The WISSH Quasars Project. II
BLR winds in hyper-luminous quasars

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The WISSH quasars project

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… and many others

TARGETING WISSH QUASARS

Sample of 86 WISE/SDSS Selected
Hyper-luminous (WISSH) quasars with $L_{Bol} > 10^{47}$ erg/s at $1.5 < z < 4.5$

WISSH Tasks

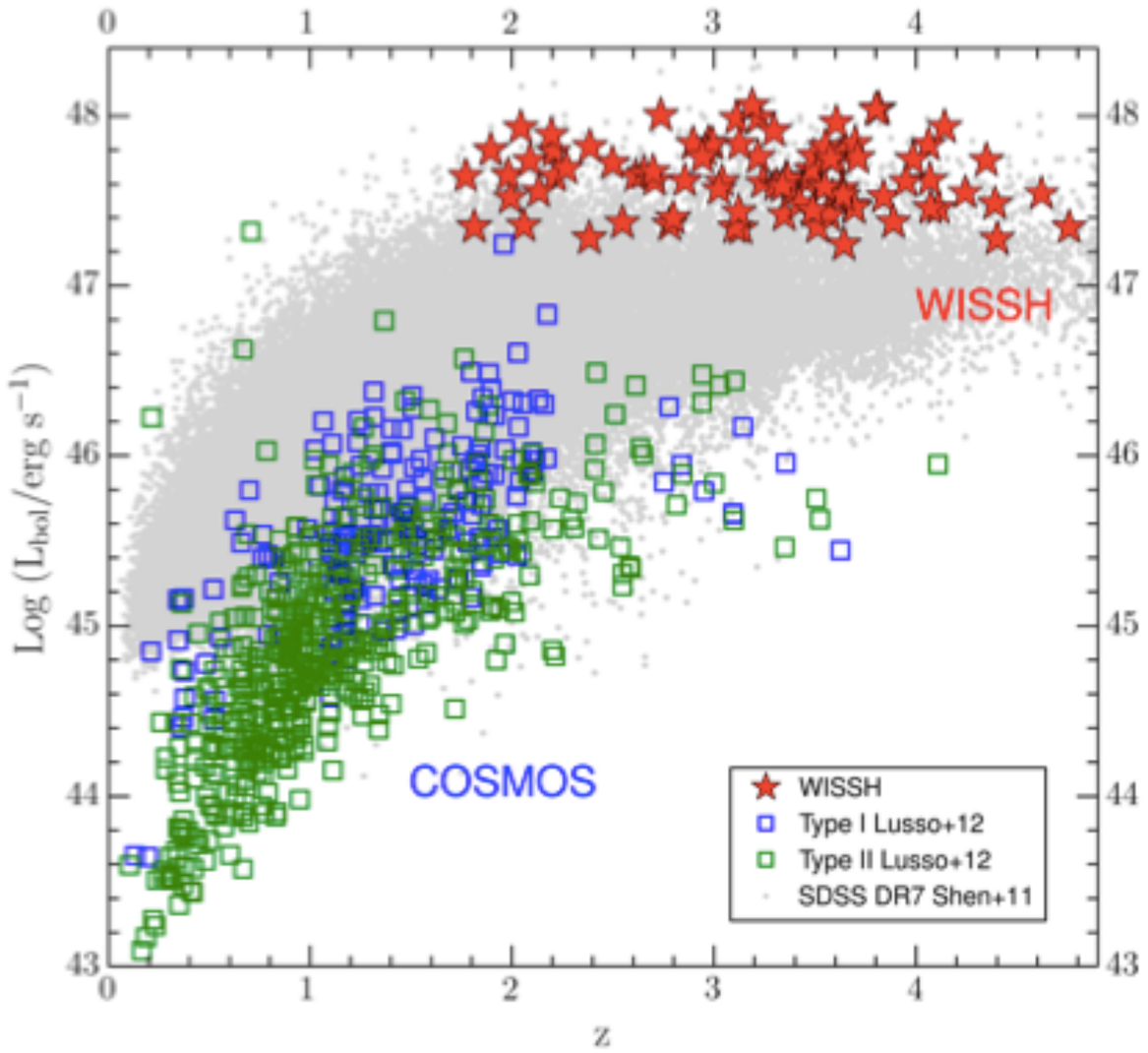
- Probing widespread presence of outflows from different gas phases/distances
- Constraining the properties of the central engine
- Studying the ISM and SFR of the quasars host galaxies

This talk:

(I) Systematic census of BLR winds (CIV) in luminous quasars

(II) Relation between NLR([OIII]) and BLR winds (CIV)

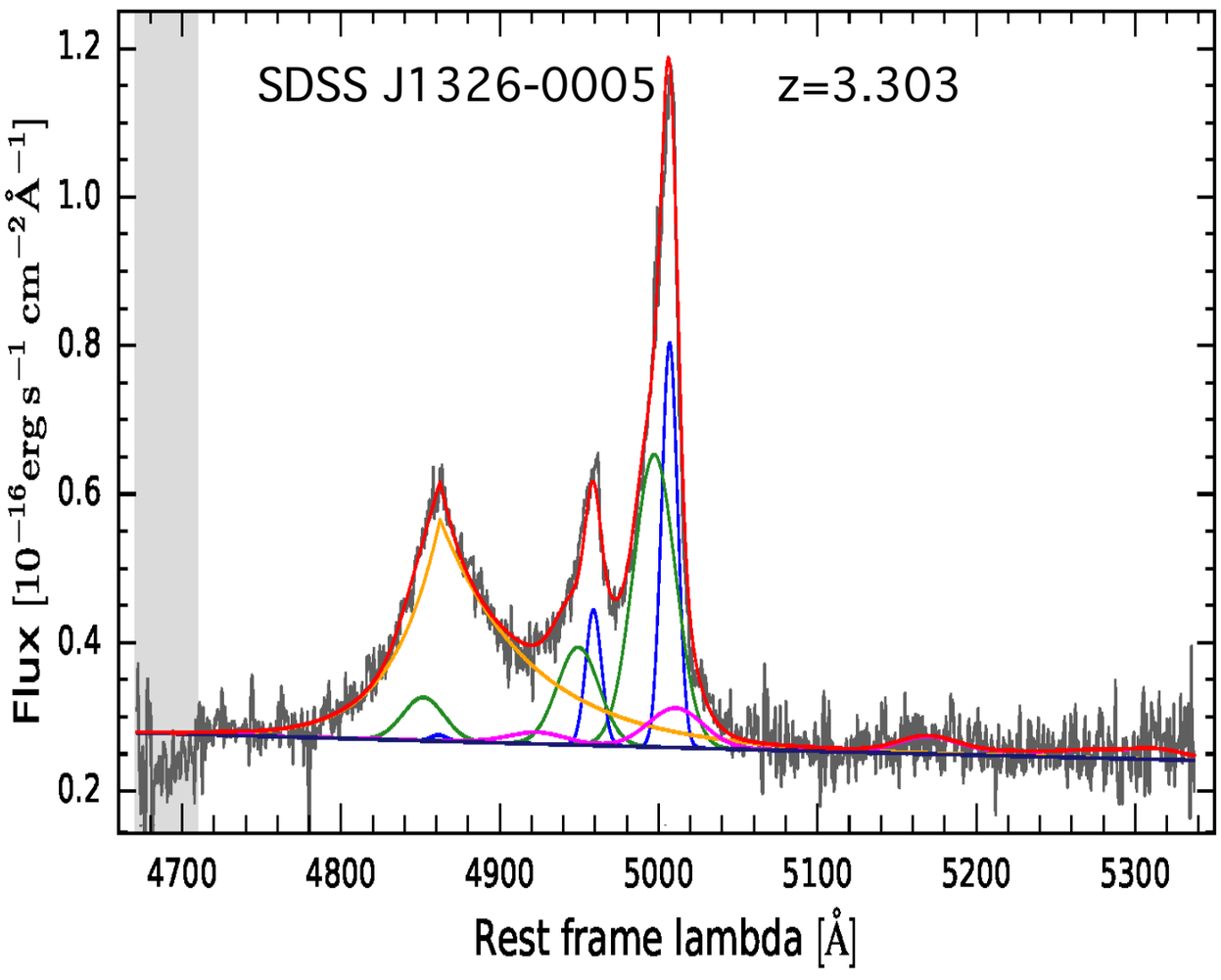
(III) Physical driver of BLR winds



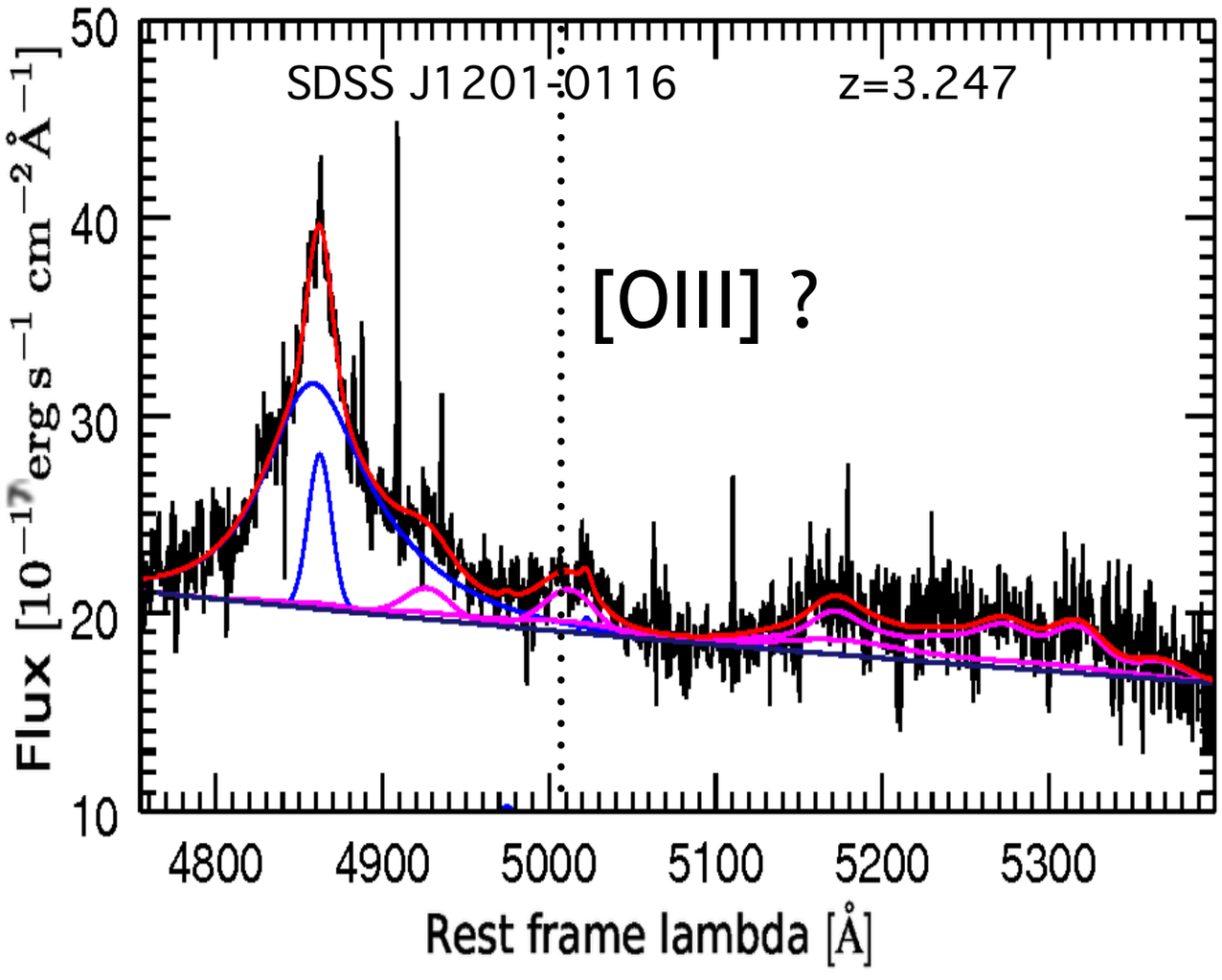
NIR SPECTRA OF THE WISSH QUASARS

30% prominent broad [OIII] emission

see Bischetti's talk



70% weak/lack [OIII] emission

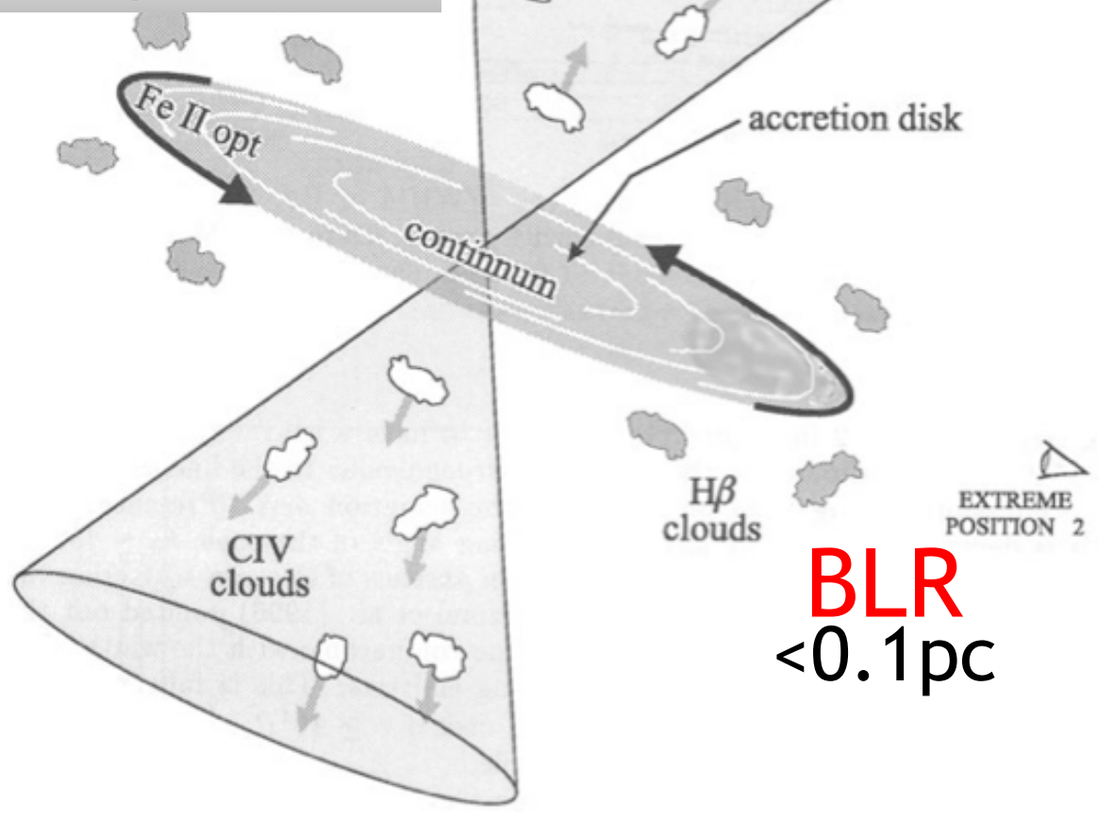


BLR WINDS VIA CIV EMISSION LINE

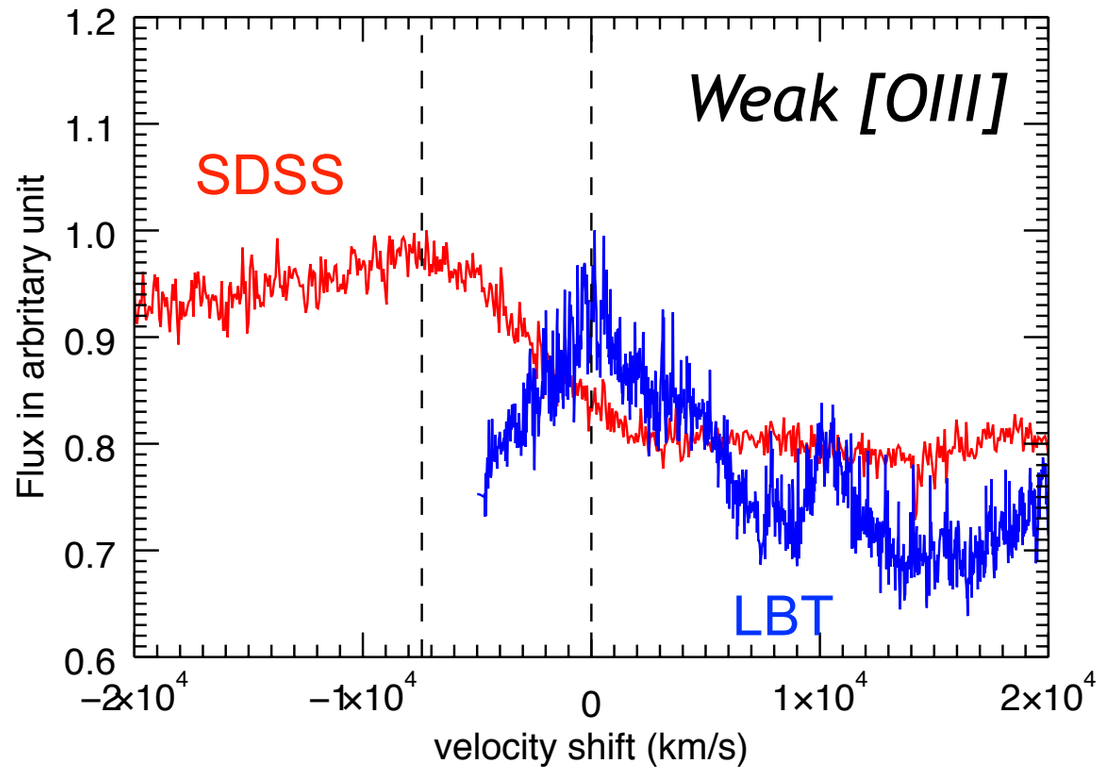
BLR winds traced by CIV(SDSS) Hbeta(LBT) velocity shift

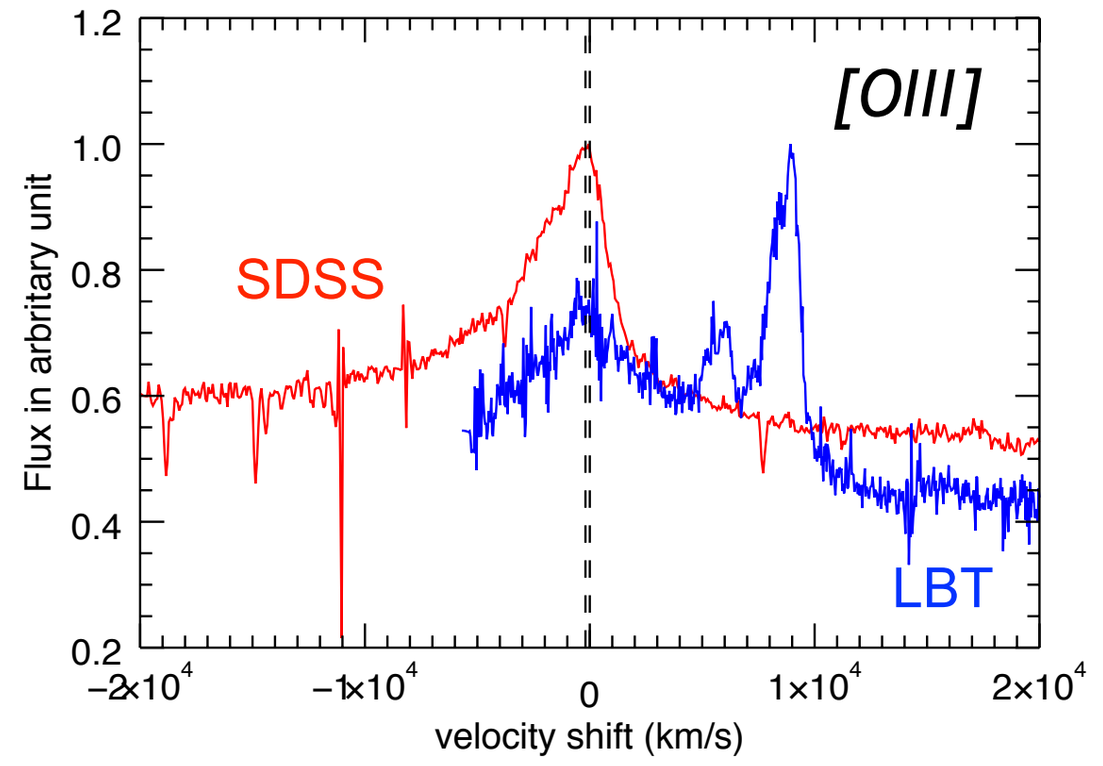
High ionization lines
CIV

Low Ionization lines
Hβ



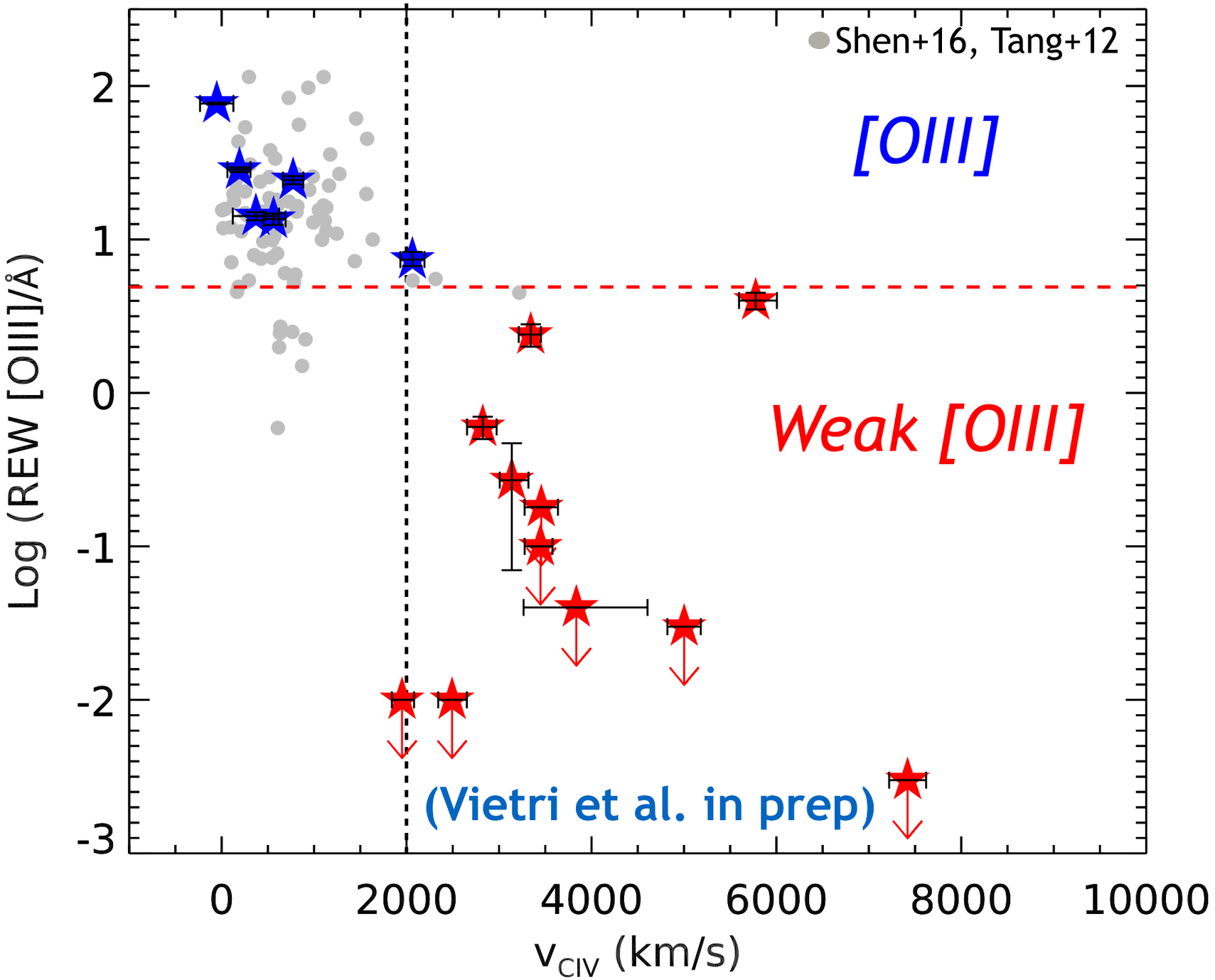
BLR
<0.1pc





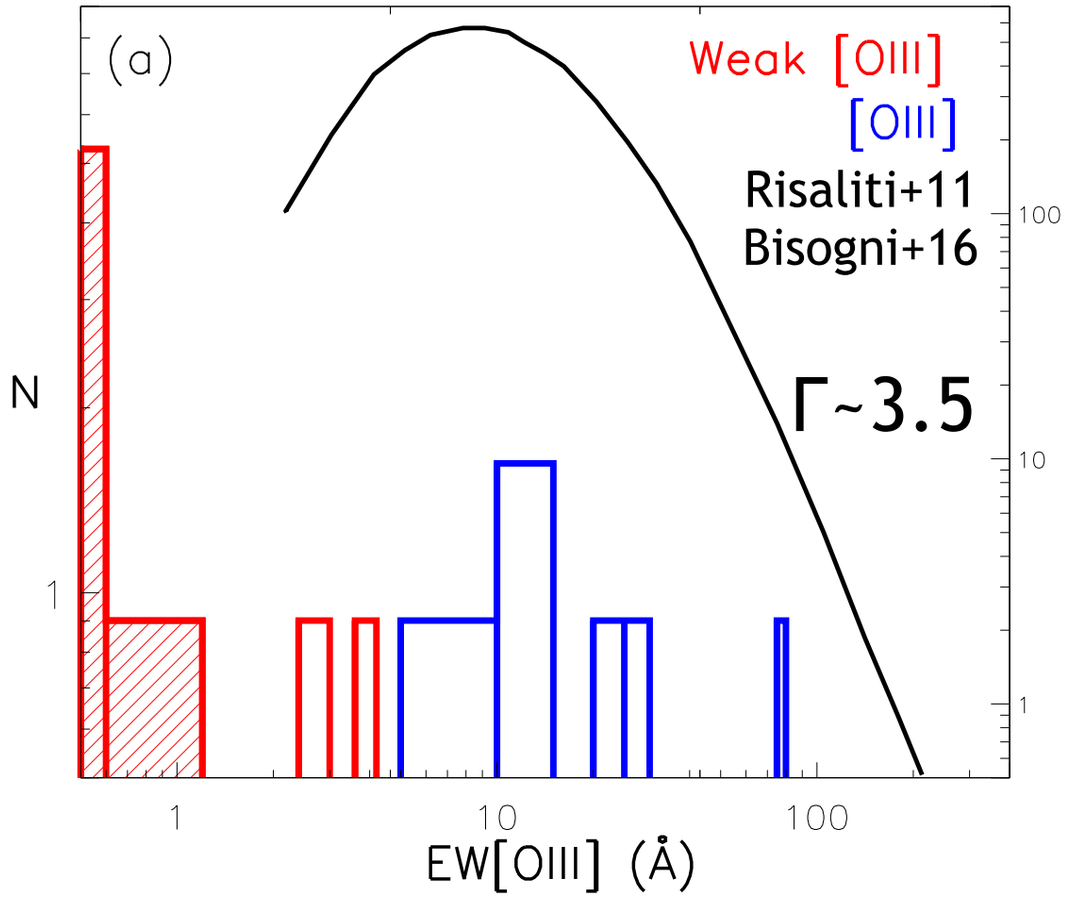
(Vietri et al. in prep)

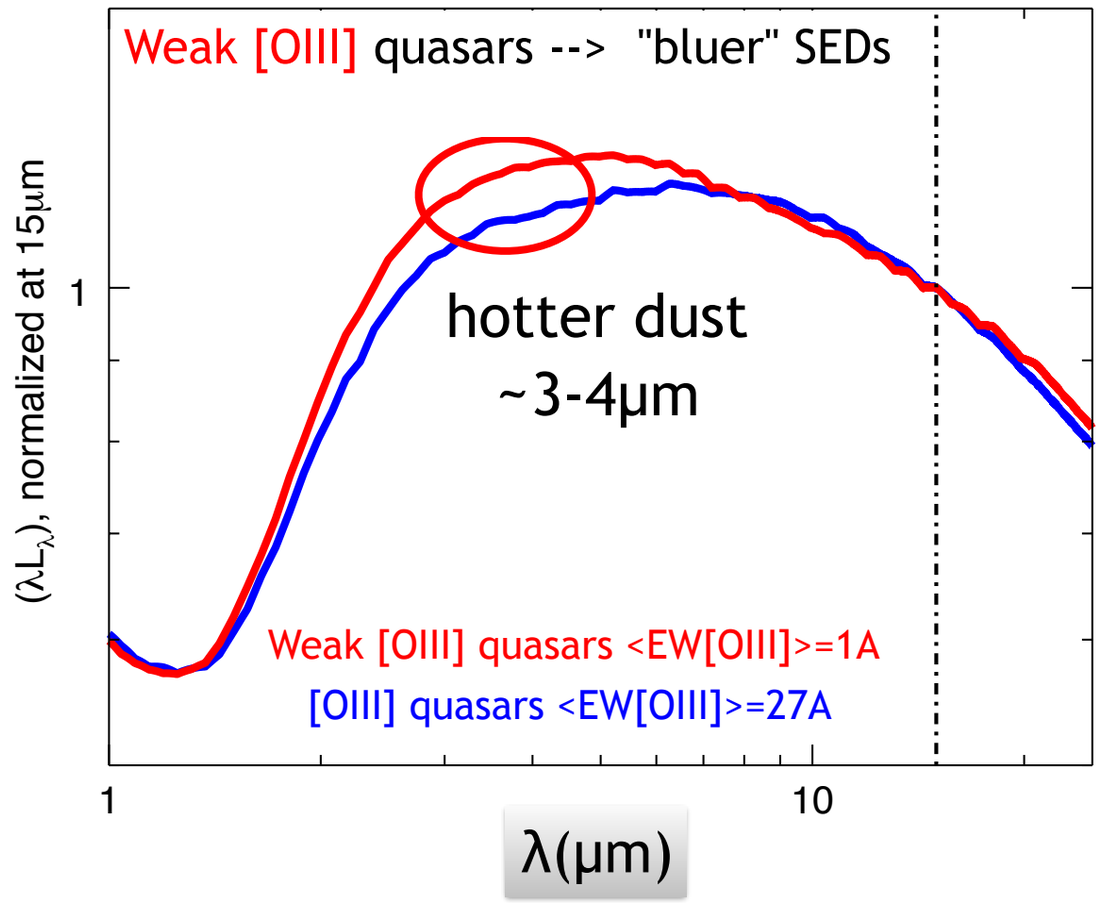
BLR(CIV) – kpc-scale [OIII] winds Dichotomy



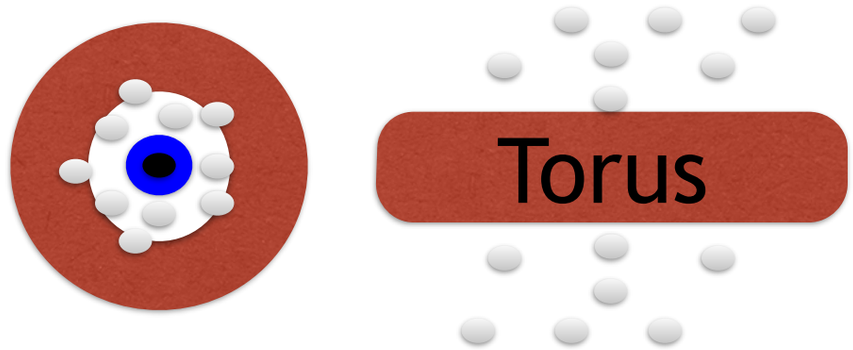
Discovery of a dichotomy:
CIV vshift > 2000 km/s if weak/no [OIII]
CIV vshift < 2000 km/s if [OIII]

BLR(CIV) – kpc-scale [OIII] winds Dichotomy





EW[OIII],obs = EW[OIII]/cosθ
WISSH: θ~30-70°

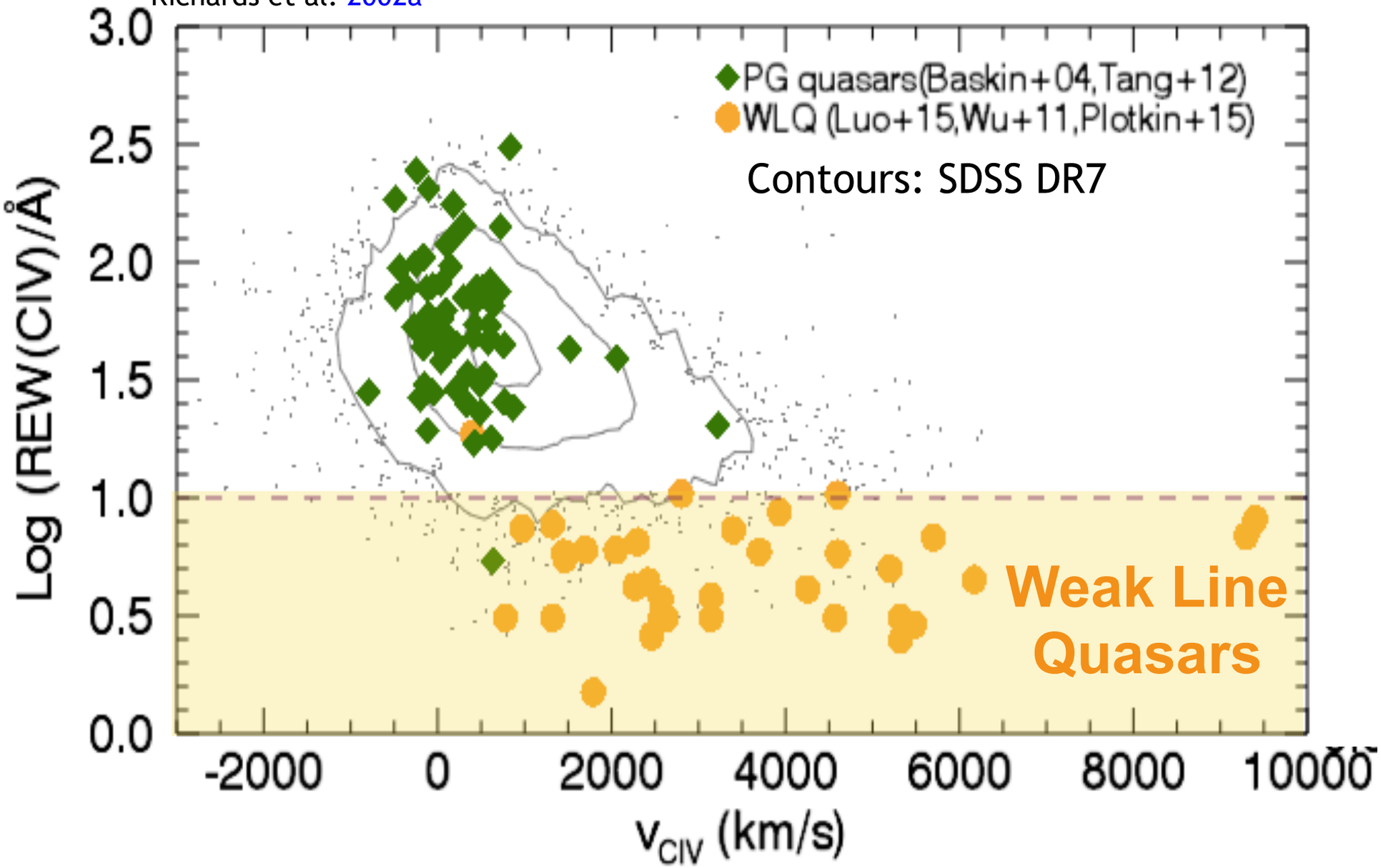


Weak [OIII] sample intrinsic distribution
[OIII] sample high inclination
(partial view of the inner, hotter dust?)

BLR WINDS VIA CIV EMISSION LINE

Rest-frame EW(CIV) vs CIV velocity shifts

Corbin & Boroson 1996
Richards et al. 2002a



Weak Line Quasars

1% SDSS QSOs
EW(CIV) < 10A

(Vietri et al. in prep)

BLR WINDS VIA CIV EMISSION LINE

Rest-frame EW(CIV) vs CIV velocity shifts

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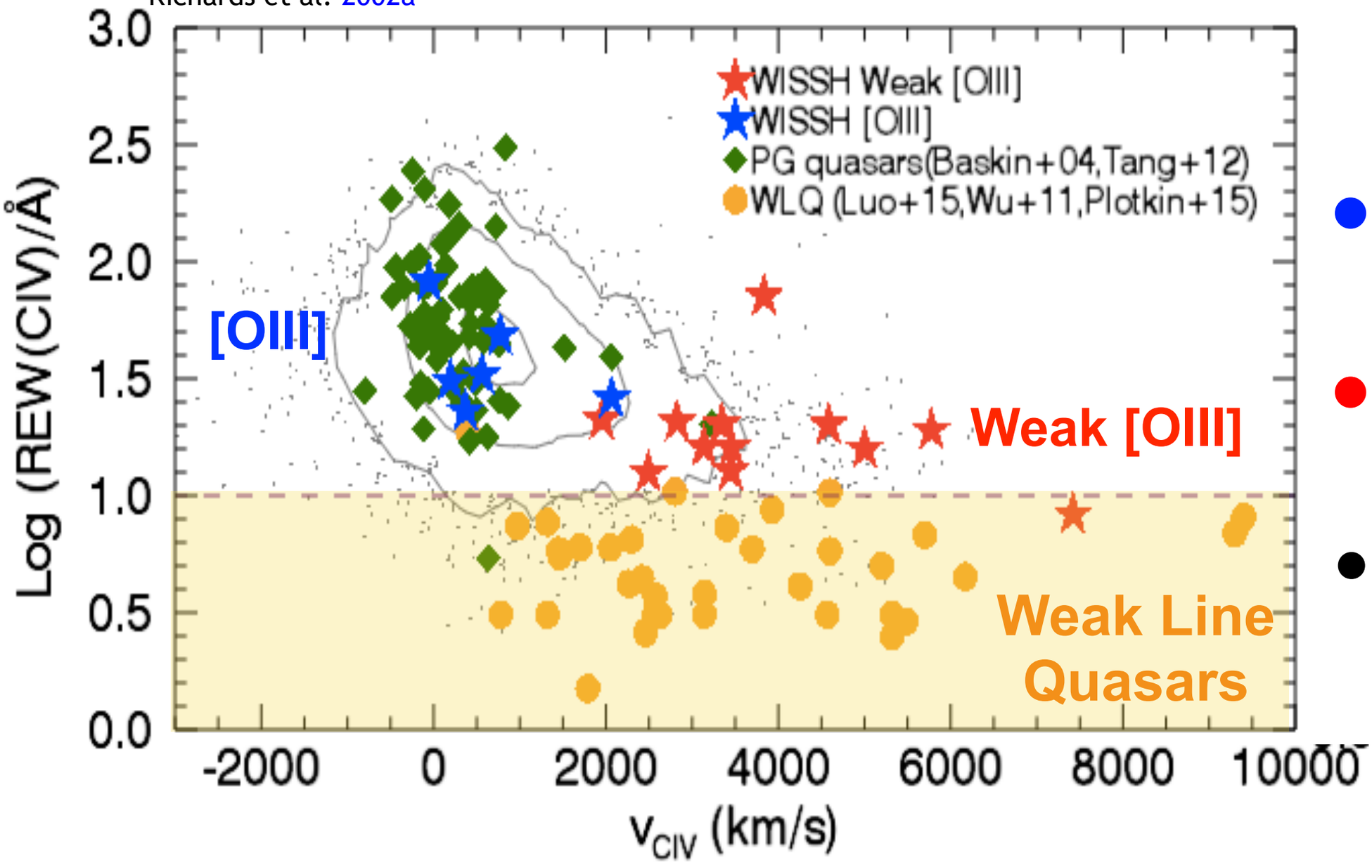
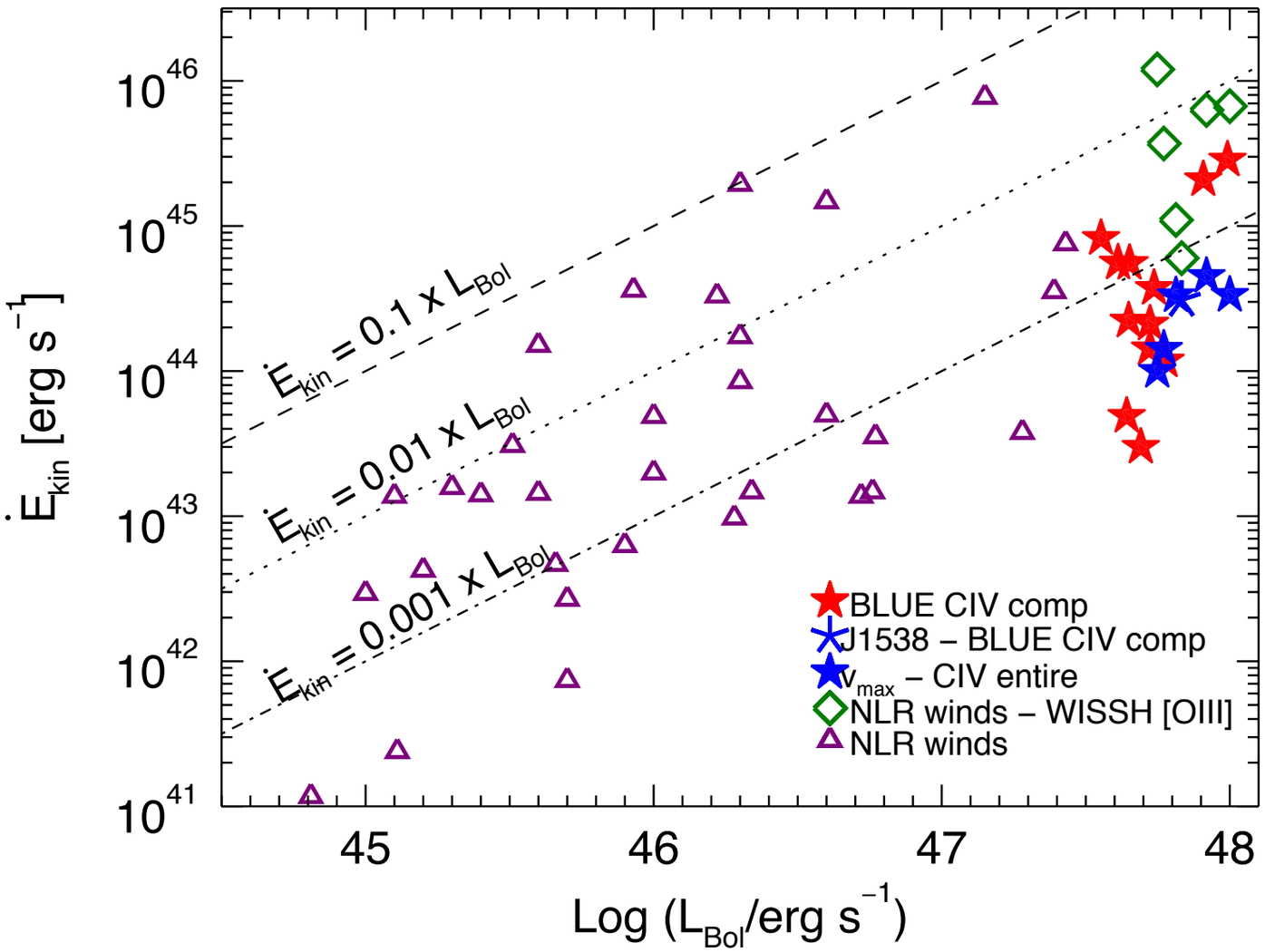


- Strong [OIII] - Weak CIV shifts
- Weak [OIII] - Strong CIV shifts
- Shifts comparable with Weak Line Quasars

WISSH QSOs also very effective in collecting the strongest CIV winds

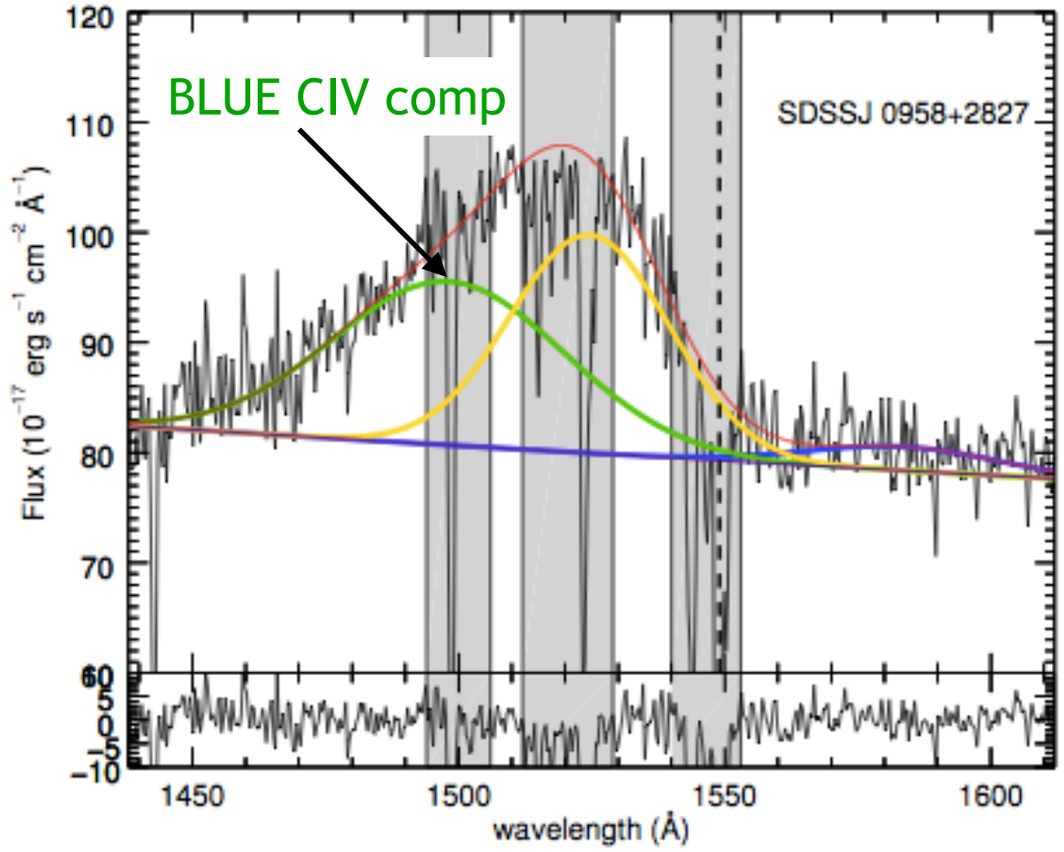
(Vietri et al. in prep)

POWERFUL CIV OUTFLOWS



$\dot{M}_{out}$ up to 100 $M_\odot$ yr^{-1}

$\dot{E}_{kin}$ up to 10^{45} erg s^{-1}



From Marziani+15

$$\dot{M}^{ion}_{out} \propto L_{45}(CIV)\ (Z_5)^{-1}\ n^{-1}_9\ r^{-1}_1\ v_{5000}$$

$$\dot{E}_{kin} = \frac{\dot{M}^{ion}_{out}\ v^2}{2}$$

$v = v_{BLUE\ comp}$ for *Weak [OIII]*

$v = v_{max} = v_{shift} + 2\sigma$ for *[OIII]*

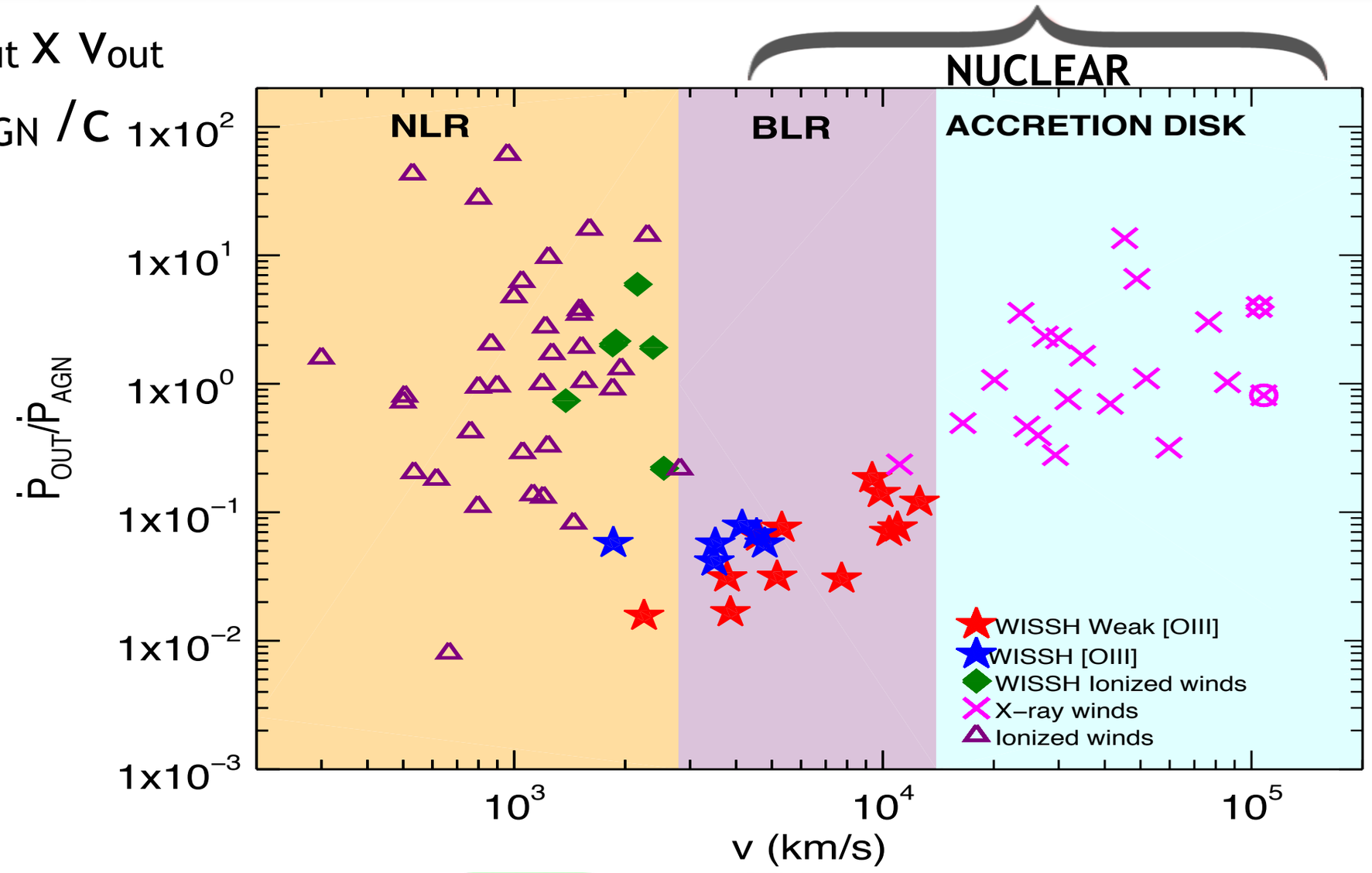
Take into account for a complete census of strong AGN-driven outflows

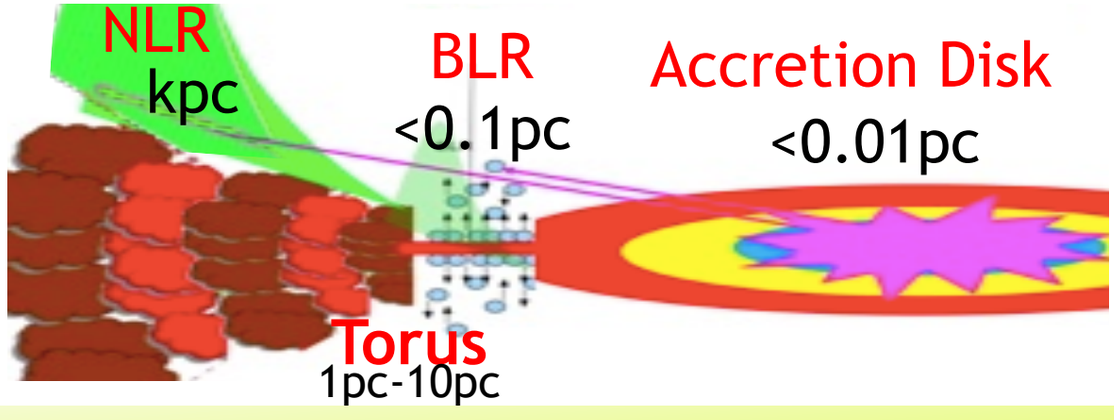
Evaluate their effects of depositing energy and momentum into the ISM

CENSUS OF AGN DRIVEN WINDS

$\dot{P}_{out}=\dot{M}_{out} \times v_{out}$

$\dot{P}_{AGN}=L_{AGN}/c$



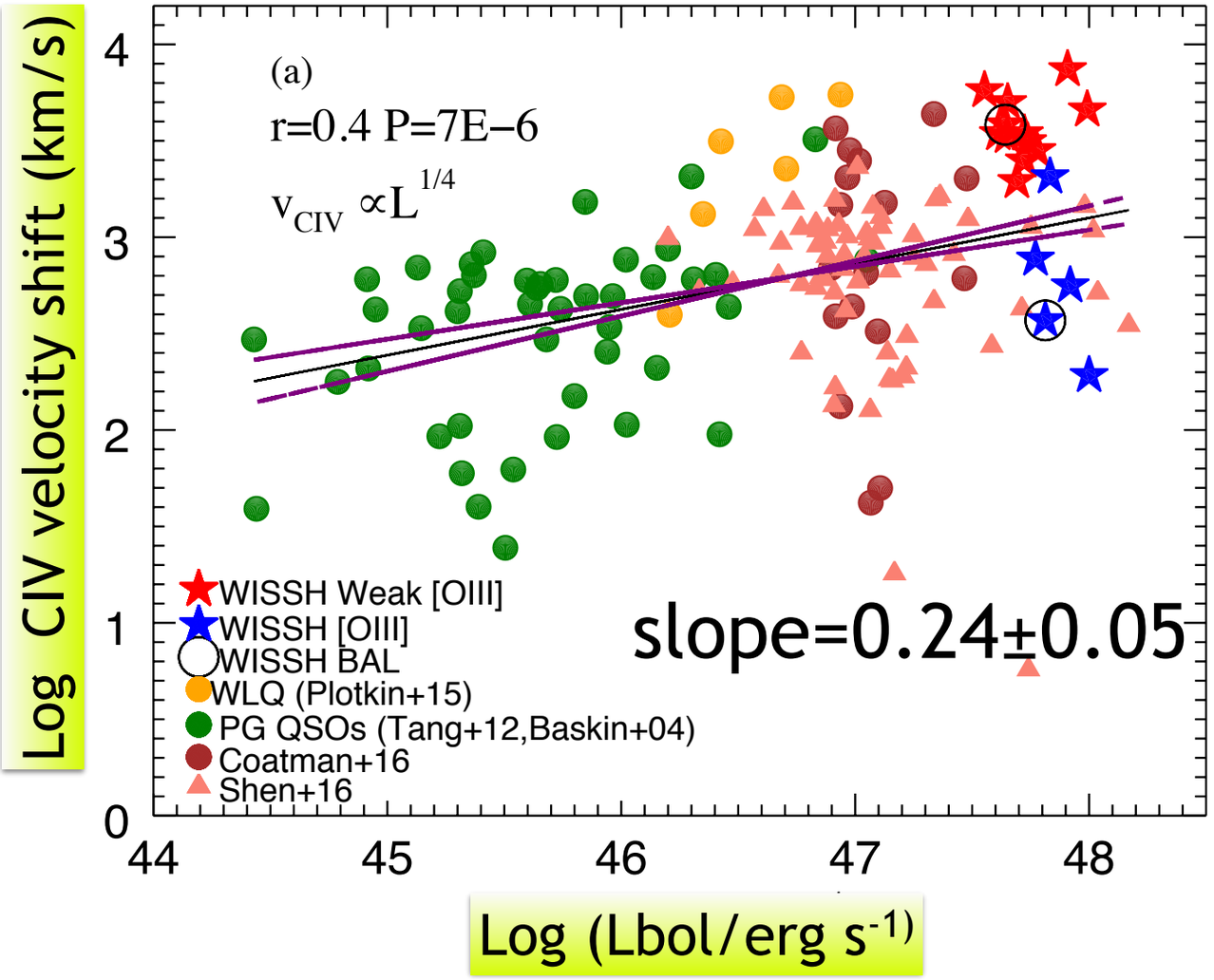


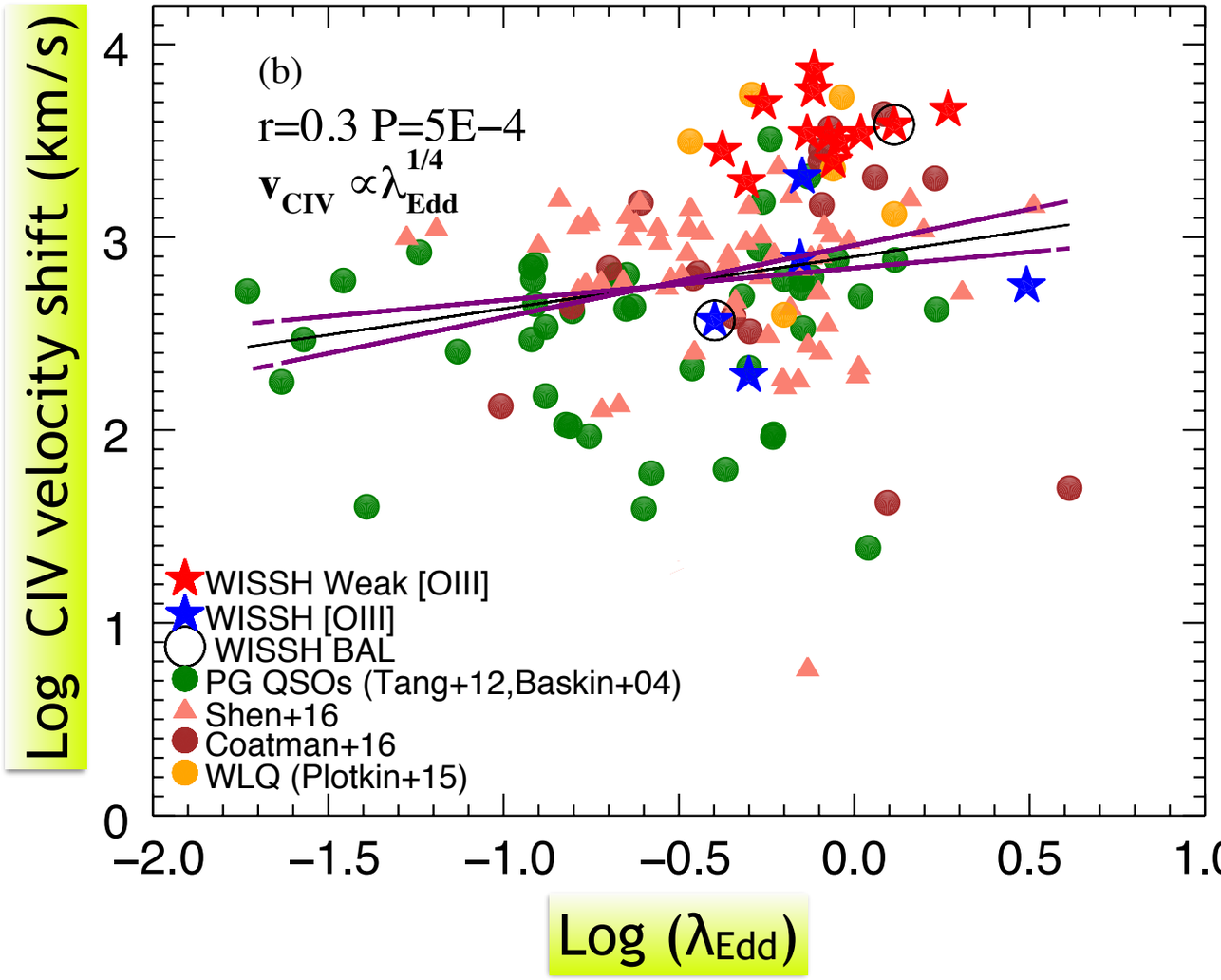
Outflow velocity distribution as a proxy of the distribution in radial distance from the AGN

Momentum load for nuclear winds may reflect the covering factor of outflowing gas

What is the Driver of BLR winds?

Sample of 147 QSOs with Hβ SMBH mass





As expected for radiatively driven winds

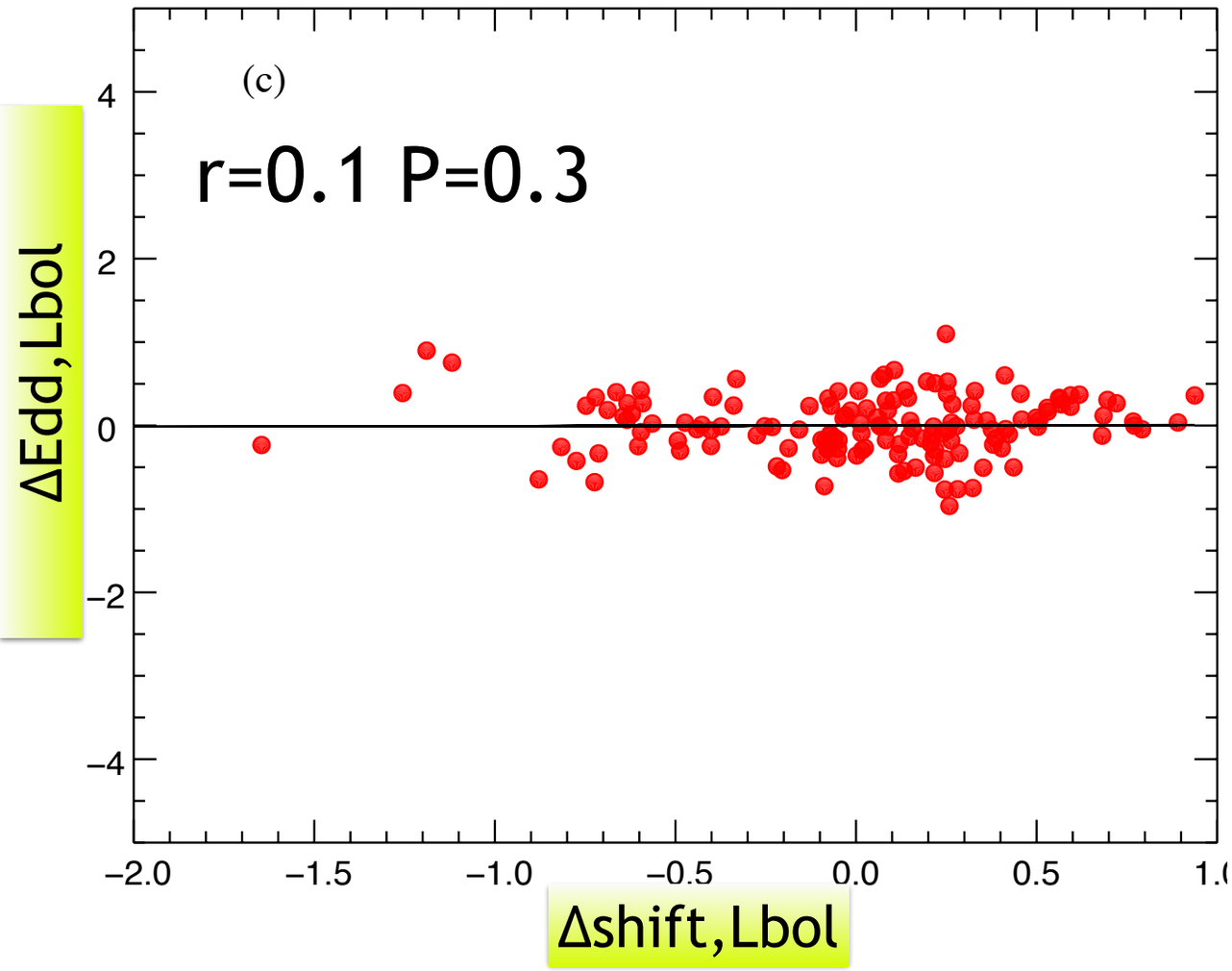
Log $V_{out} \propto 0.25$ Log L_{Bol}

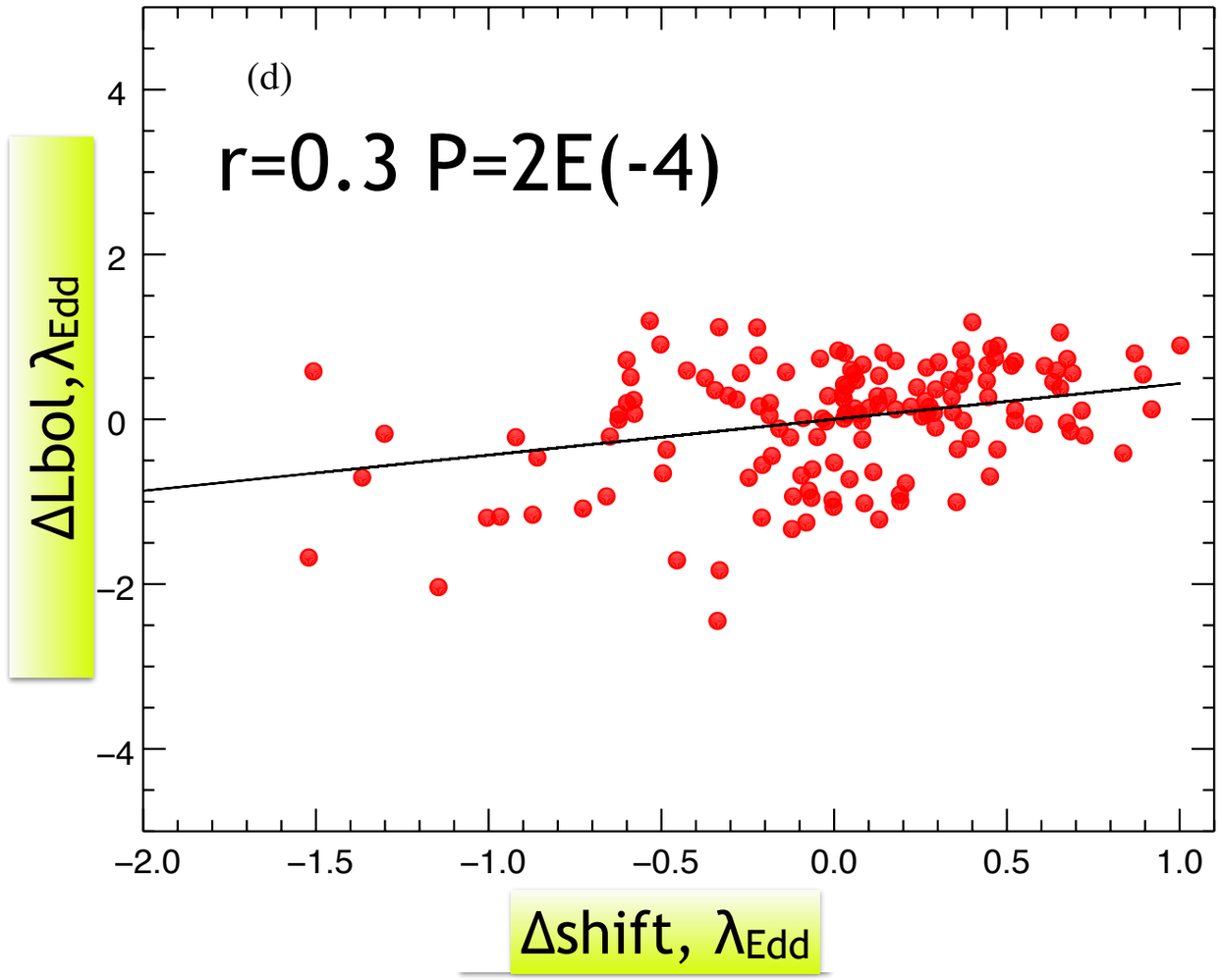
(Vietri et al. in prep)

What is the Driver of BLR winds?

Correlations between residuals:

Hypothesis → Fundamental correlation with L_{Bol}



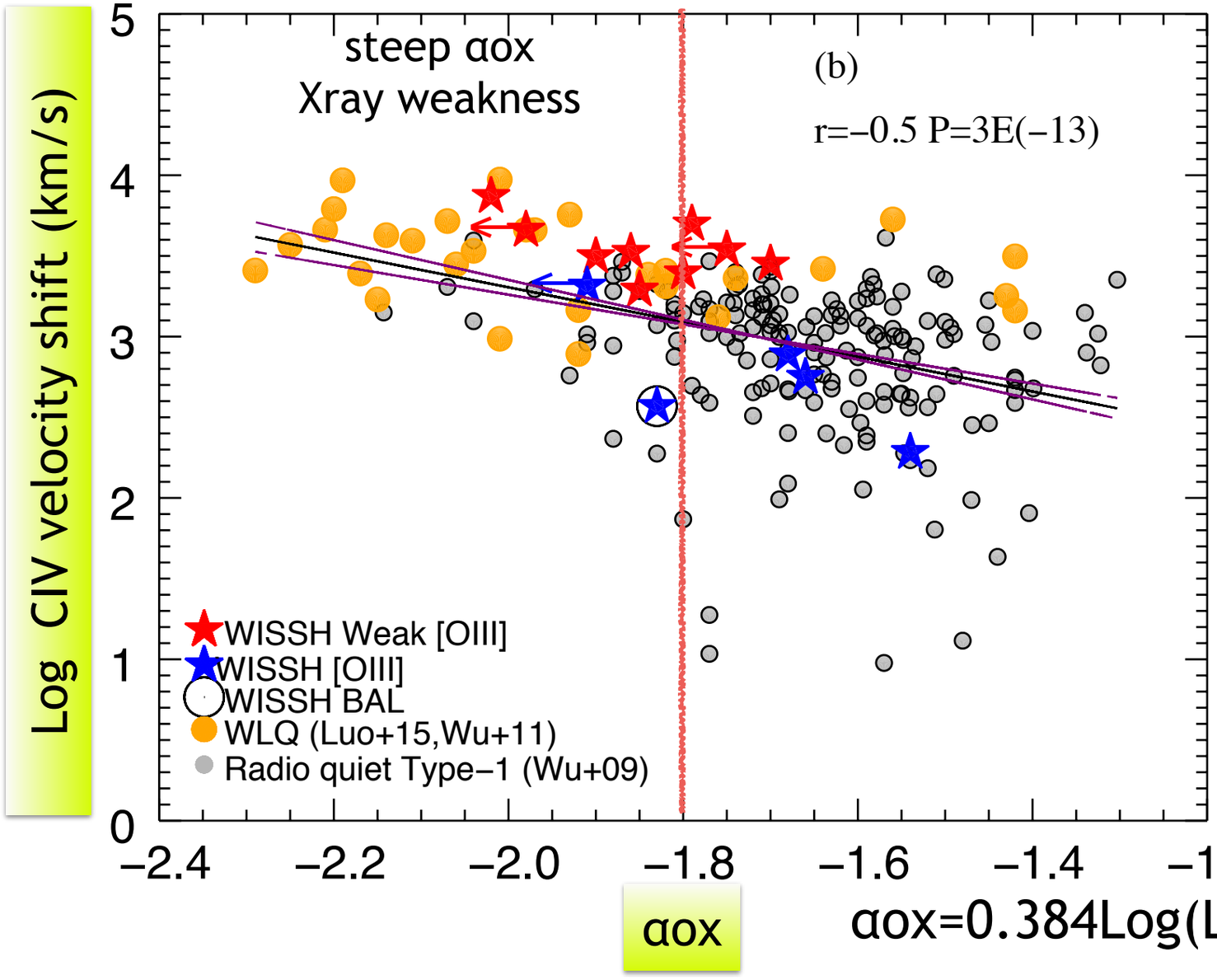


Result → Lbol is the main driver of BLR winds

(Vietri et al. in prep)

What is the Driver of BLR winds?

Is the shape UV–X ionizing continuum the physical driver of the BLR winds?



$\alpha ox = 0.384 \log(L_{2keV}/L_{2500A})$

Well know anti-correlation:

$\alpha ox - L_{UV}$ Vignali+2003

$\alpha ox + L_{Bol}$ as primary drivers of the CIV blueshifts

Strong X-ray radiation can easily overionize the material and hamper an efficient line-driving mechanism

(Vietri et al. in prep)

CONCLUSIONS

The WISSH sample
86 Hyper-luminous, Type 1 quasars with L_{Bol} >10^{47} erg/s at 1.5 <z< 4.5

WISSH: Revealing widespread presence of outflows in the most luminous quasars

Results from LUCI/LBT(Optical) - SDSS(UV) data (18 targets)

DISCOVERY HIGH-VELOCITY (3000-8000 KM/S) BLR WINDS

High luminosity as a key ingredient (70% of the WISSH)
Radiatively driven BLR winds ($v \propto L_{Bol}^{(1/4)}$)
Powerful BLR winds E_{kin} up to 0.1% L_{Bol}

DICHOTOMY OF BLR(CIV) - KPC-SCALE [OIII] WINDS

CIV vshift > 2000 km/s if weak/no [OIII]
CIV vshift < 2000 km/s if [OIII]
Inclination likely play a major role

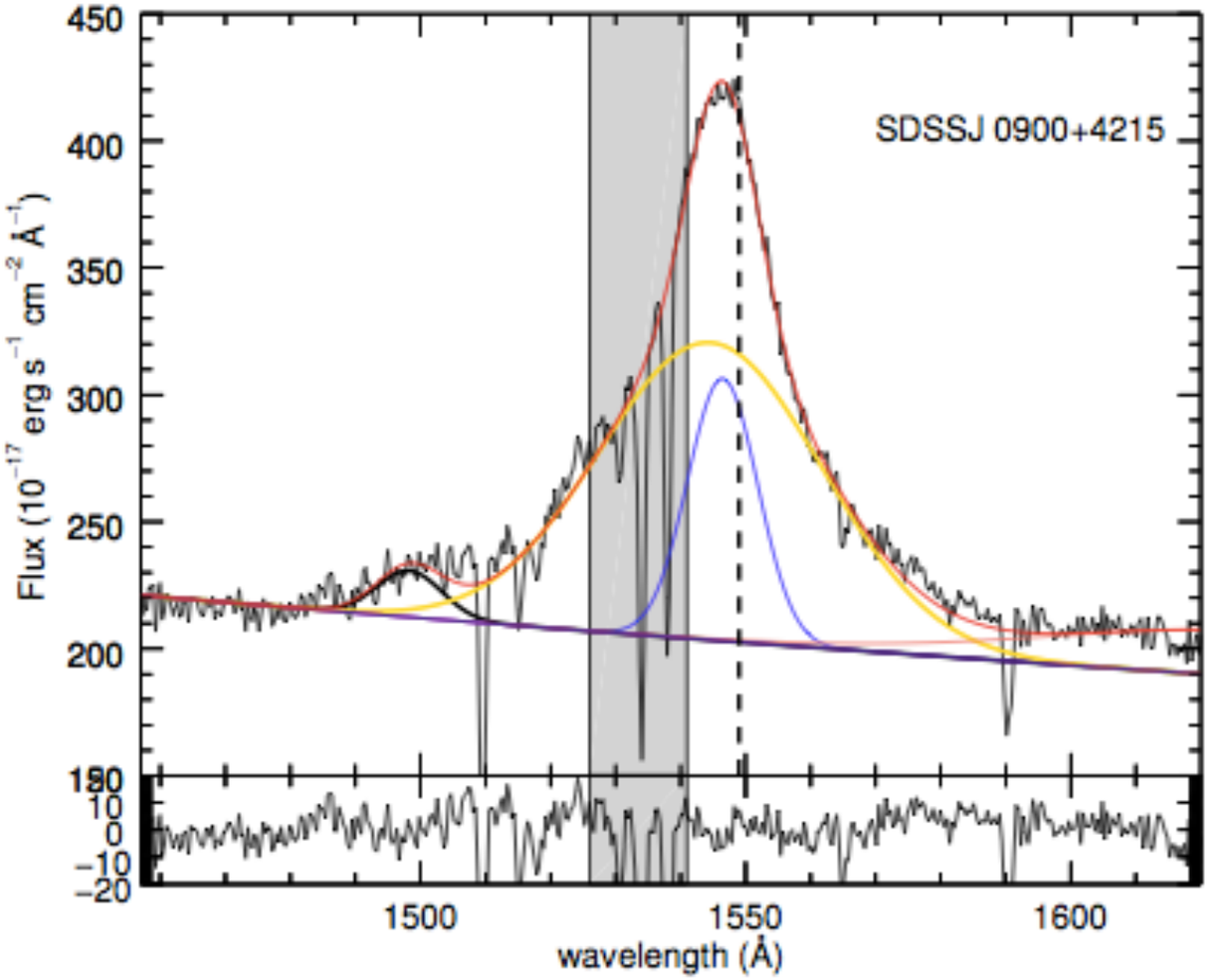
PHYSICAL DRIVER OF CIV WINDS

Combination of steep αox and Large L_{Bol}

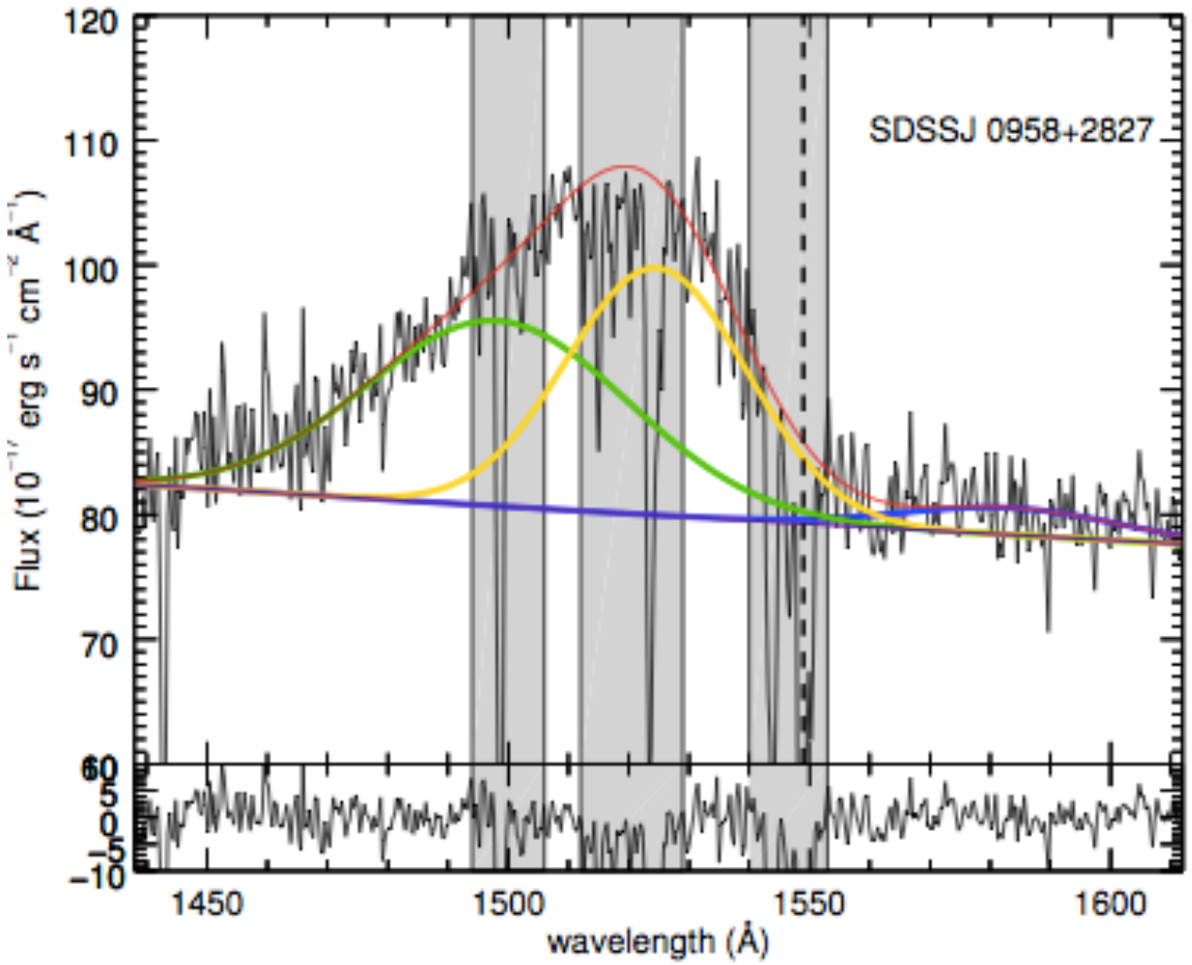
ADDITIONAL slides

Model fitting

[OIII] source



Weak [OIII] source



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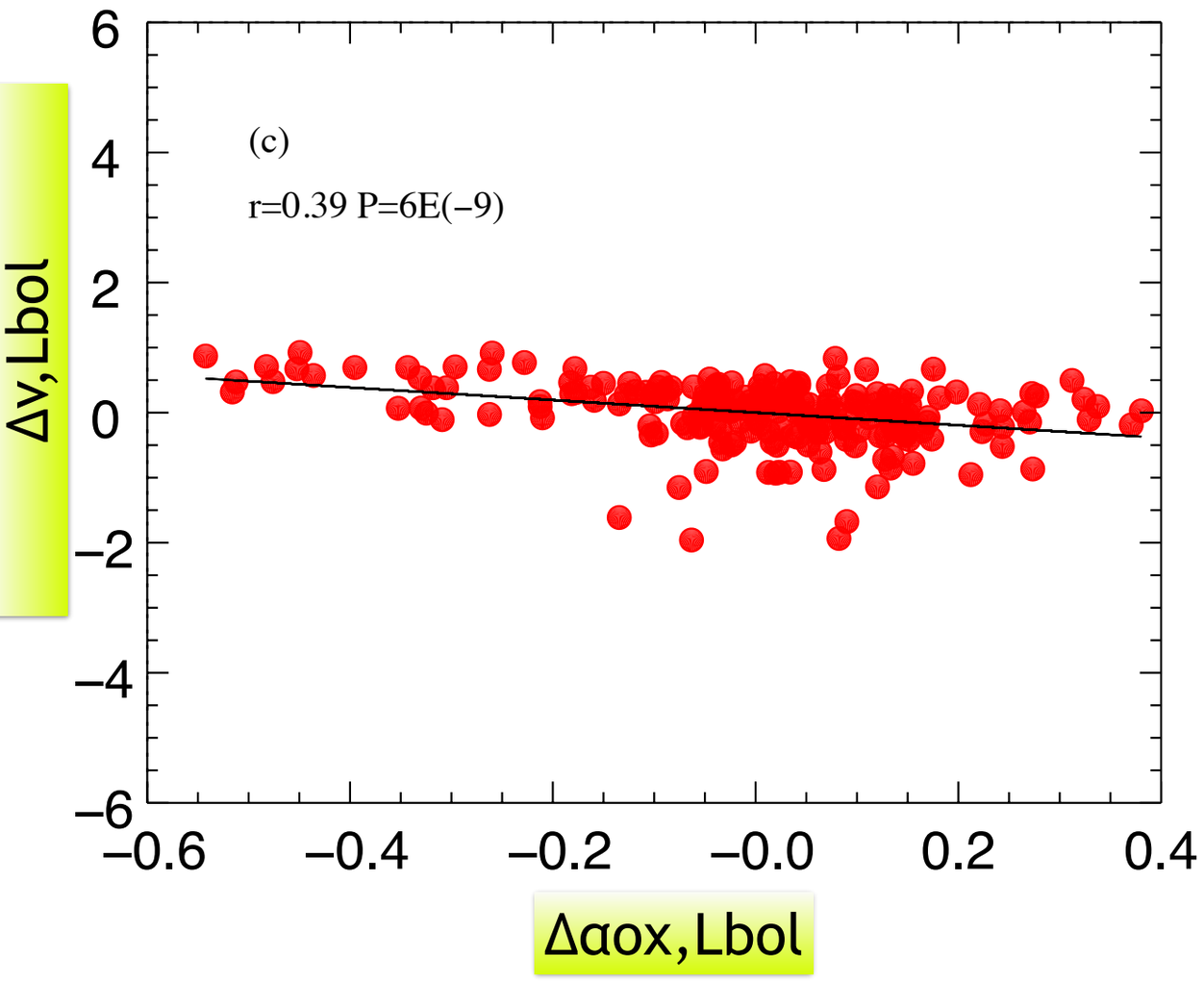

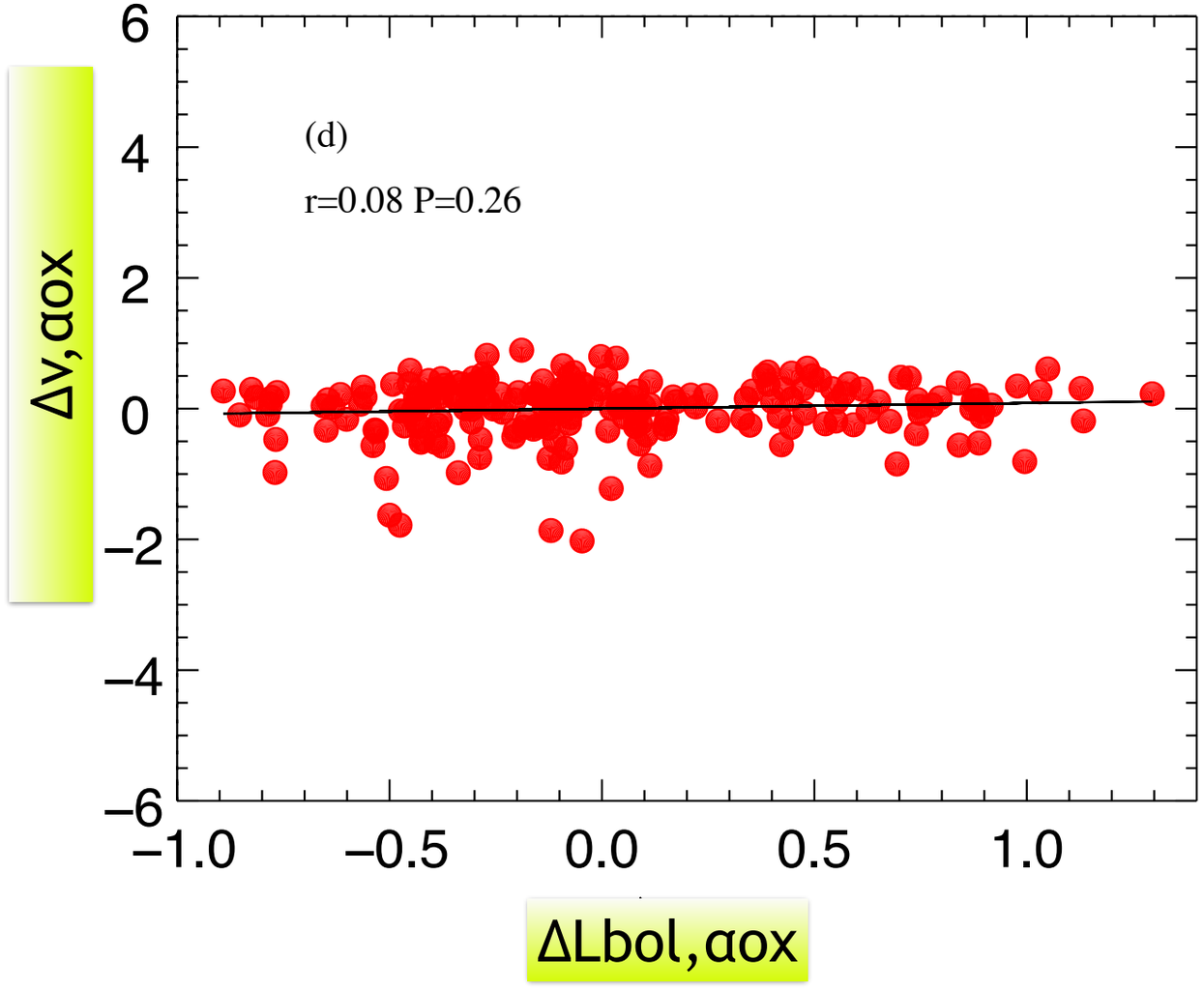

αox as primary driver of the CIV blueshifts

(Vietri et al. in prep)