THE WISSH SURVEY: BLR VS NLR WINDS IN THE MOST LUMINOUS QUASARS

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The WISSH quasars project

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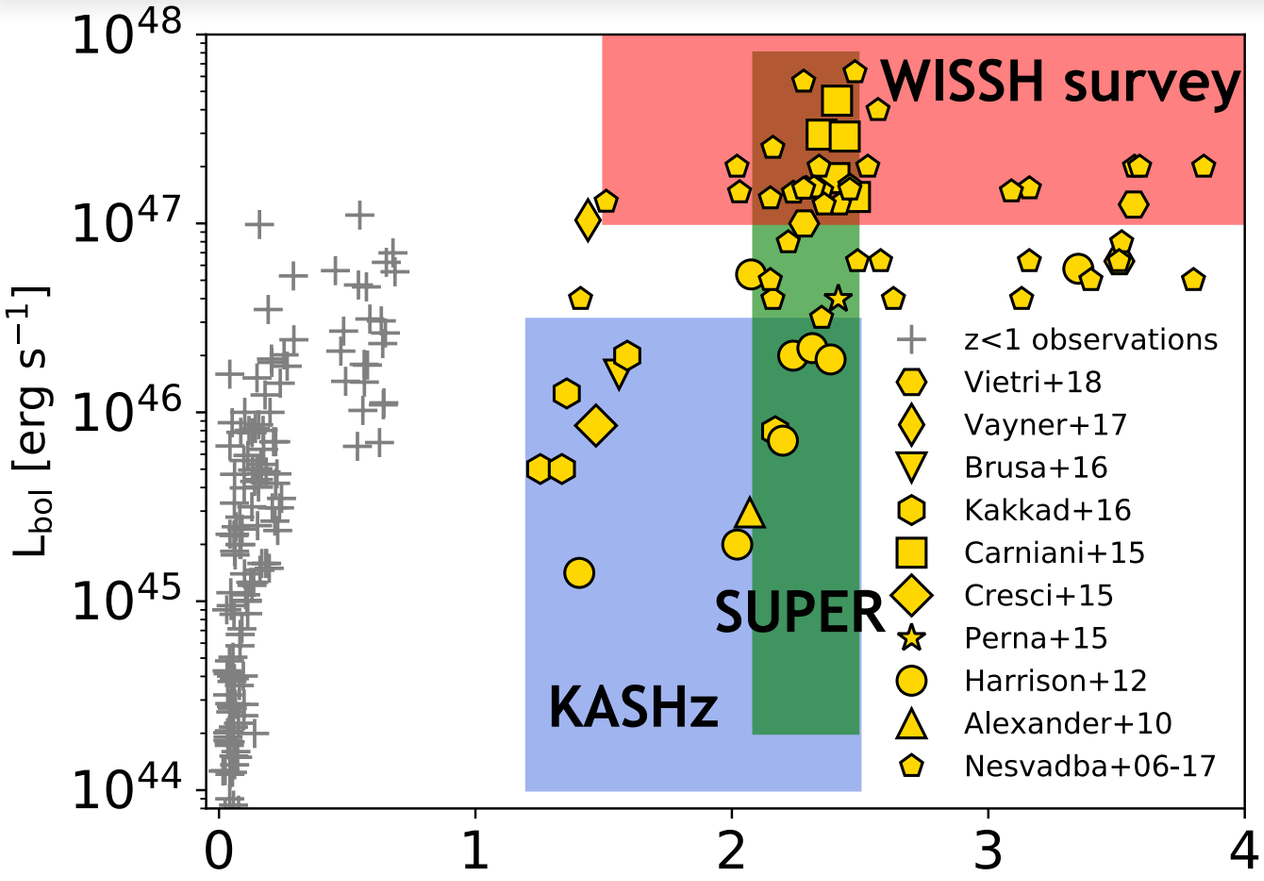
G. Cresci, A. Marconi INAF Arcetri
… and many others

The WISSH Quasars survey



WISSH Quasars

Sample of 86 WISE/SDSS Selected Hyper-luminous (WISSH) quasars

- SDSS DR7 broad-line Quasars at z >1.5 with WISE(22μm) > 3mJy
- $L_{Bol} > 2 \times 10^{47}$ erg s^{-1}
- Xray weakness (Martocchia+17)

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

Extensive multi-λ observing program: panchromatic view of Hyper-Lum QSOs

Proprietary data: LBT/LUCI, SINFONI, X-shooter, XMM & Chandra, ALMA, Noema, MUSE
Public data: Herschel, WISE, 2MASS, SDSS

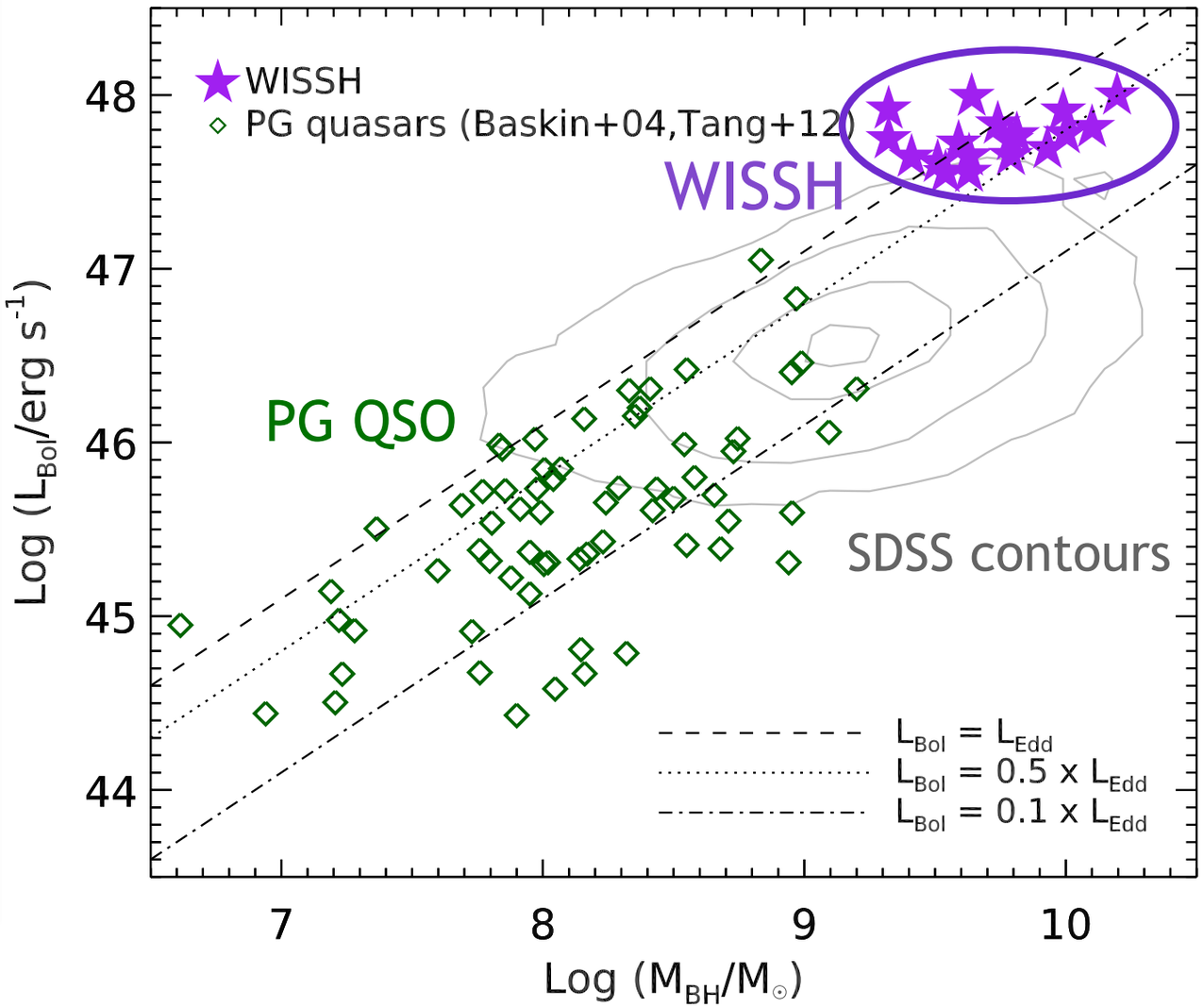
see M. Bischetti's talk

see A. Travascio's talk

SMBH MASS FROM Hβ EMISSION LINE

LBT/LUCI campaign (36 targets): initial sample of 18 WISSH quasars

- FWHM(Hβ) 3,000-8,000 km/s
- Hβ-based SMBH masses
  from ~ 2×10^9 M⊙
  up to ~ 2×10^{10} M⊙
- LBol from multi-component broad-band (MID-IR to UV) SED fitting
  (Duras et al. 2017, Duras in prep)
  see F. Duras' talk
- High accretion rates 0.4 < λEdd < 3

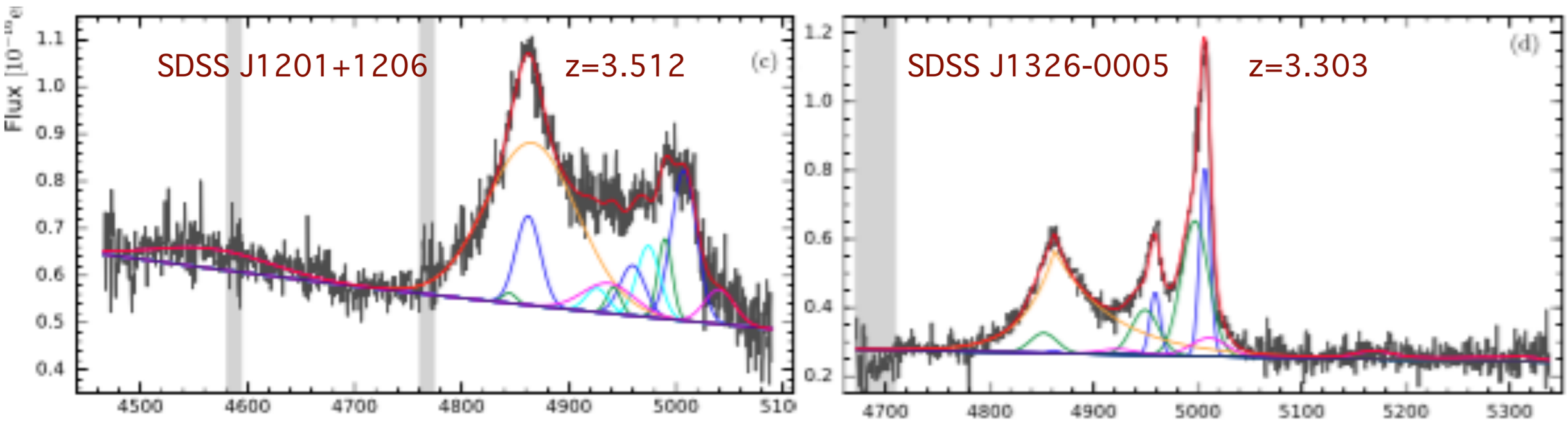


(Vietri et al. 2018,A&A 617, A81)

Opportunity of collecting high-mass, highly accreting SMBHs at the peak of the quasar number density

NIR SPECTRA OF THE WISSH QUASARS

30% prominent broad [OIII] emission



*Bischetti, Piconcelli, **Vietri** + 2017, A&A, 598, A122*

Very broad blue-shifted [OIII] lines

$FWHM_{[OIII]}$ ~ 1200 -2200 km s^{-1}

Strong [OIII] lines observed so far

$L_{[OIII]} > 10^{44}$ erg s^{-1}

Fast [OIII] emission v(max) ~ 1400 -3000 km s^{-1}

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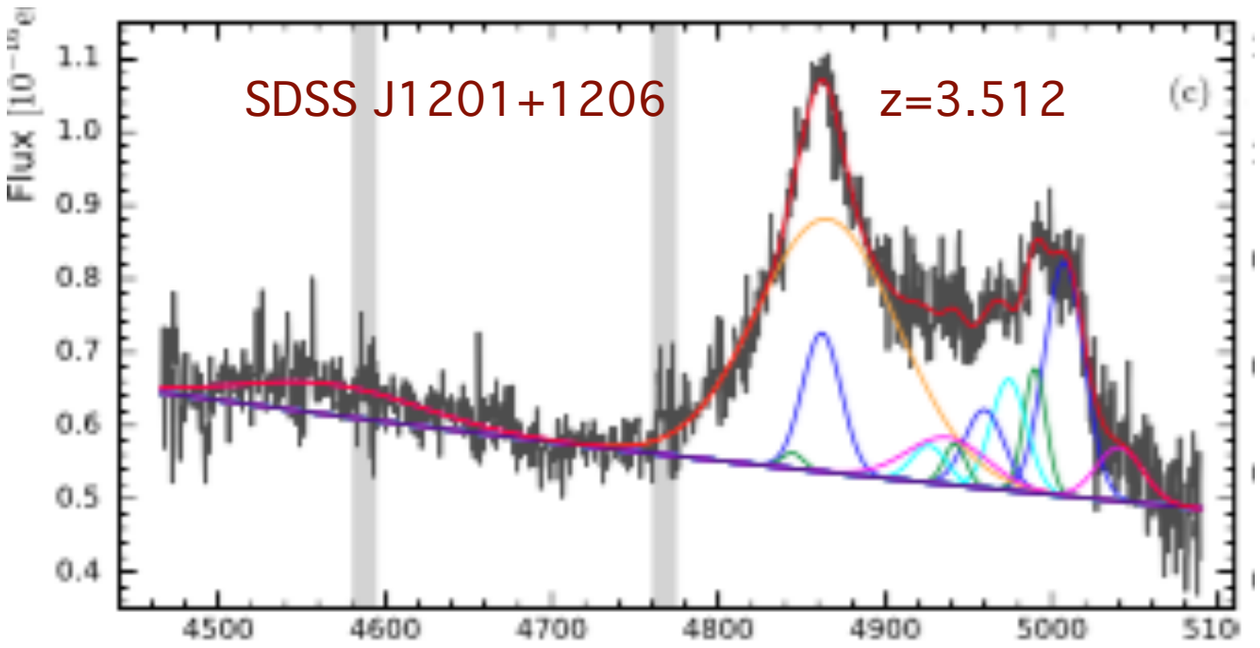

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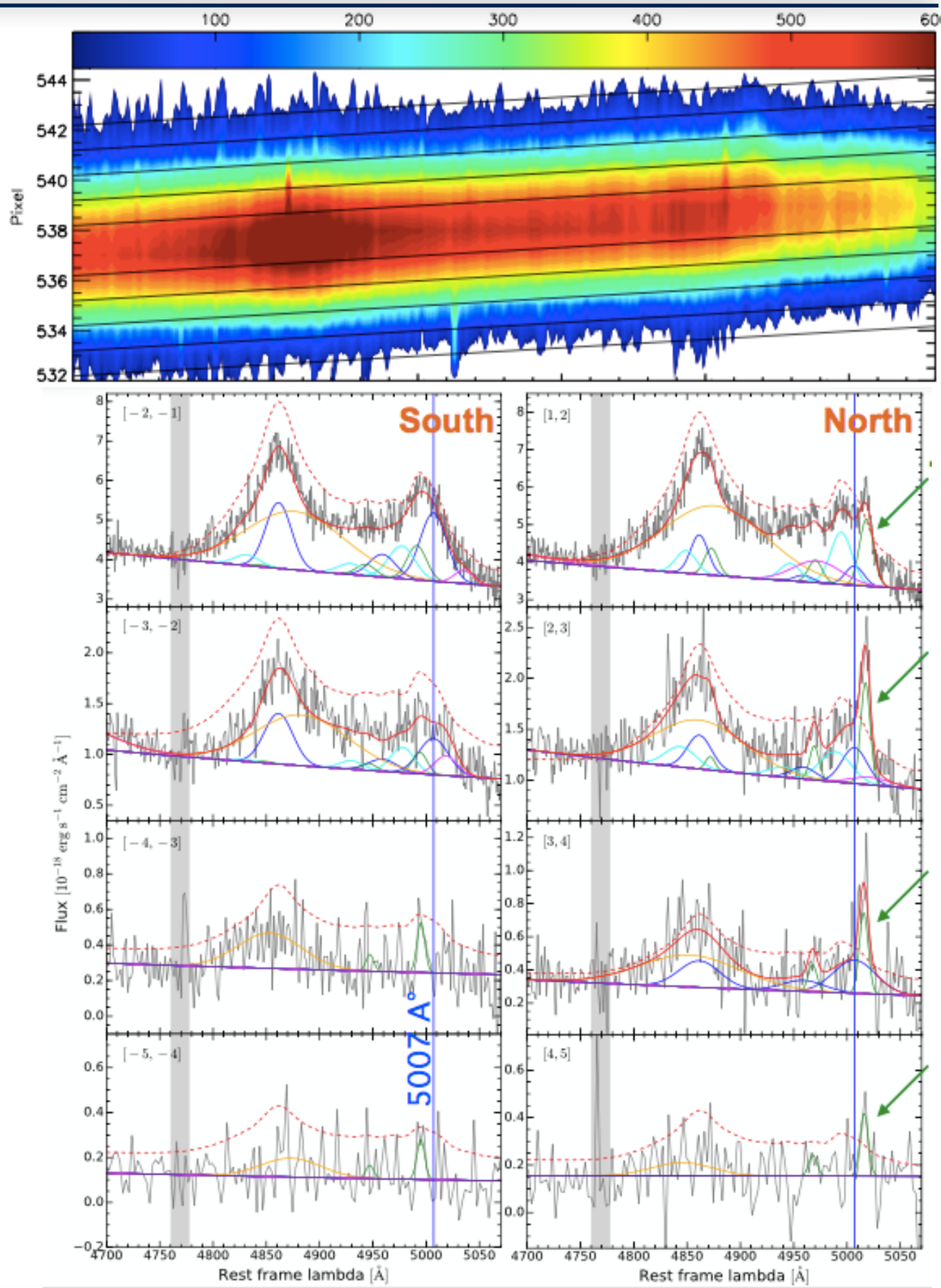
scenario : bipolar outflow up to ~ 7 kpc



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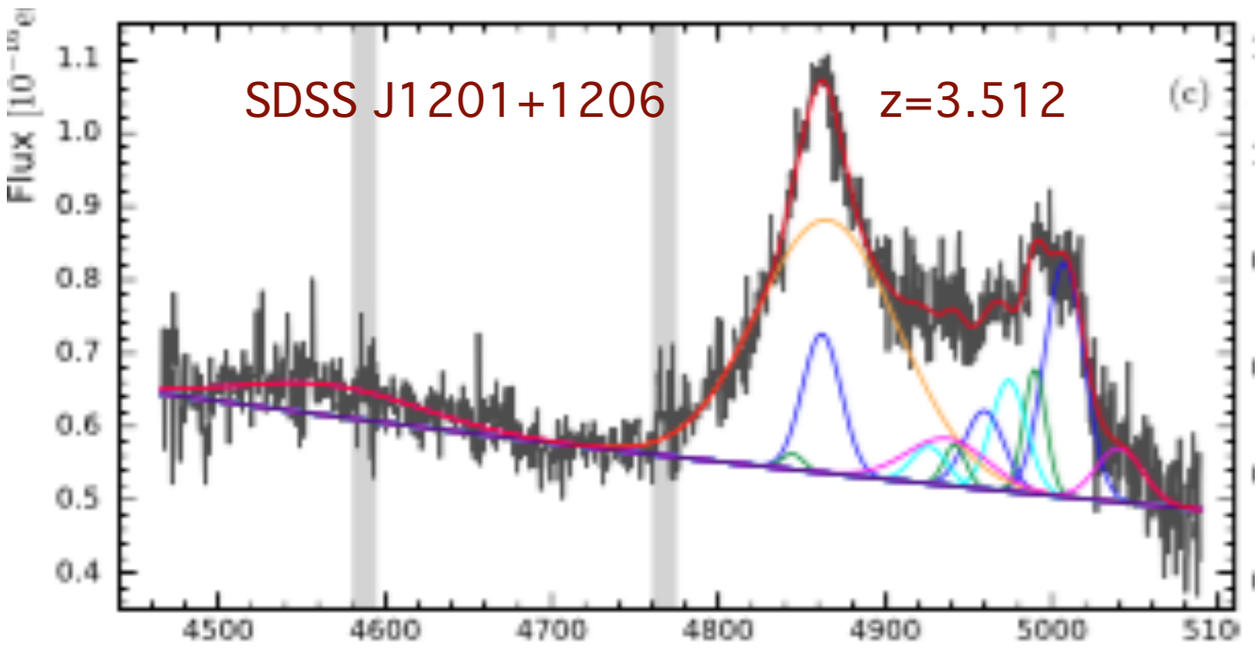

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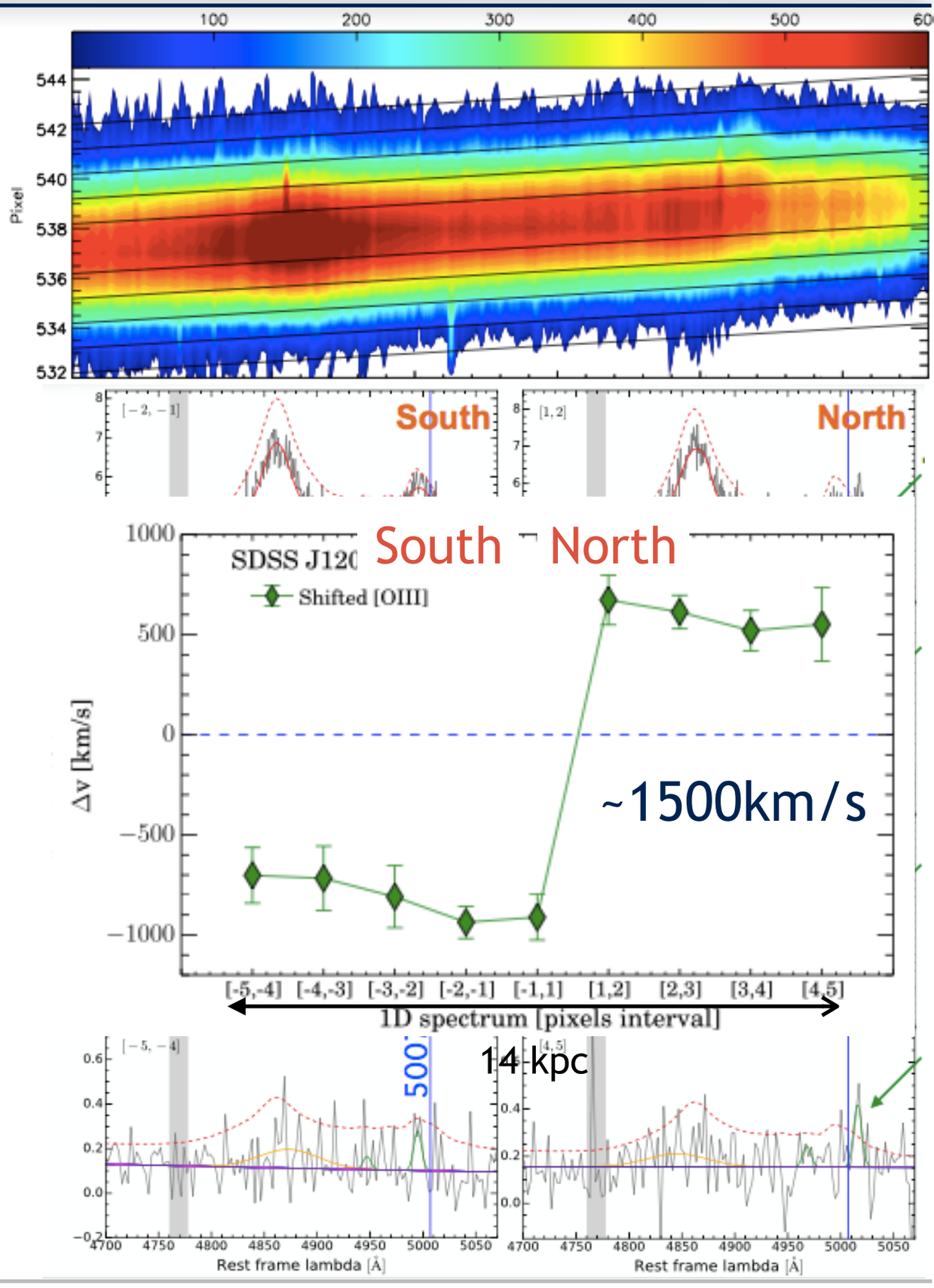
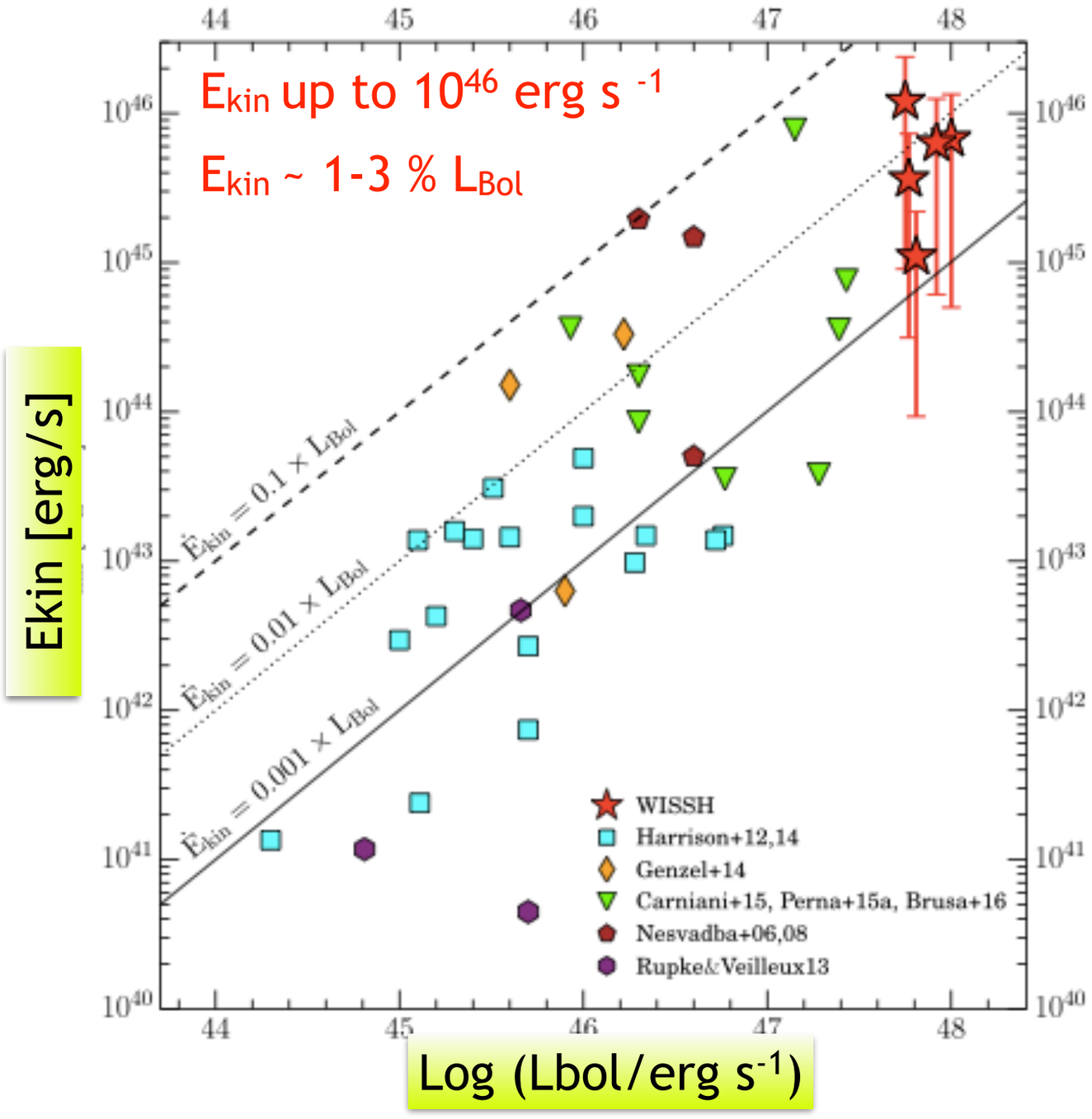


Powerful [OIII] outflows in WISSH Quasars



$$L^{broad}_{[OIII]} \longrightarrow M_{ion}$$

$$\dot{M} \sim \frac{3\, M_{ion}\, v_{max}}{R}$$

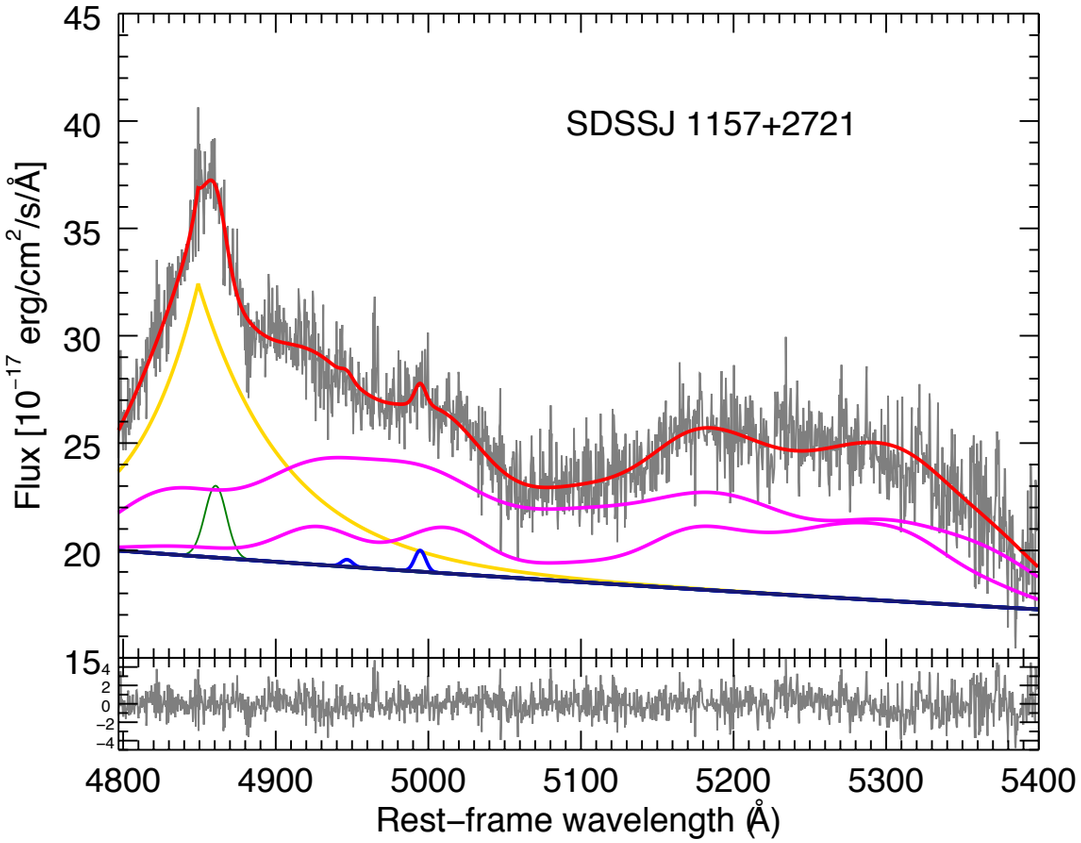
$$\dot{E}_{kin} = \frac{\dot{M} v^2_{max}}{2}$$

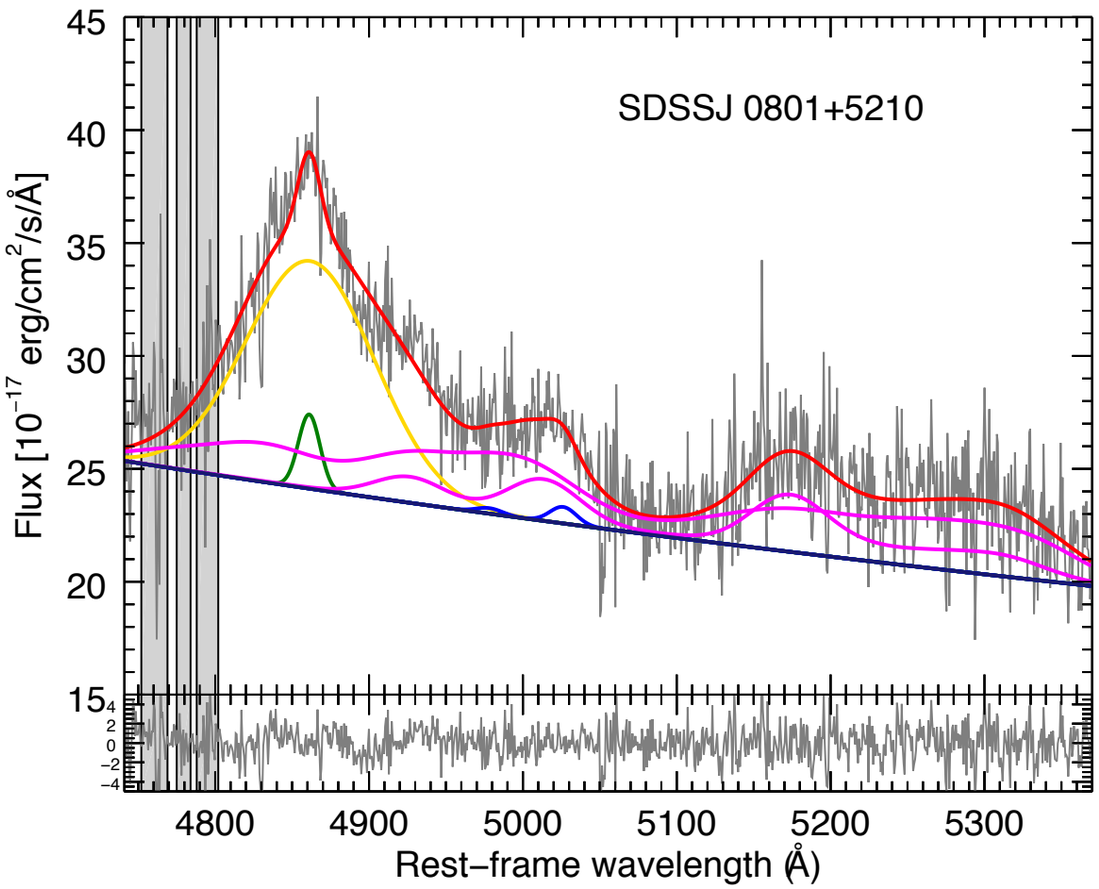
*Bischetti, Piconcelli, **Vietri** + 2017, A&A, 598, A122*

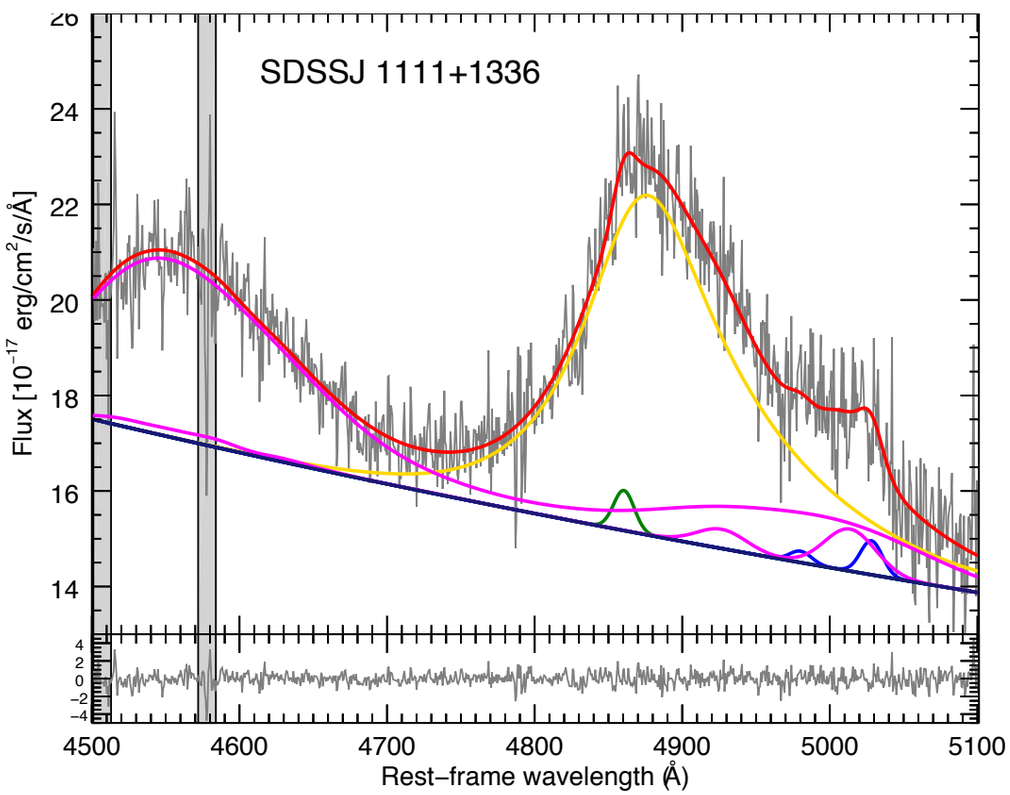
WISSH quasars allow to reveal extremely powerful outflows

Lack of [OIII] in WISSH Quasars?

70% weak/lacks of [OIII] emission



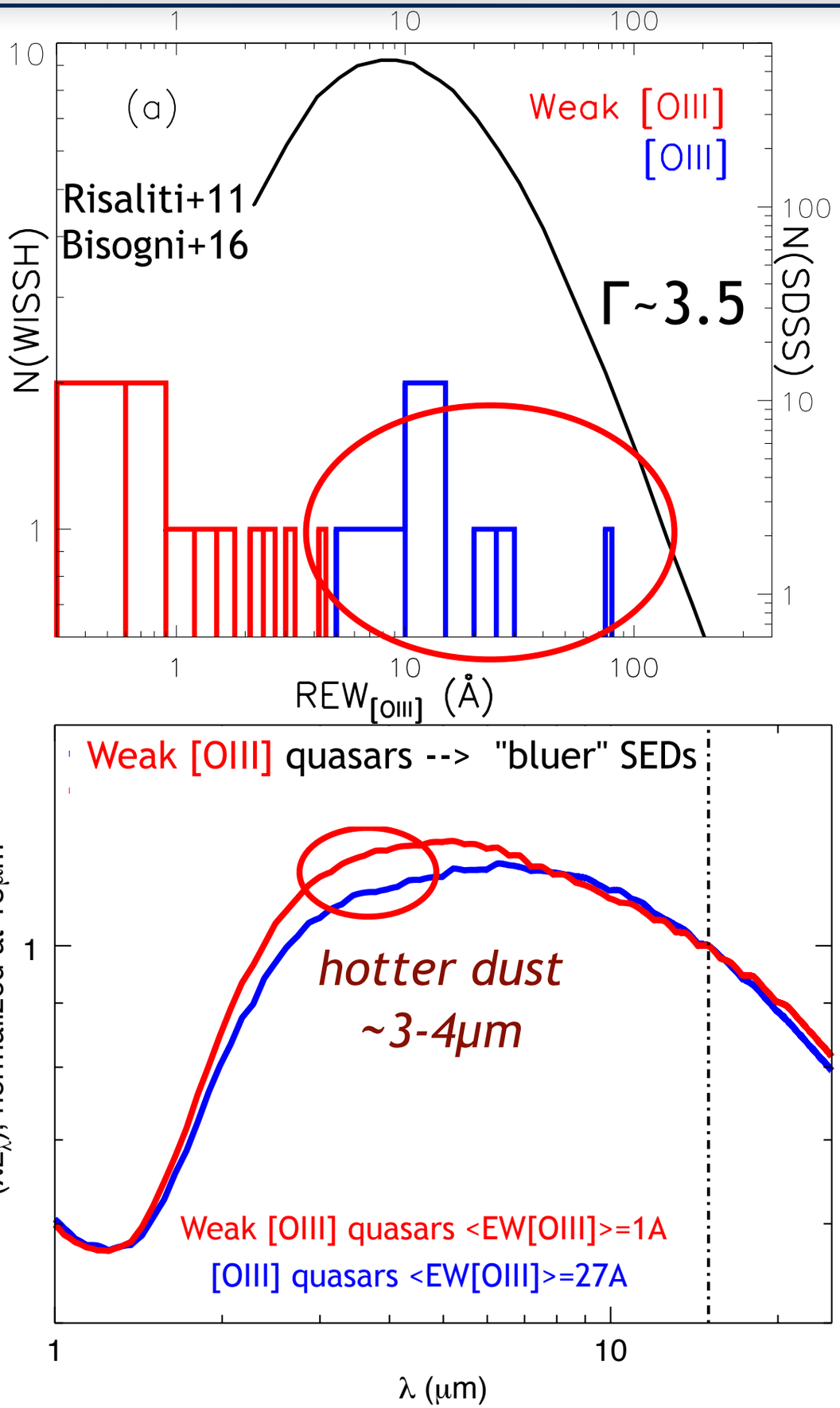




Strong, complex FeII emission

Weak [OIII] emission line? Iron residual?

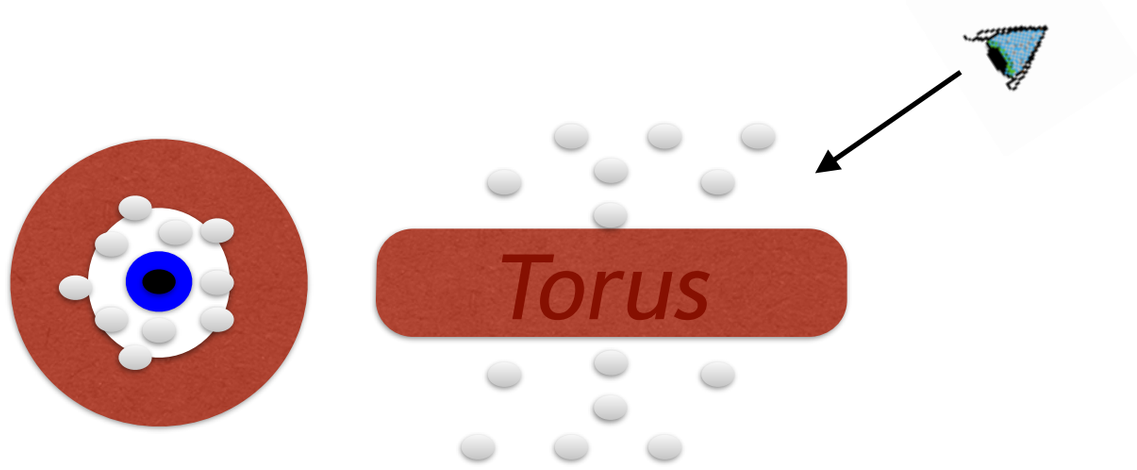
[OIII] DICHOTOMY



EW[OIII],obs = EW[OIII]/cosθ

the higher EW[OIII] the higher inclination

WISSH: θ~25-70°



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

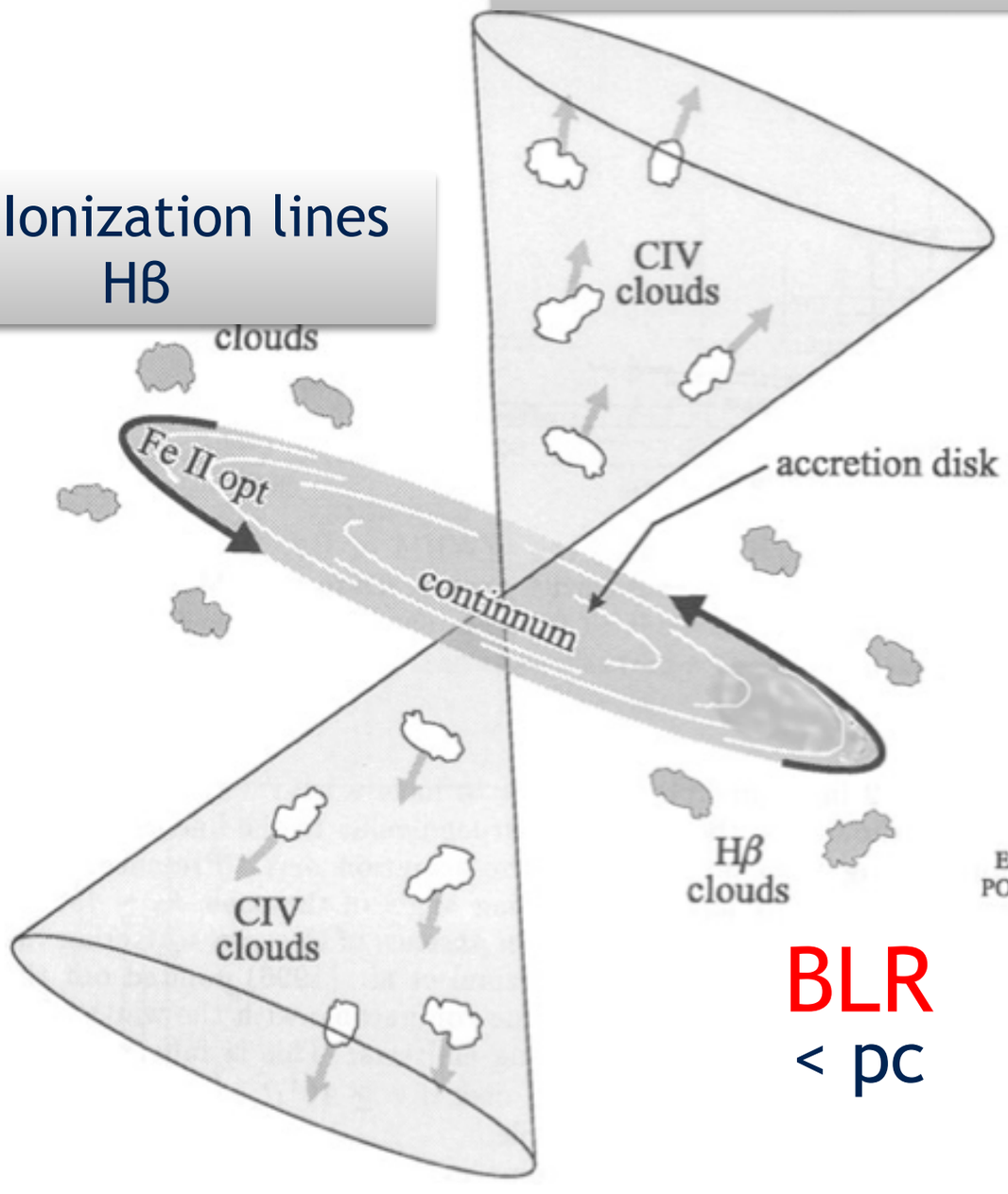
(Vietri et al. 2018,A&A 617, A81)

BLR WINDS VIA CIV EMISSION LINE

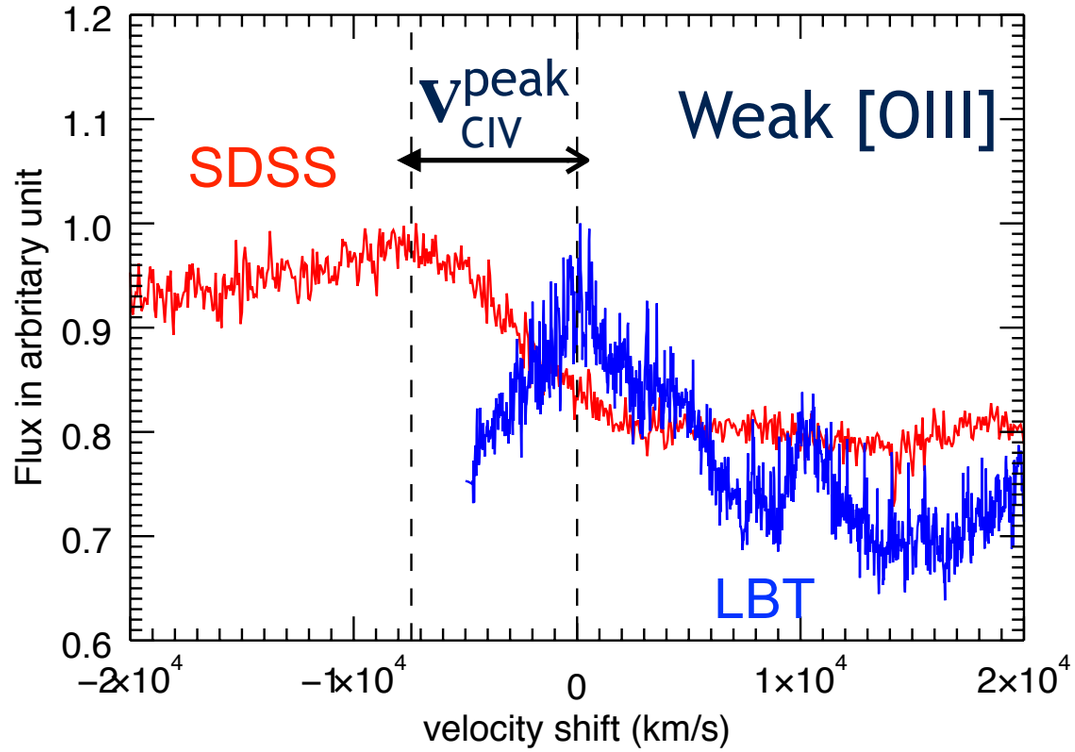
BLR winds traced by CIV(SDSS)-Hbeta(LBT) velocity shift

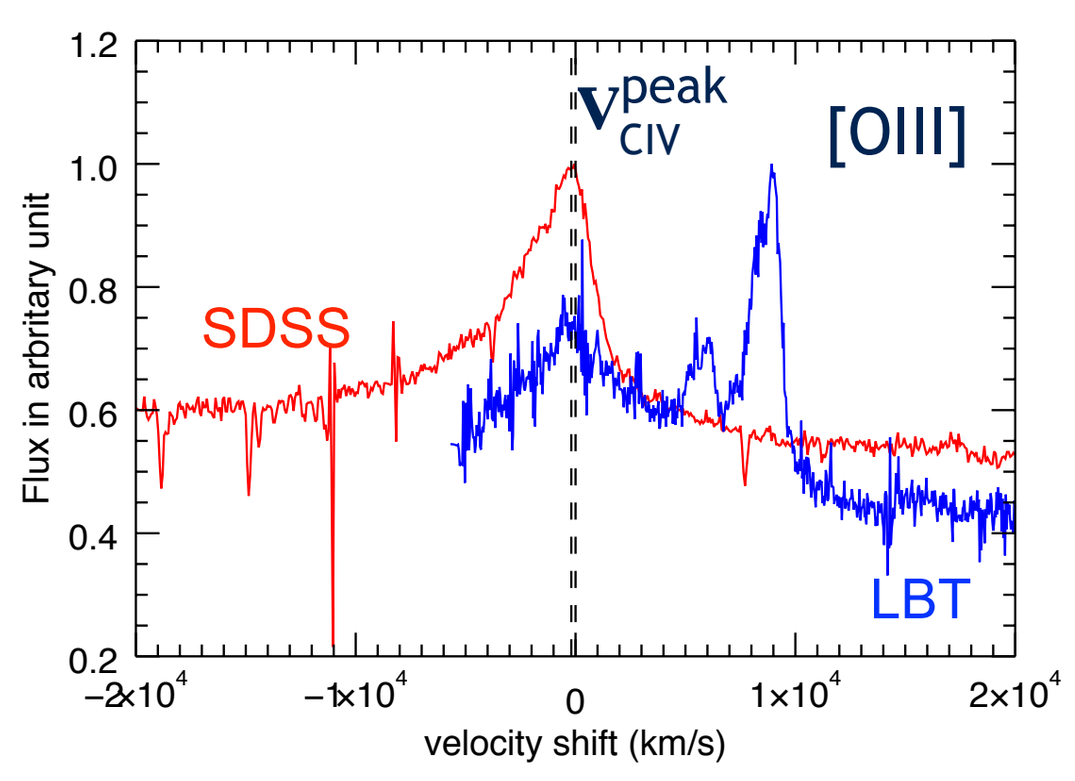
High ionization lines
CIV

Low Ionization lines
Hβ



BLR
< pc





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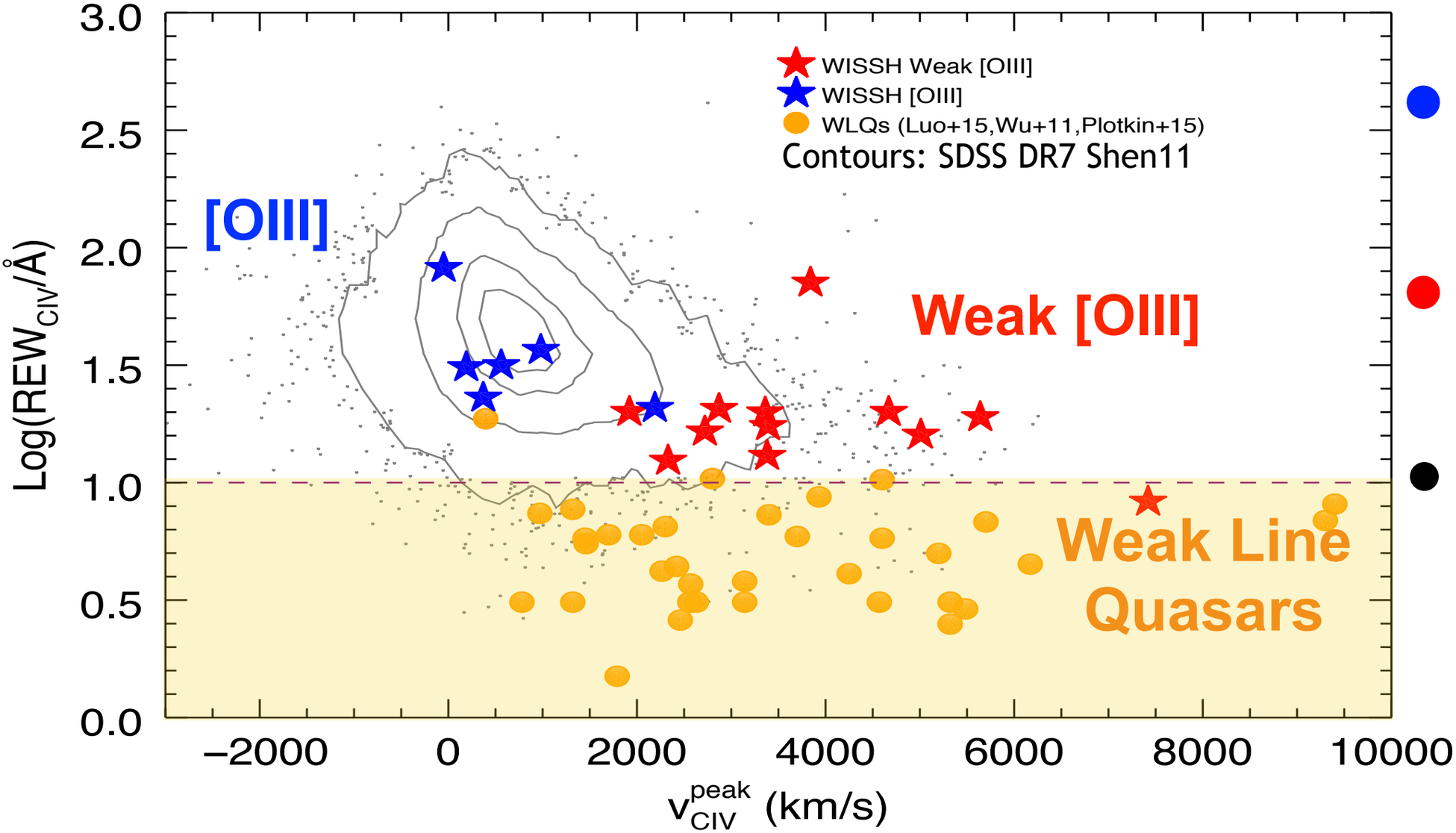


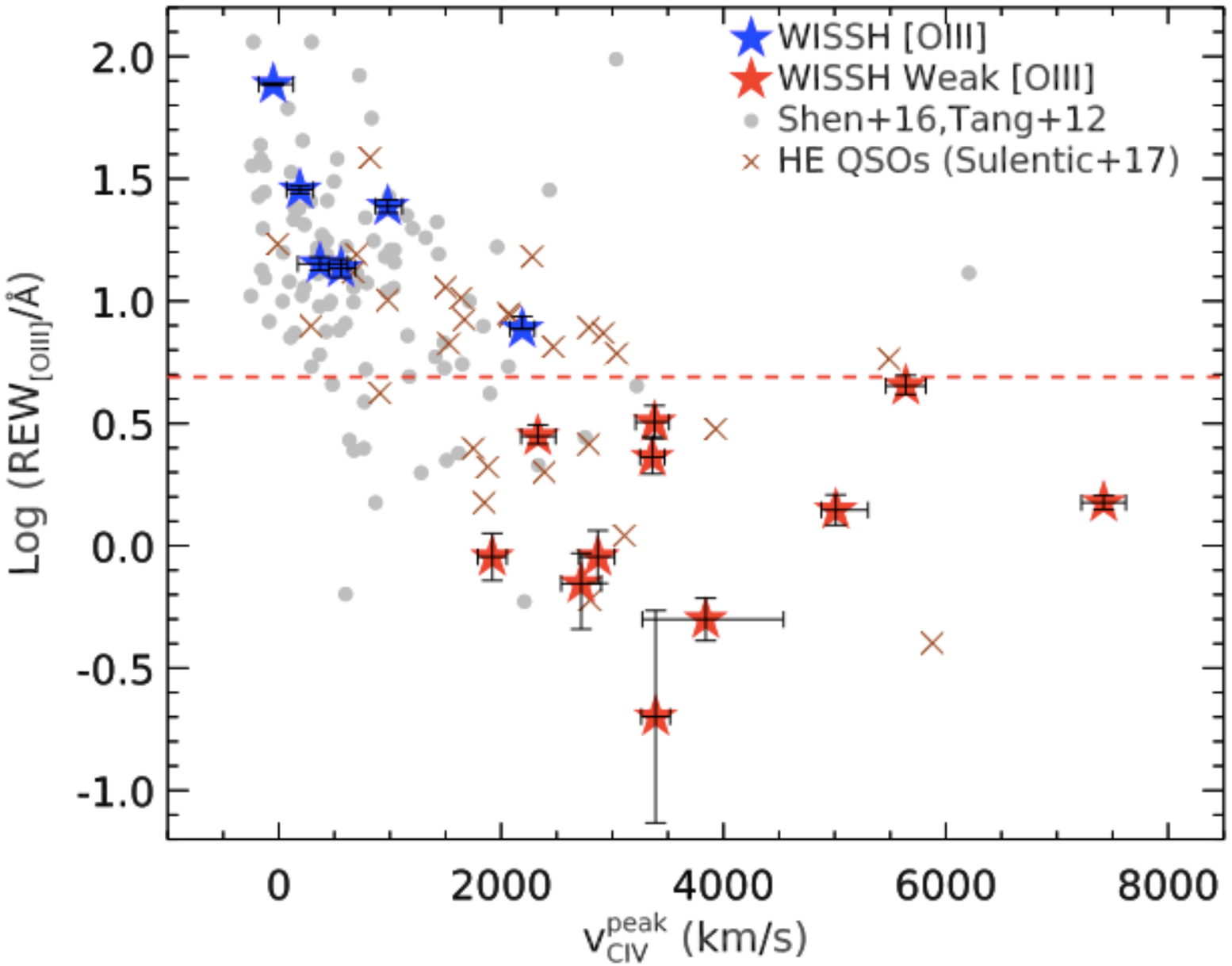
- Strong [OIII] - Weak CIV shifts
- Weak [OIII] - Strong CIV shifts
- Shifts comparable with Weak Line Quasars

1% SDSS QSOs EW(CIV) < 10A

WISSH QSOs also very effective in collecting the strongest CIV winds

(Vietri et al. 2018,A&A 617, A81)

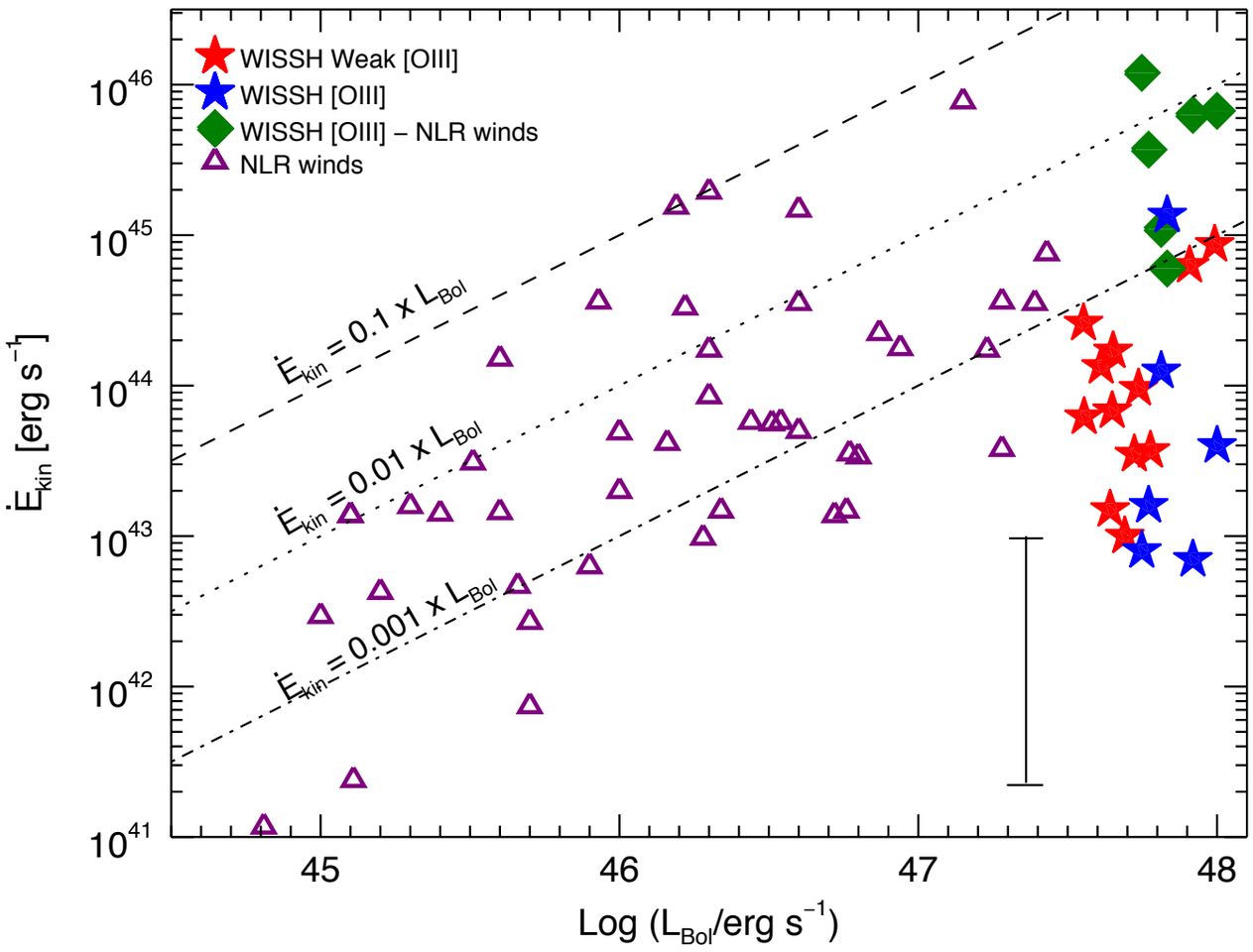
BLR(CIV) – NLR([OIII]) WINDS DICHOTOMY



(Vietri et al. 2018,A&A 617, A81)

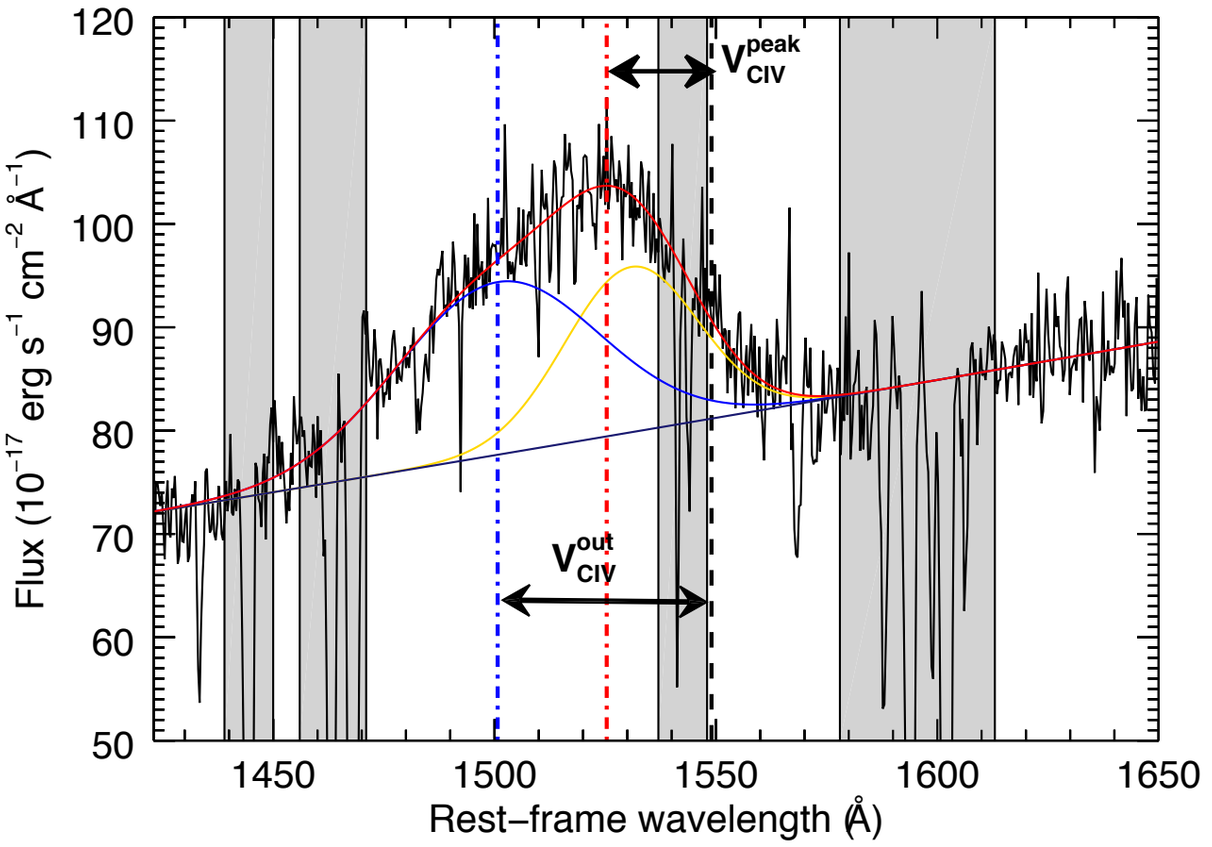
Discovery of a dichotomy:
CIV vshift > 2000 km/s if weak/no [OIII]
CIV vshift < 2000 km/s if [OIII]

BLR WINDS VIA CIV EMISSION LINE



$\dot{M}_{out}$ up to 30 $M_\odot$ yr^{-1}

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



From Marziani+15

$$\dot{M}^{ion}_{out} \propto L_{45}(CIV)\ (Z_5)^{-1}\ n_9^{-1}\ r_1^{-1}\ v$$

$$\dot{E}_{kin} = \frac{1}{2}\,\dot{M}^{ion}_{out} \times\ v^2\ (ergs^{-1})$$

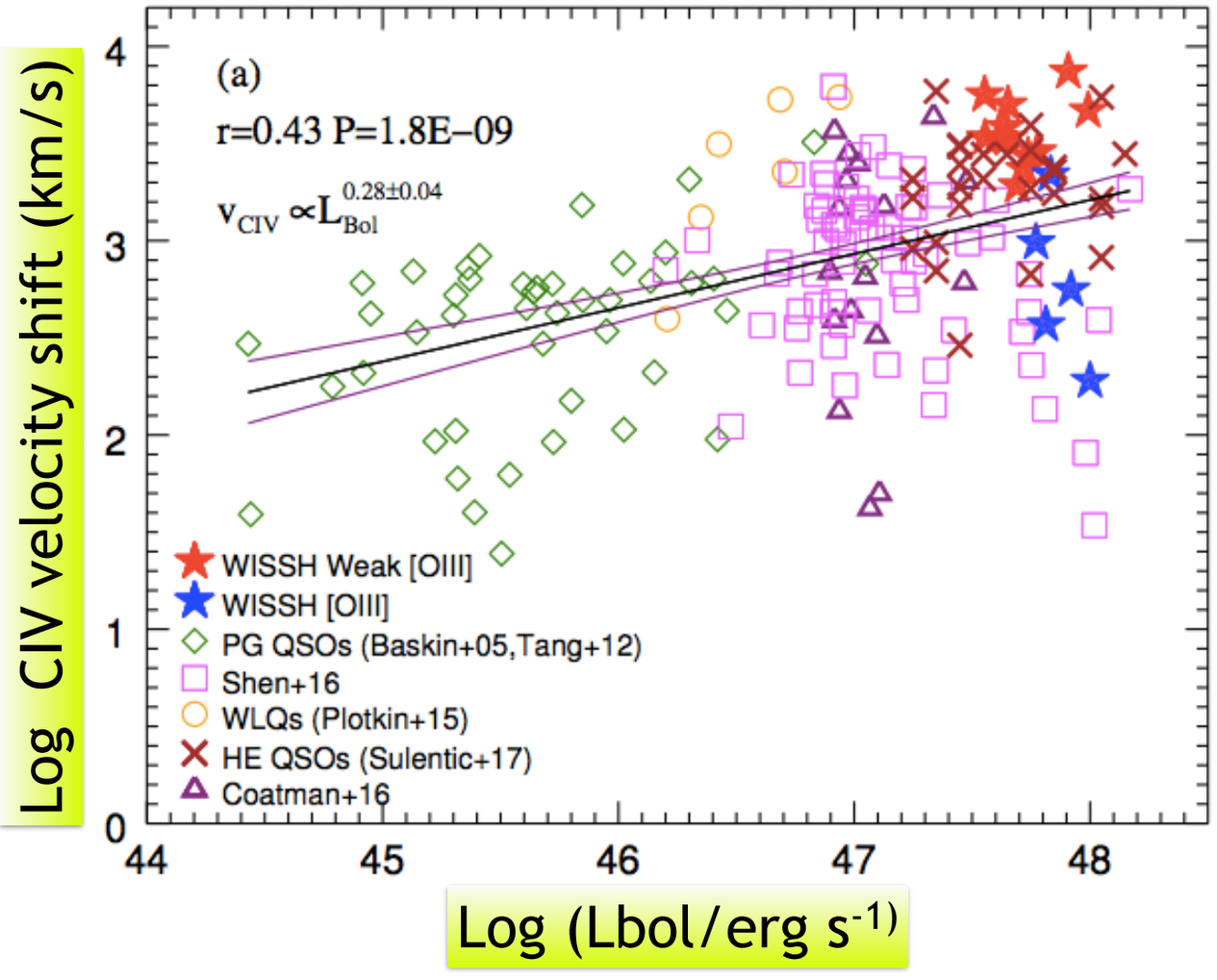
(Vietri et al. 2018,A&A 617, A81)

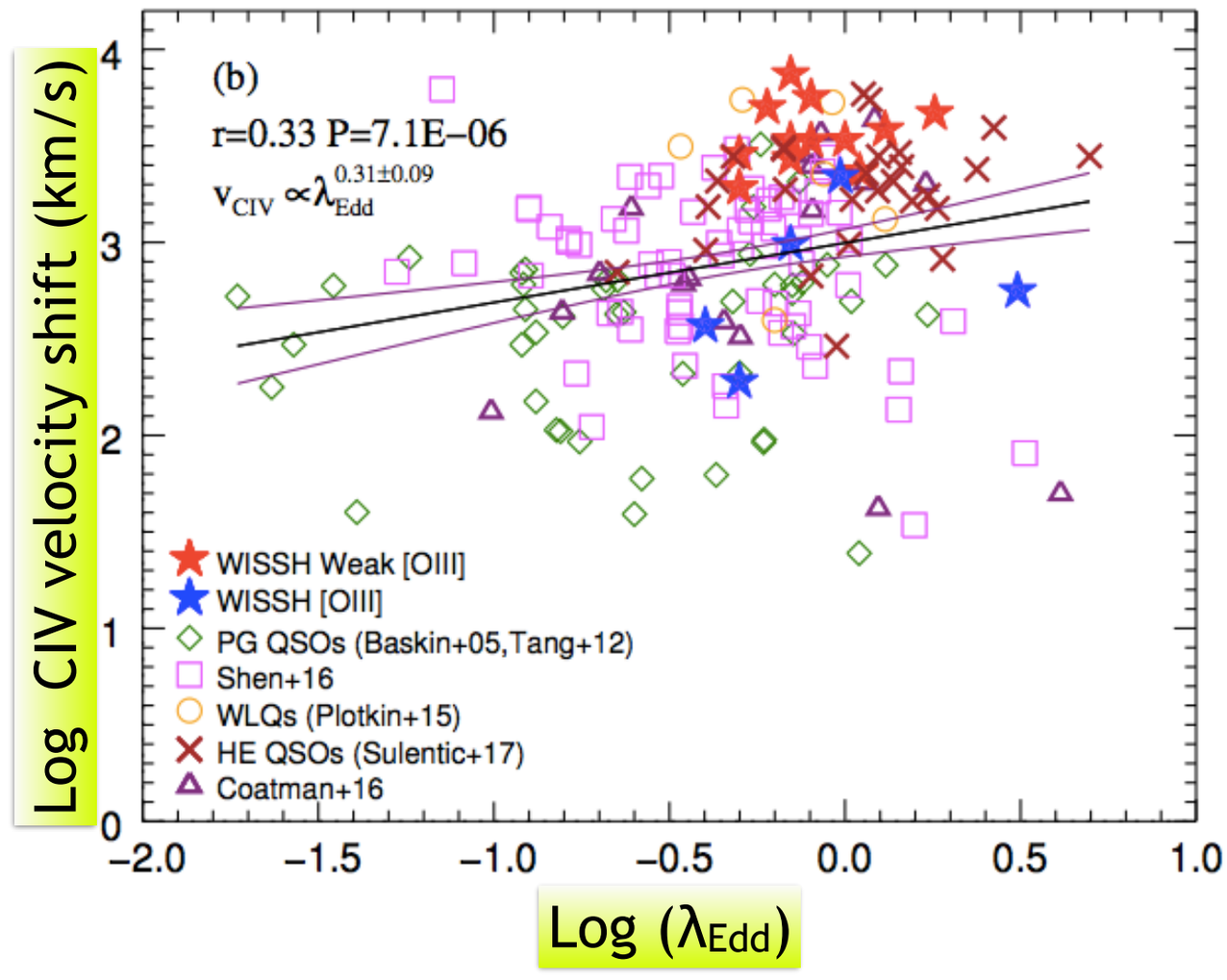
Take into account for a complete census of strong AGN-driven outflows

Evaluate their effects of depositing energy and momentum into the ISM

What is the Driver of BLR winds?

Sample of 147 QSOs with Hβ SMBH mass





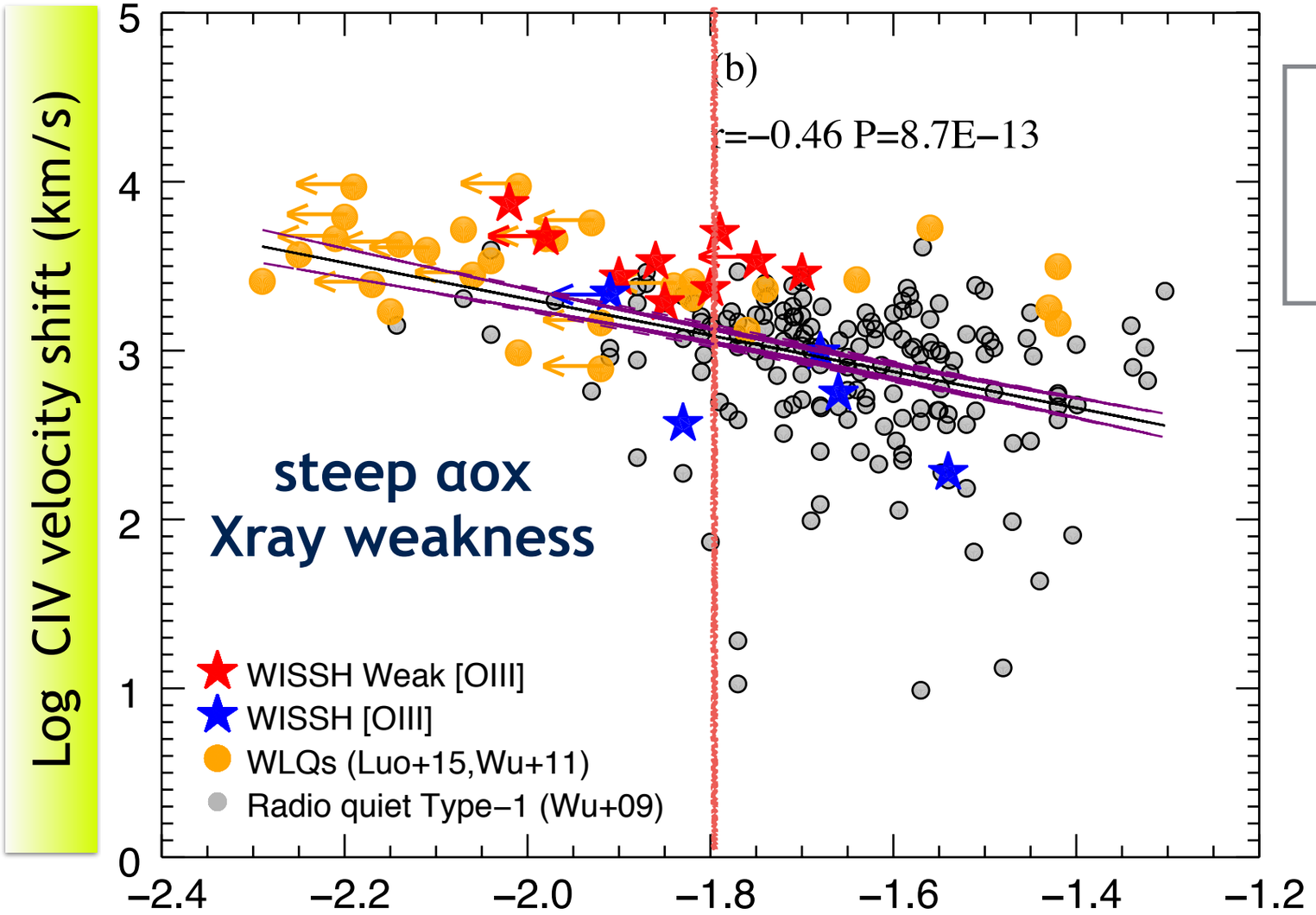
As expected for radiatively driven winds

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

(Vietri et al. 2018,A&A 617, A81)

What is the Driver of BLR winds?

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



Well known anti-correlation:

αox–L_{UV} Vignali+2003 Lusso+2010 Lusso & Risaliti 2016

steep αox/high L_{Bol} as primary driver of the CIV blueshifts

αox=0.384Log(L_{2keV}/L_{2500A})

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

(Vietri et al. 2018,A&A 617, A81)

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)

ULTRAMASSIVE (UP TO 2×10^{10} M⊙) – HIGHLY ACCRETING SMBH AT Z~3

POWERFUL MASSIVE KPC SCALE IONIZED WINDS

SINFONI IFU spectrocopy follow-up is on-going

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

High luminosity as a key ingredient (70% of the WISSH)
Radiatively driven BLR winds ($v \propto L_{Bol}^{(1/4)}$)
BLR winds as powerful as NLR winds

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

Steep αox and large L_{Bol}

(Vietri et al. 2018,A&A 617, A81)