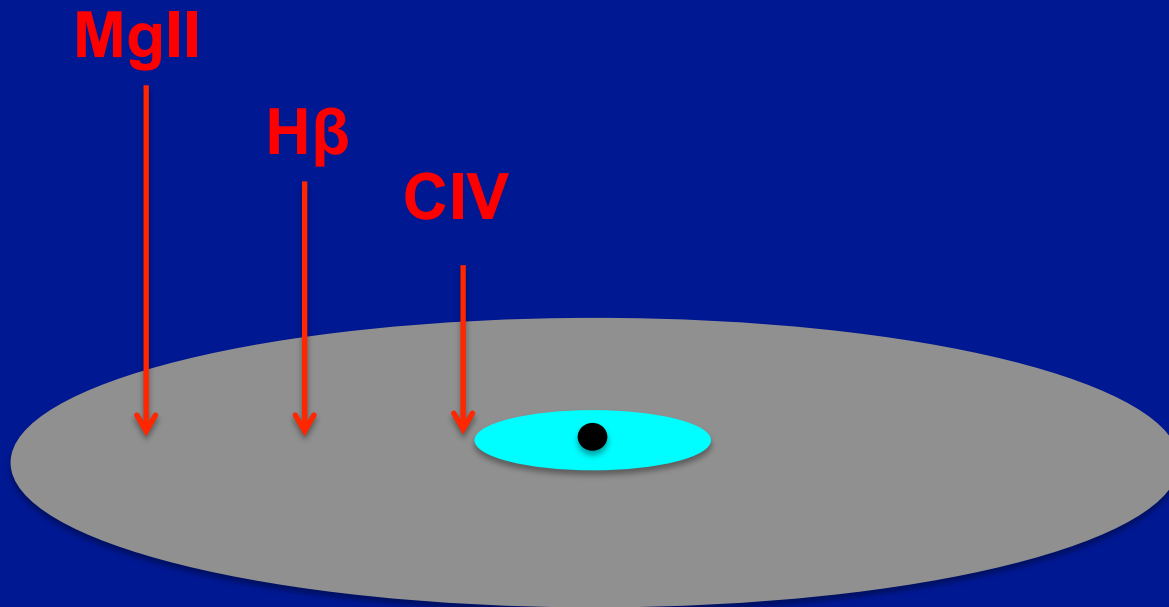
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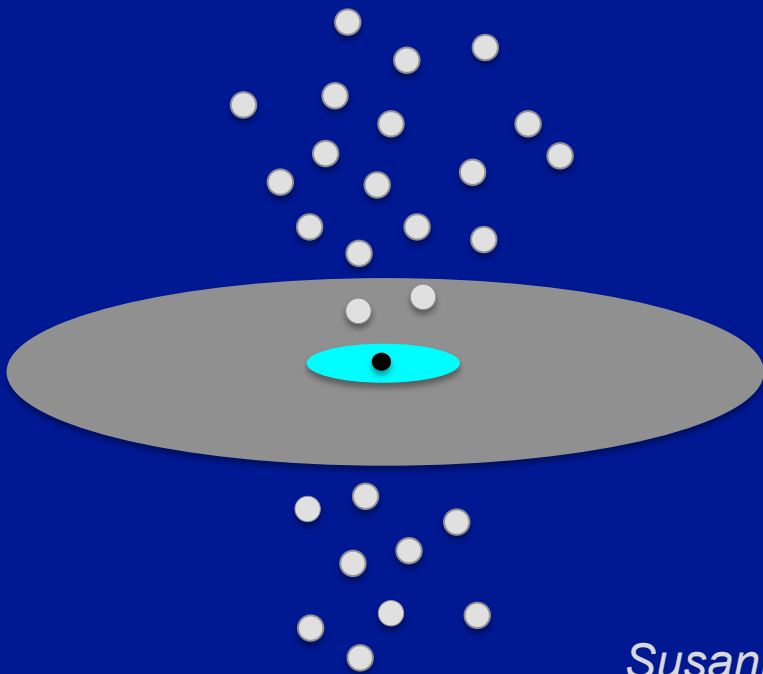
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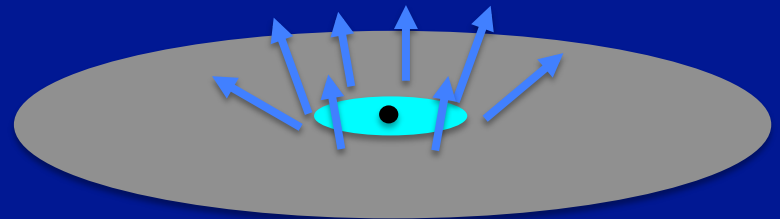
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Bisogni, Denney, Peterson in prep.

Peak CIV \rightarrow NO outflow,
NLR present!

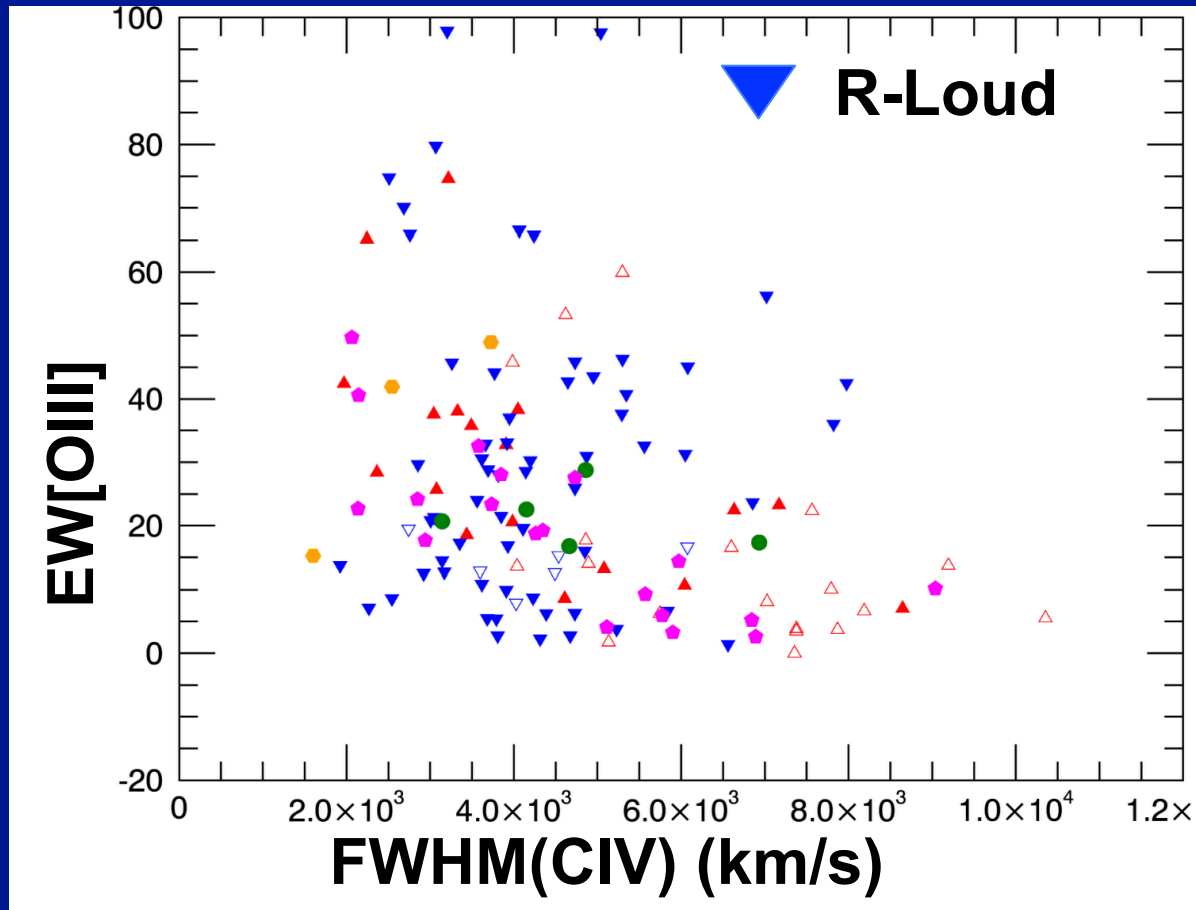


Boxy, blueshifted CIV \rightarrow
OUTFLOW,
NO NLR!



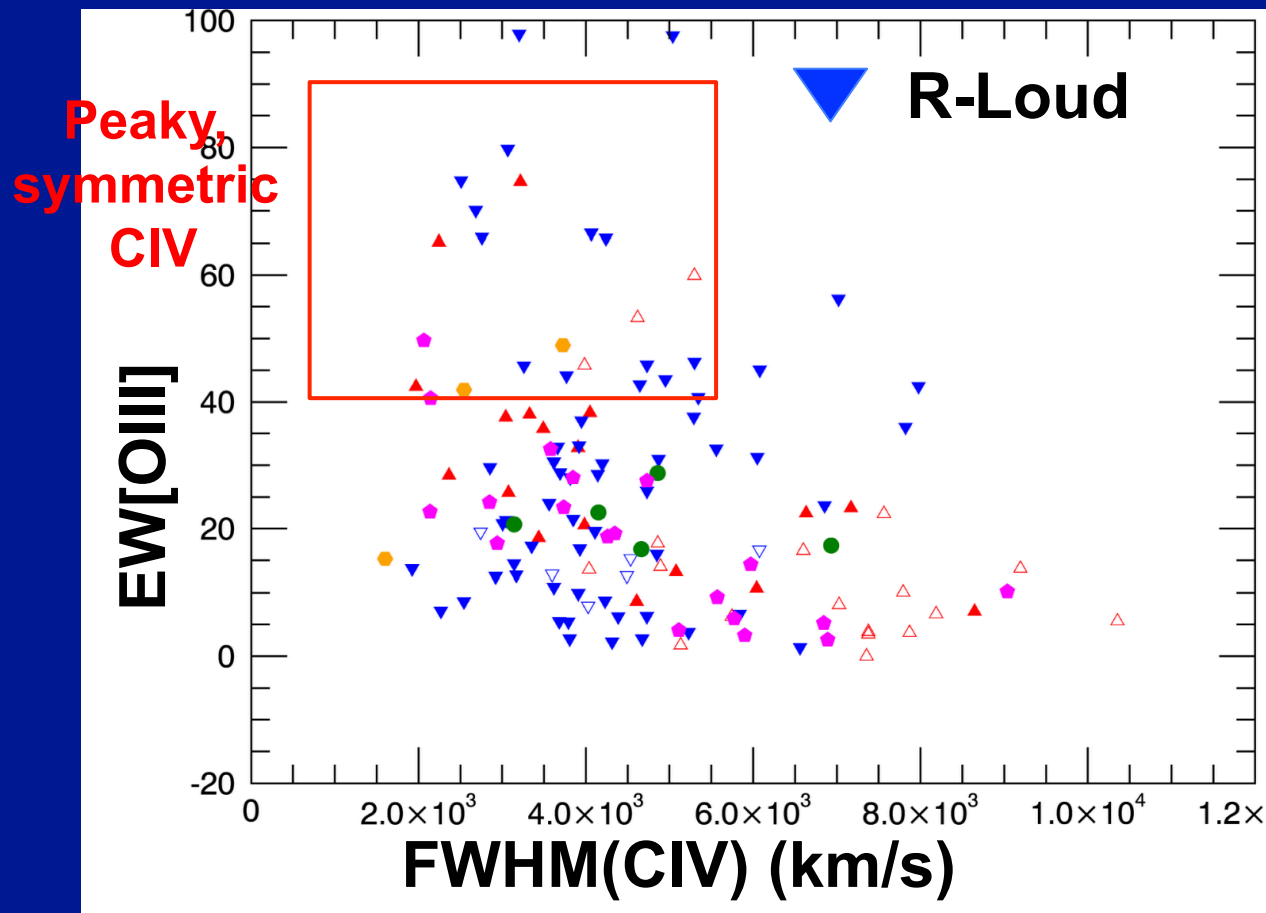
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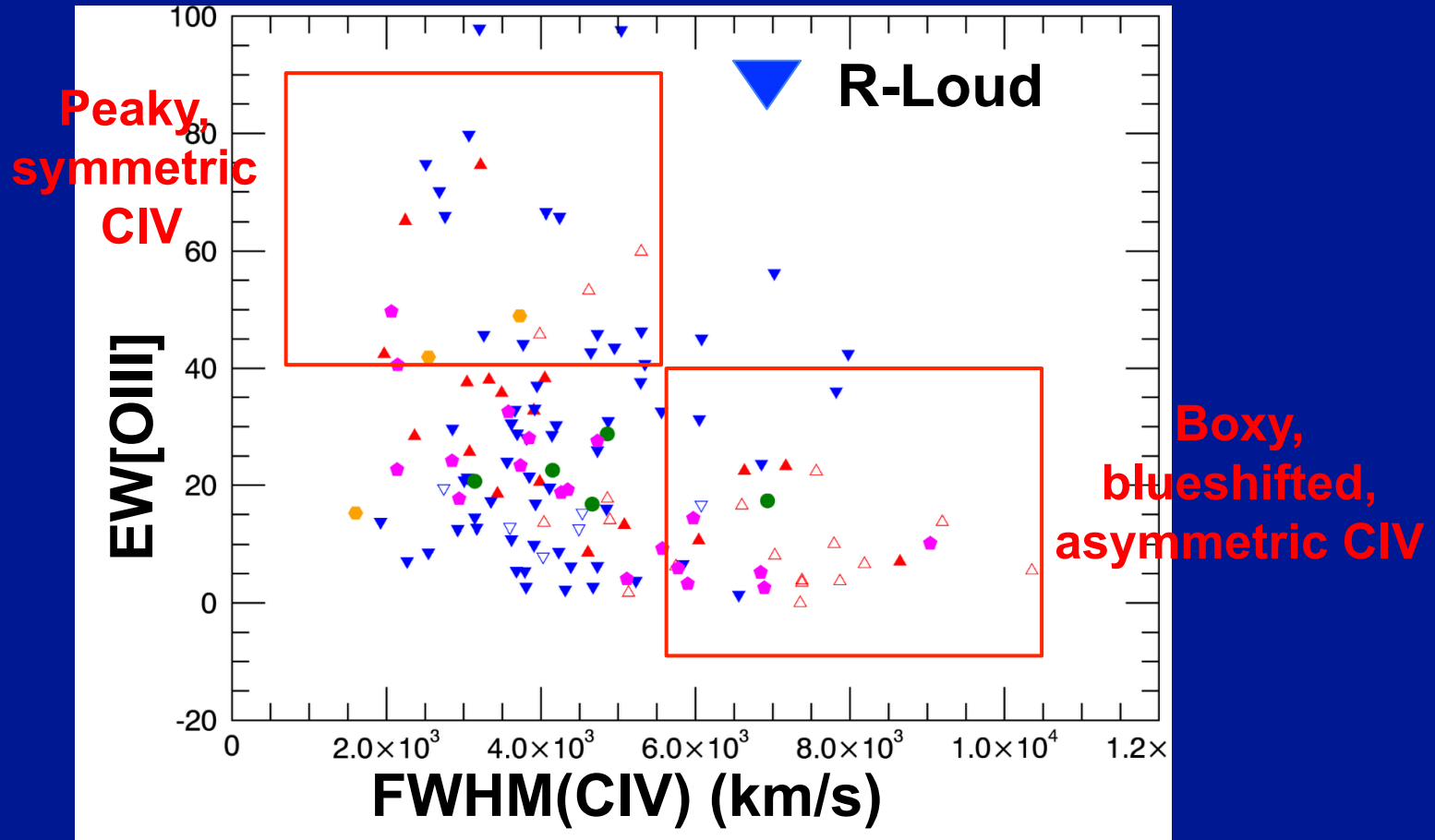
CIV-[OIII] connection

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



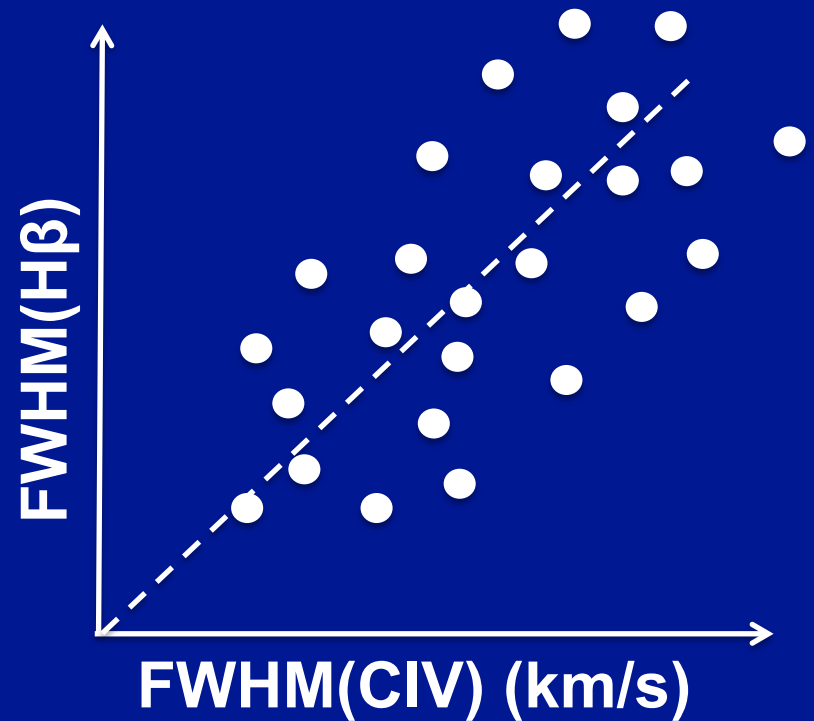
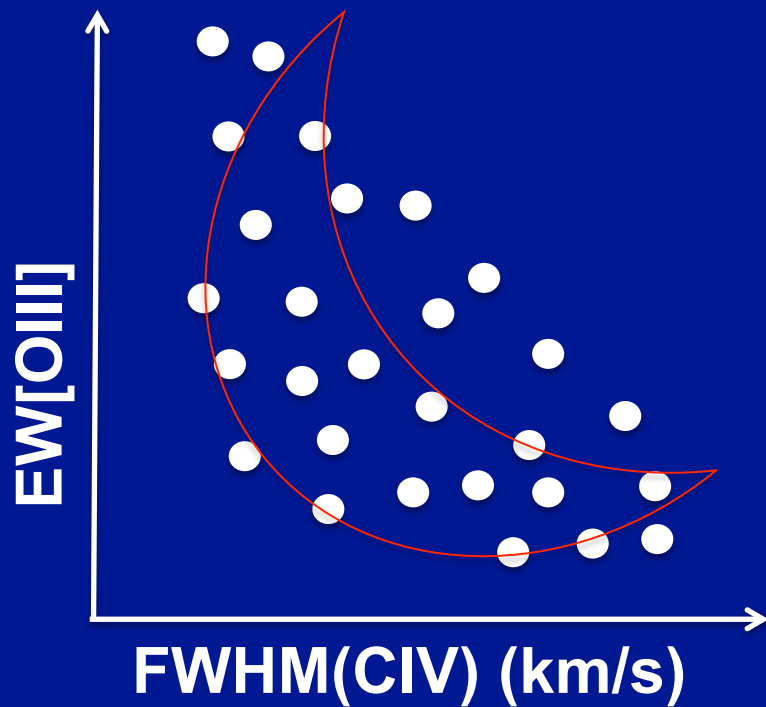
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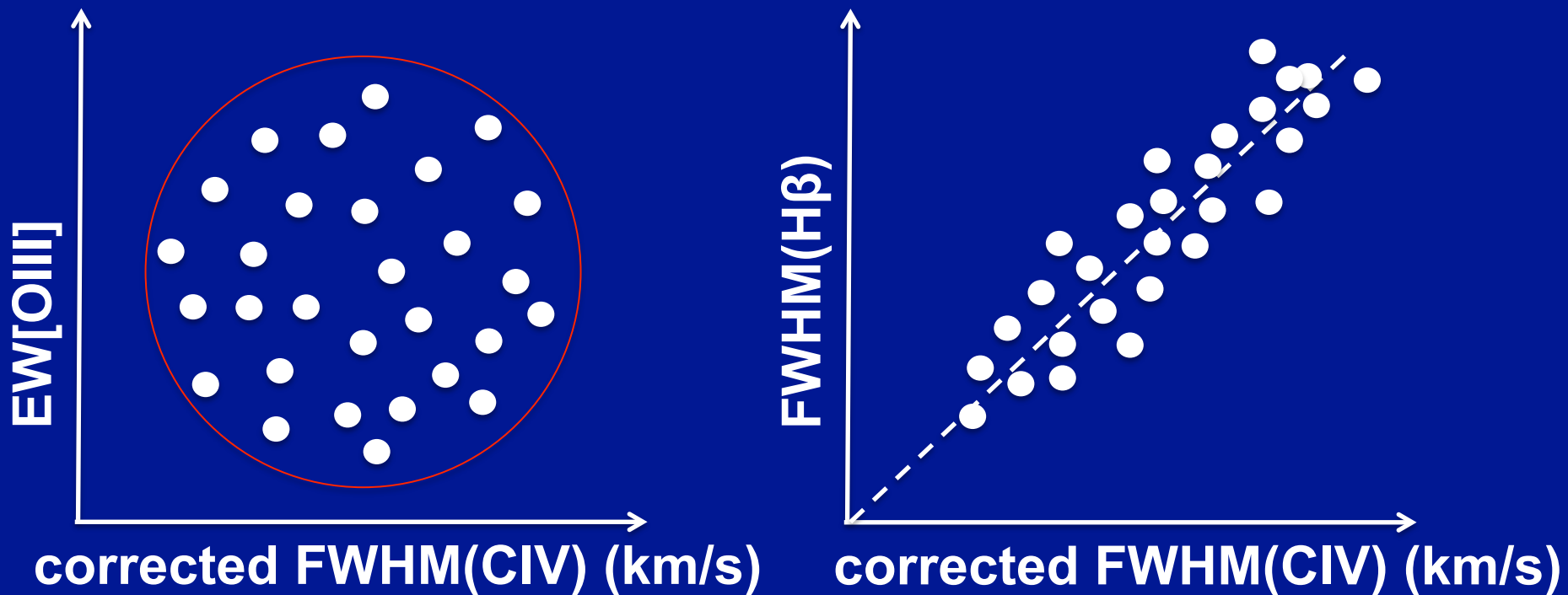
CIV-[OIII] connection: goal

Bisogni, Denney, Peterson in prep.



CIV-[OIII] connection: goal

Bisogni, Denney, Peterson in prep.



→ 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 good representations of:
 - CIV peakiness $f(\textit{peak})$
 - CIV blueness $f(\textit{blue})$

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→ correct FWHM(CIV):

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

CIV-[OIII]: PCA and correlations

Bisogni, Denney, Peterson in prep.

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

- Correction of virial mass estimations

$EW[OIII]$: $H\beta$, $H\alpha$, $MgII$, (CIV as well..) for the orientation effects

$[OIII] - CIV$: CIV for the contaminating components