

Windy or not: Radio pc-scale evidence for a broad-line region wind in Radio Quiet AGN

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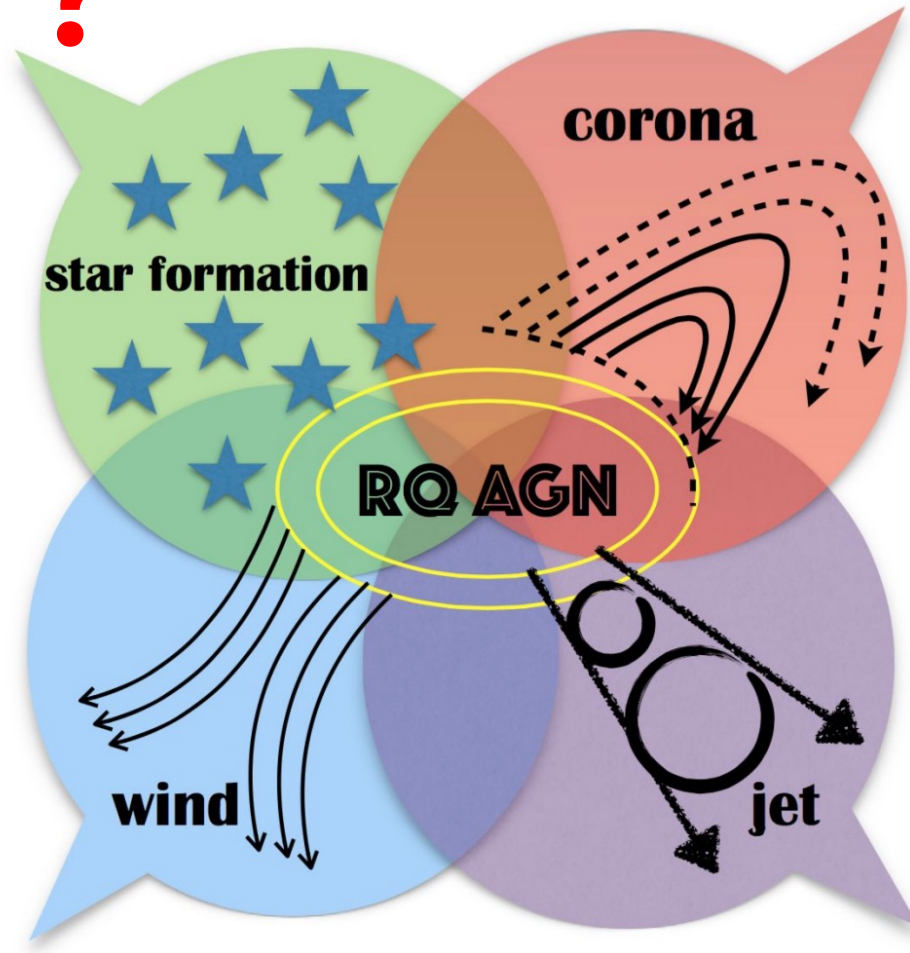
Technion
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Radio emission mechanisms in RQ AGN

*diffuse, low brightness,
FIR-radio relation* ?

*Neupert effect,
 $L_r/L_X \sim 10^{-5}$
mm-band compact core* ?



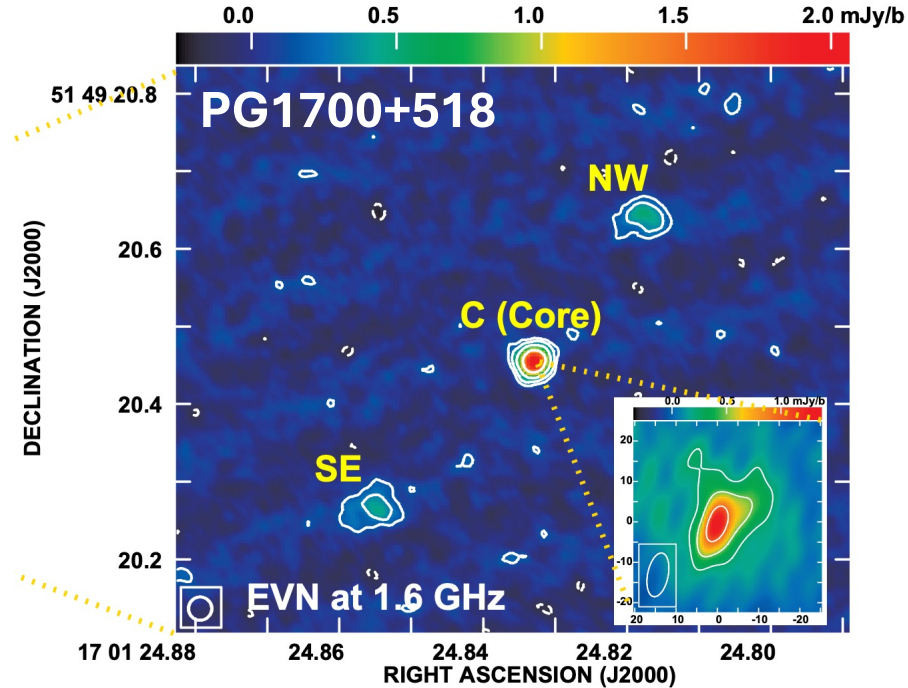
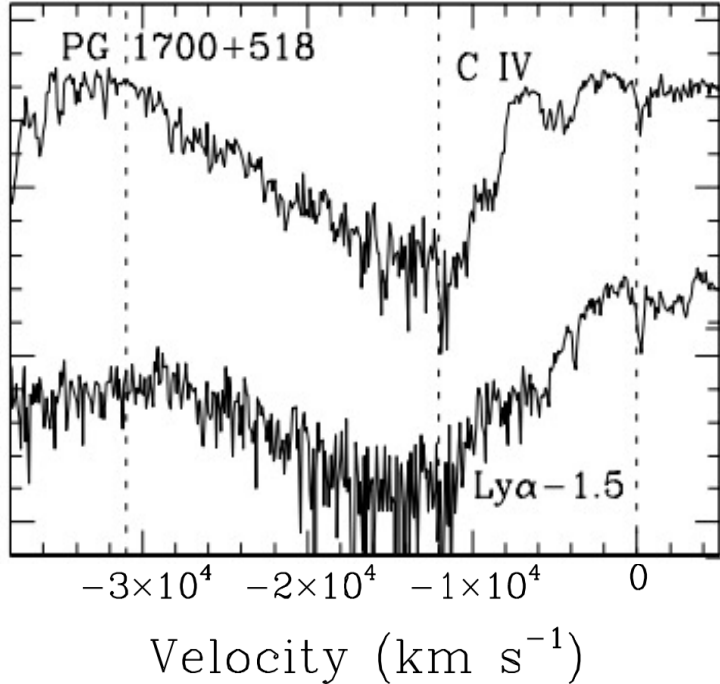
*shocks,
outflowing line-emitting gas* ?

*collimated,
radio blob speed
high T_b ,
high polarization* ?

(Panessa et al. 2019)

The UV wind indicators

- Blueshifted C IV broad absorption line



(Laor & Brandt 2002,
Yang et al. 2012)

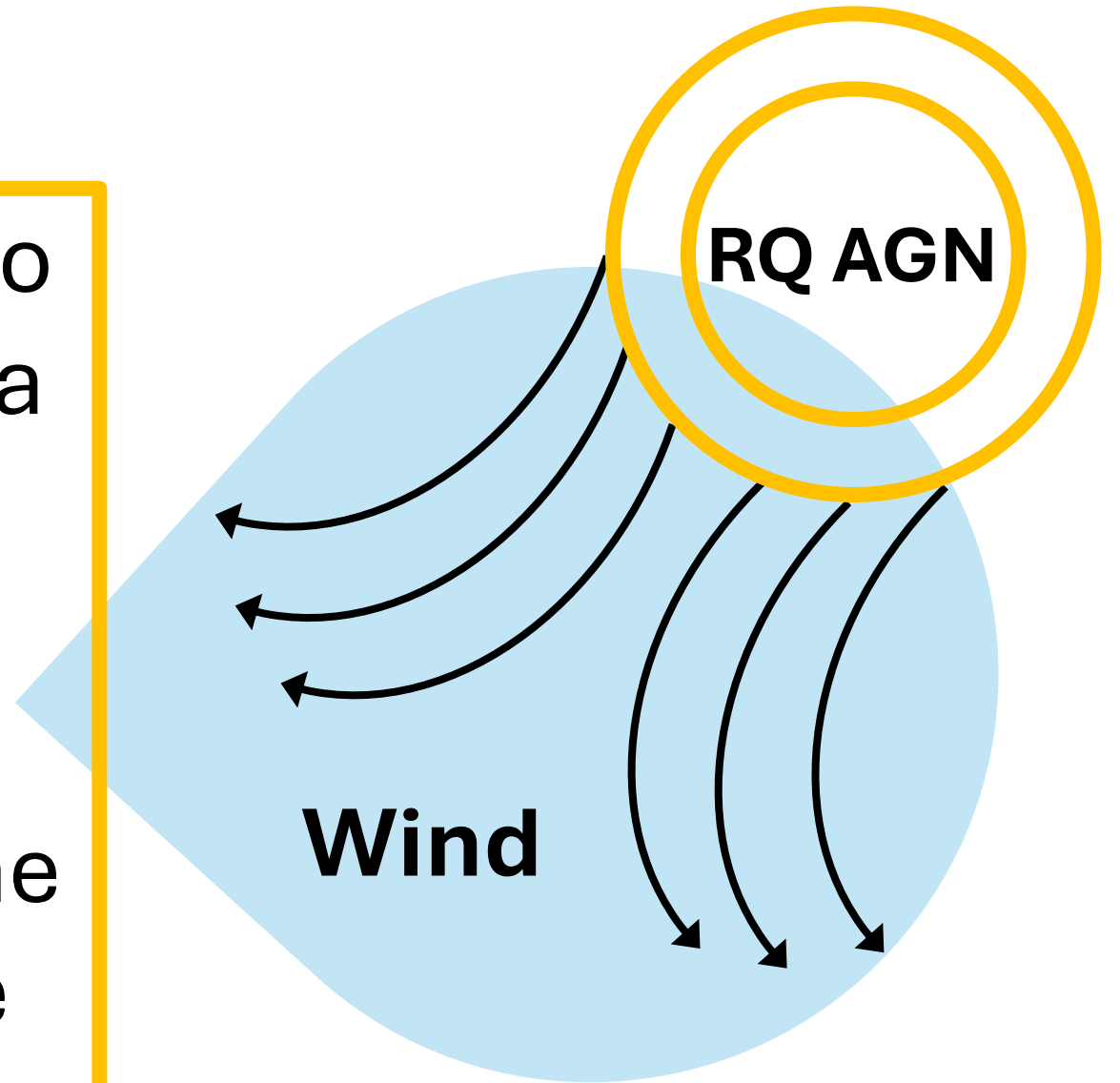
- An excess blue wing in the C IV emission line

Do objects with a blueshifted C IV emission line also show pc-scale radio extended emission?

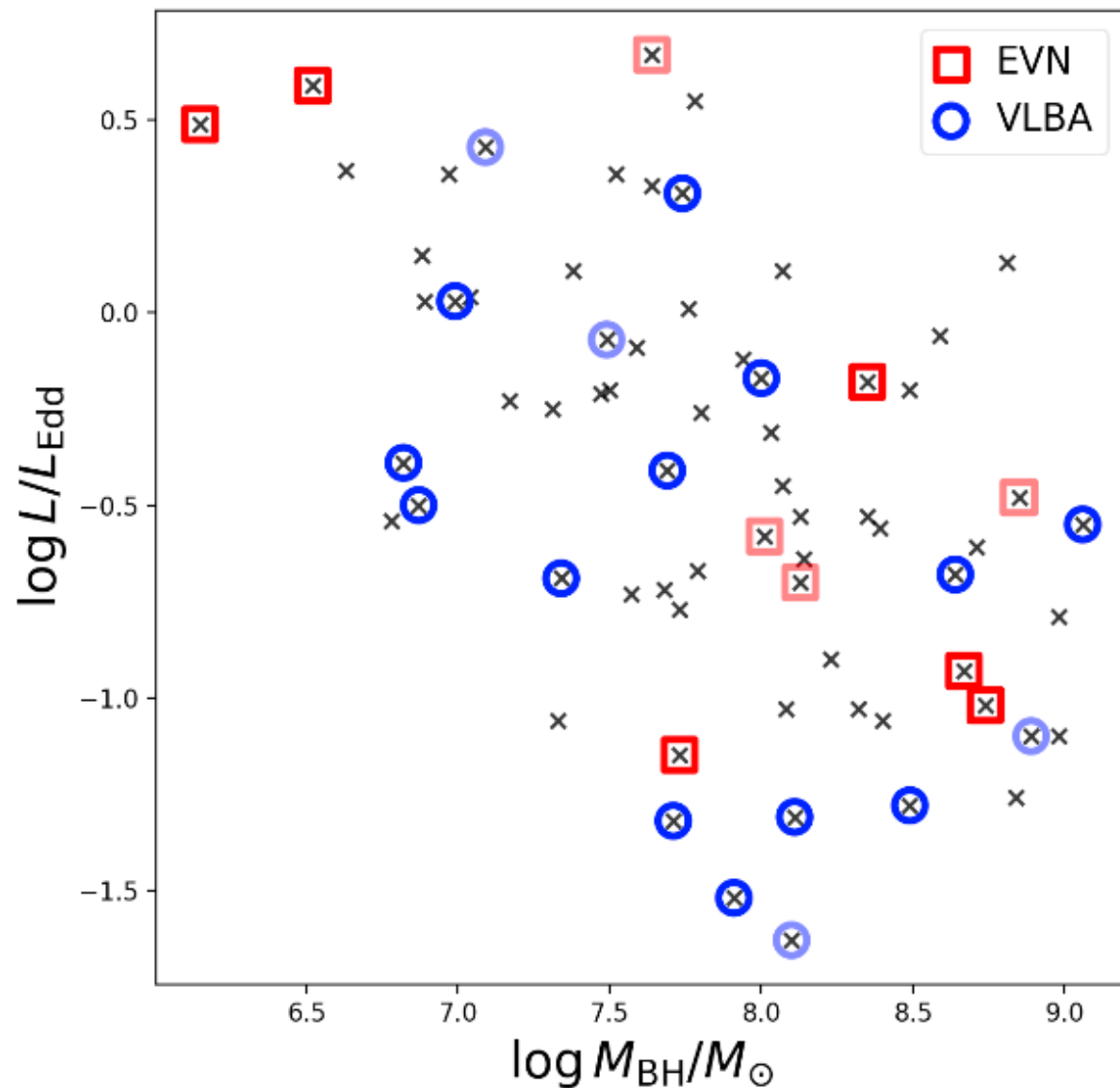
Motivation

Compare the pc-scale radio emission of 6 objects with a BLR wind and 13 objects without a BLR wind.

Do objects with a broad-line region wind show evidence for a radio wind?



Sample



EVN and VLBA 1-5 GHz

19 RQ $z < 0.5$ PG quasars

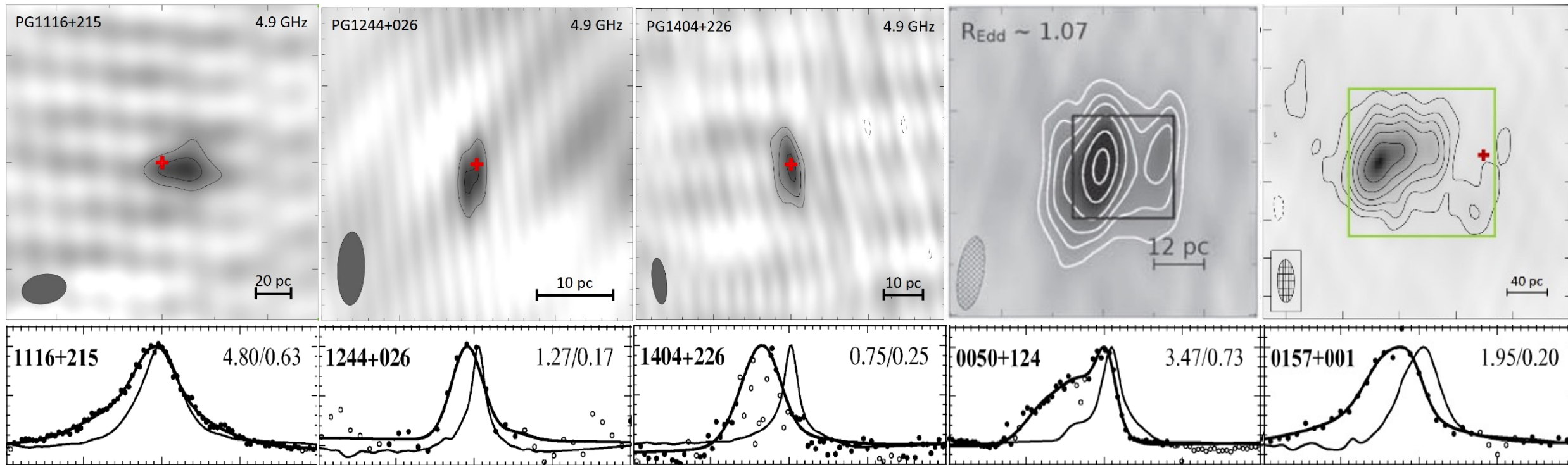
$$M_{\text{BH}} \sim 10^{6.2} - 10^{9.1} M_{\odot}$$

$$L/L_{\text{Edd}} \sim 0.03 - 4$$

(Chen et al. 2024)

Radio + BLR wind sources

High L/L_{Edd} ?



Radio wind: Steep slope $\alpha_{1-5} < -0.5$, Extended $\frac{S_{\text{core}}}{S_{\text{total}}} < 0.5$.

BLR wind: An excess blue wing in C IV emission line

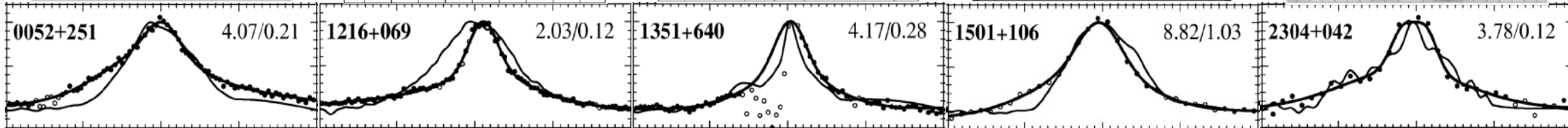
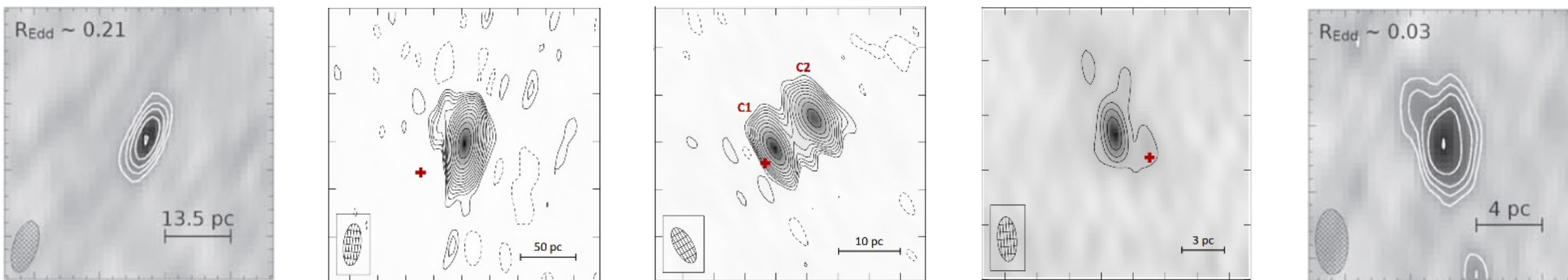
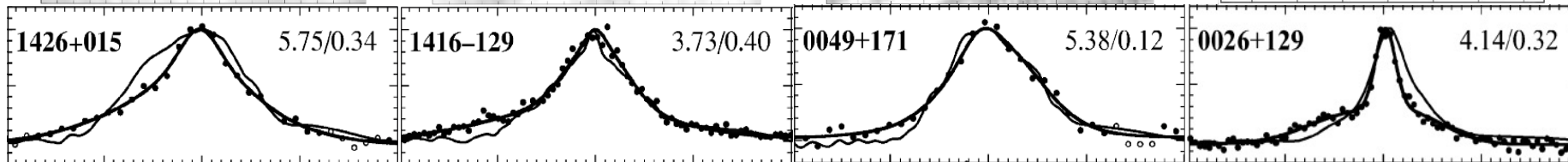
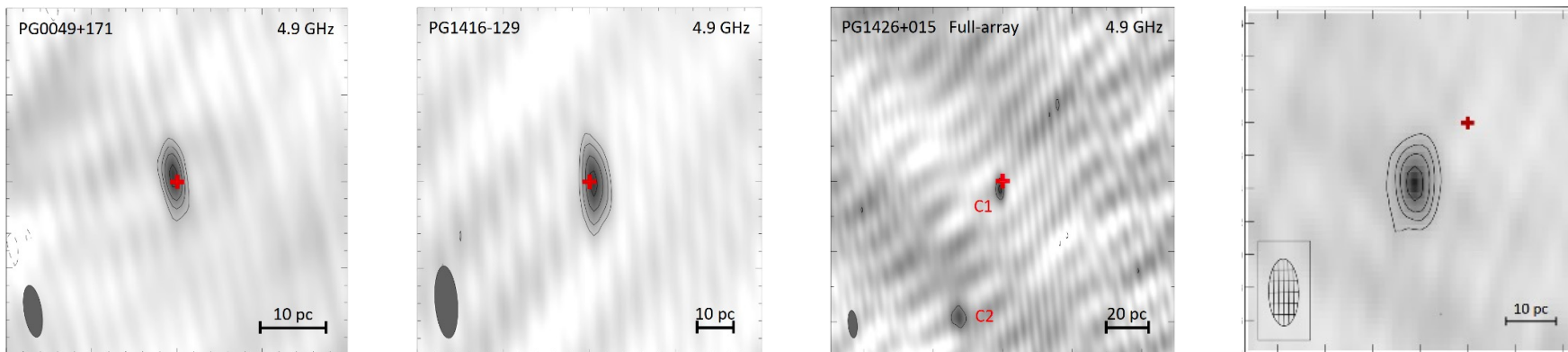
(Baskin & Laor 2005,
Alhosani et al. 2022,
Chen et al. 2023,
Chen et al. 2024)

No wind sources

Low L/L_{Edd} ?

No radio wind:
 Flat slope $\alpha_{1-5} > -0.5$
 Compact $\frac{S_{\text{core}}}{S_{\text{total}}} > 0.5$

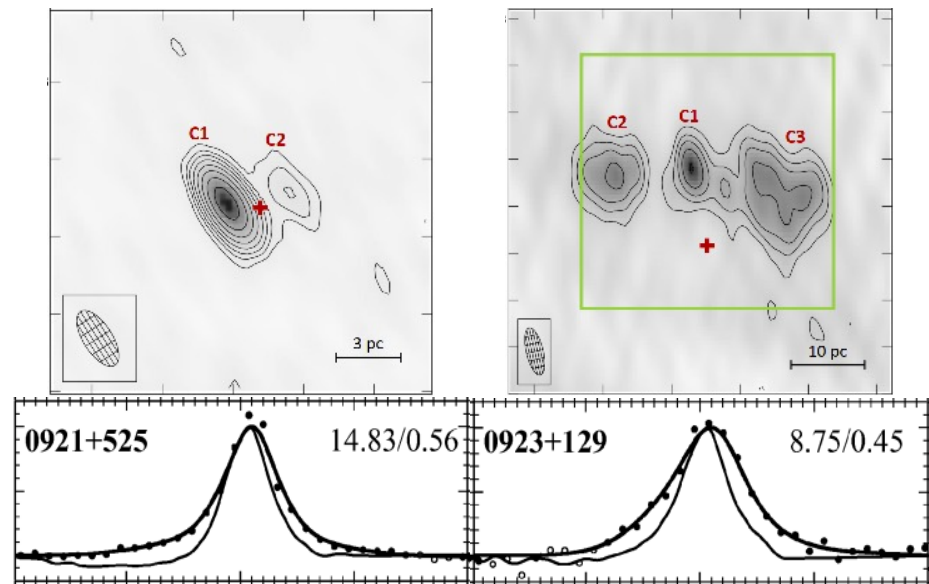
No BLR wind:
 Symmetric C IV emission line



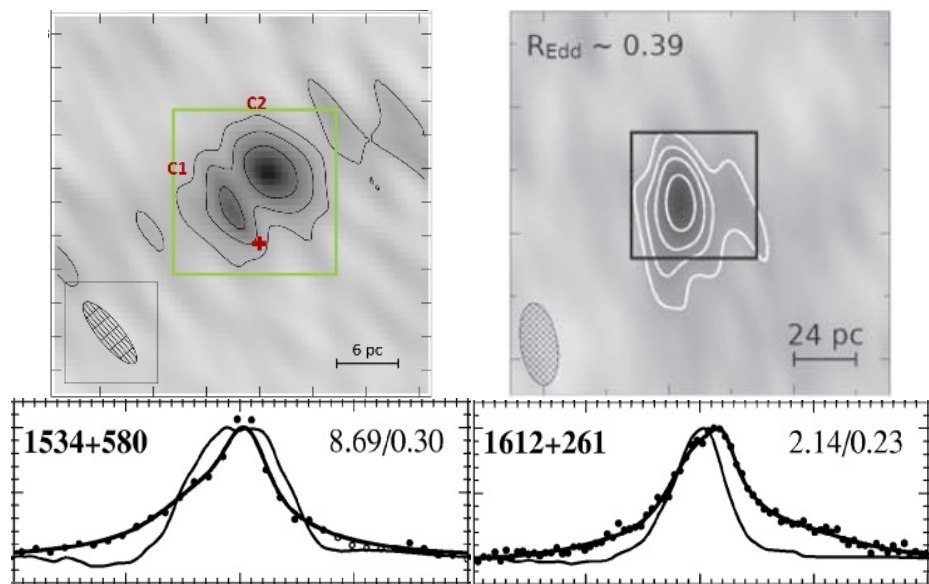
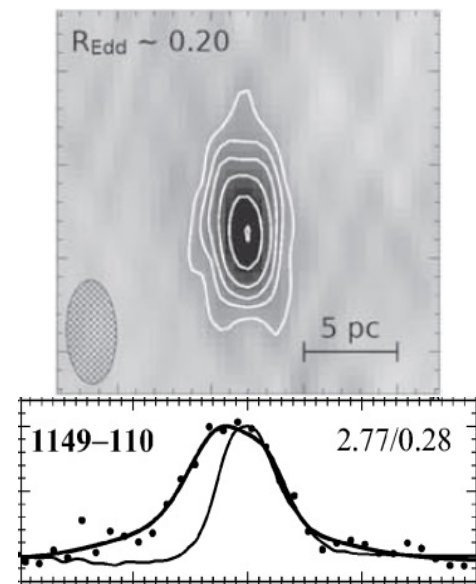
(Baskin & Laor 2005, Alhosani et al. 2022, Chen et al. 2023, Chen et al. 2024)

Either radio or BLR wind

Radio
wind



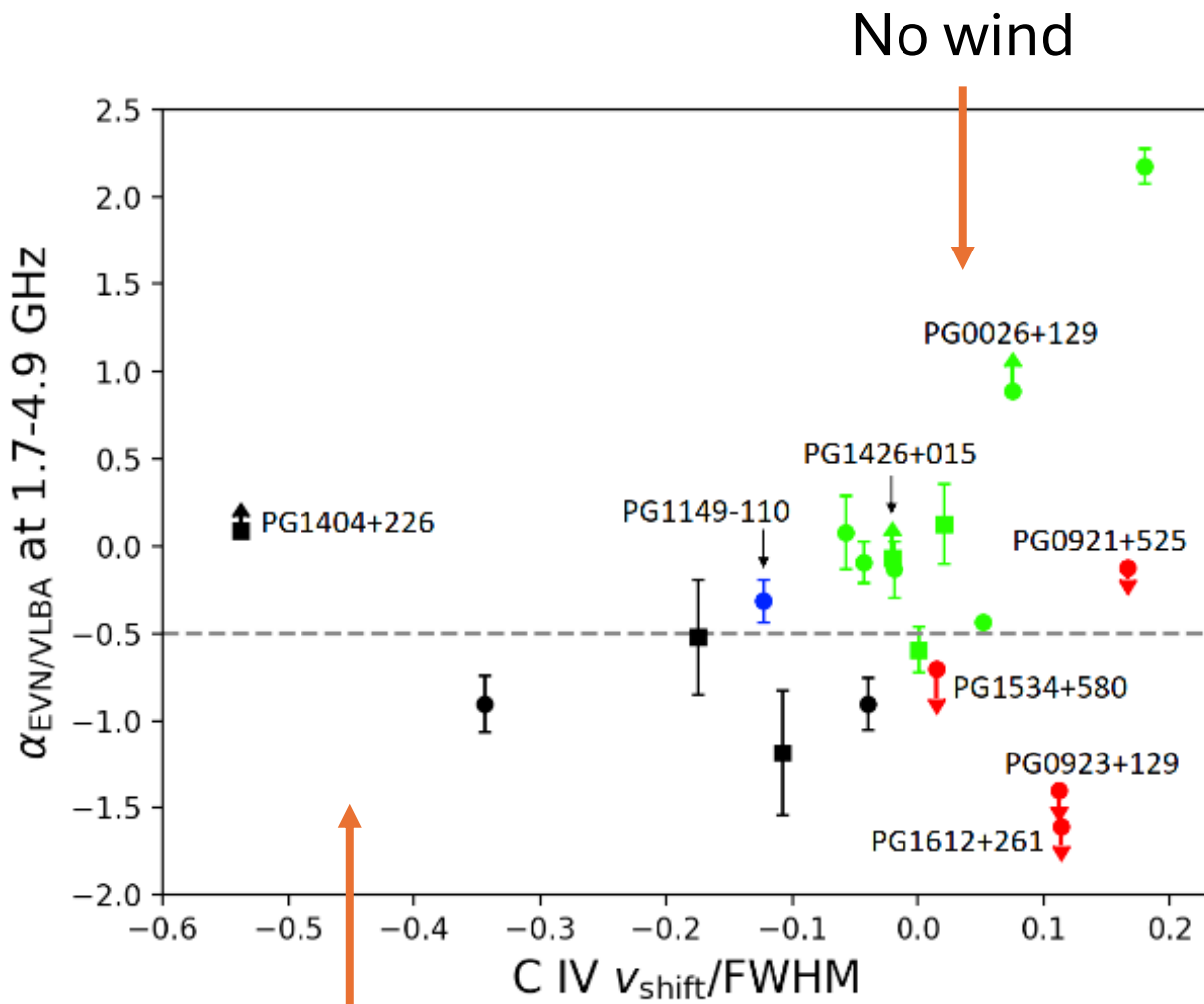
BLR
wind



(Baskin & Laor 2005,
Alhosani et al. 2022,
Chen et al. 2023)

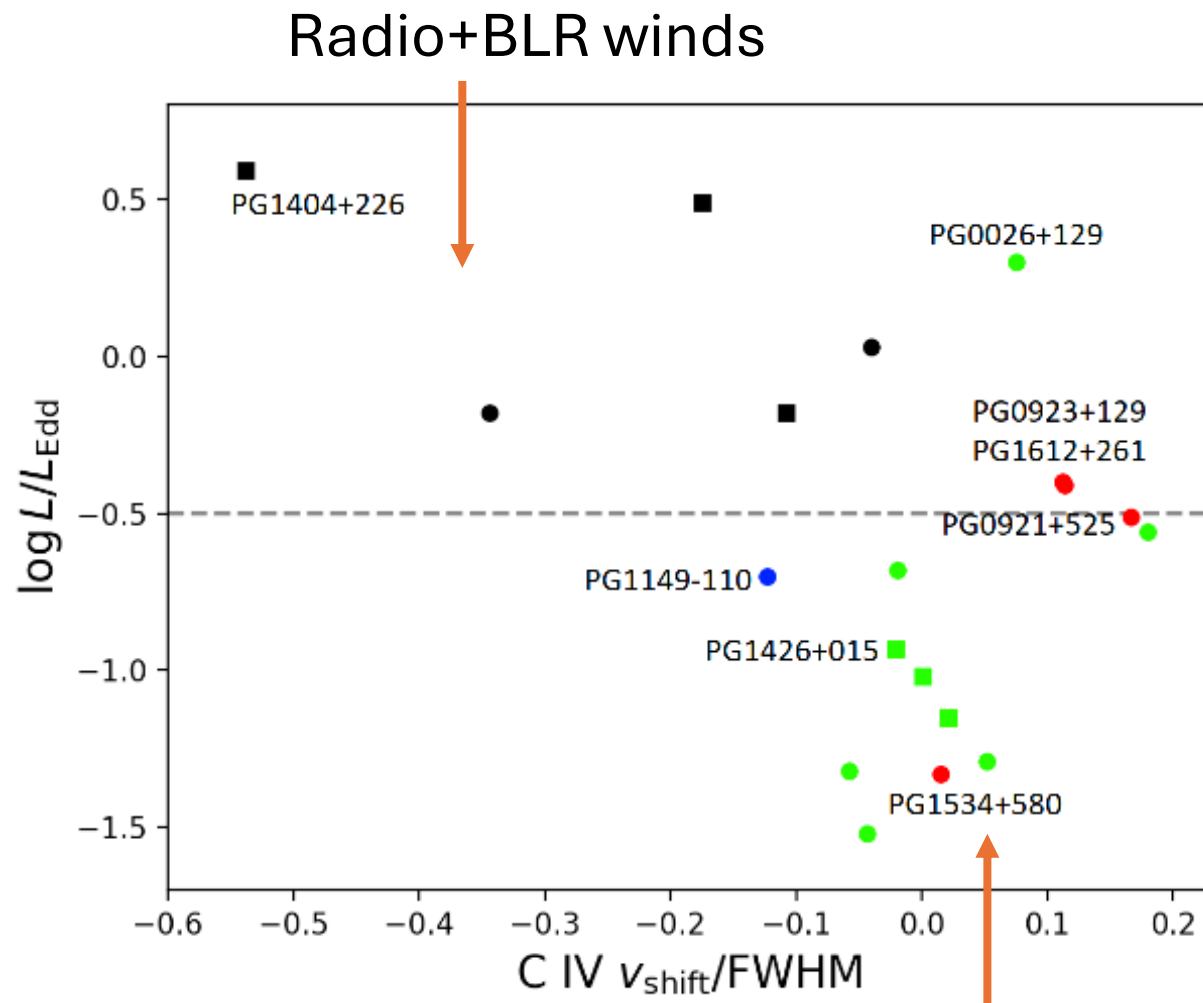
Correlations

Black: Radio+BLR winds Red: Radio wind only
Green: No wind Blue: BLR wind only



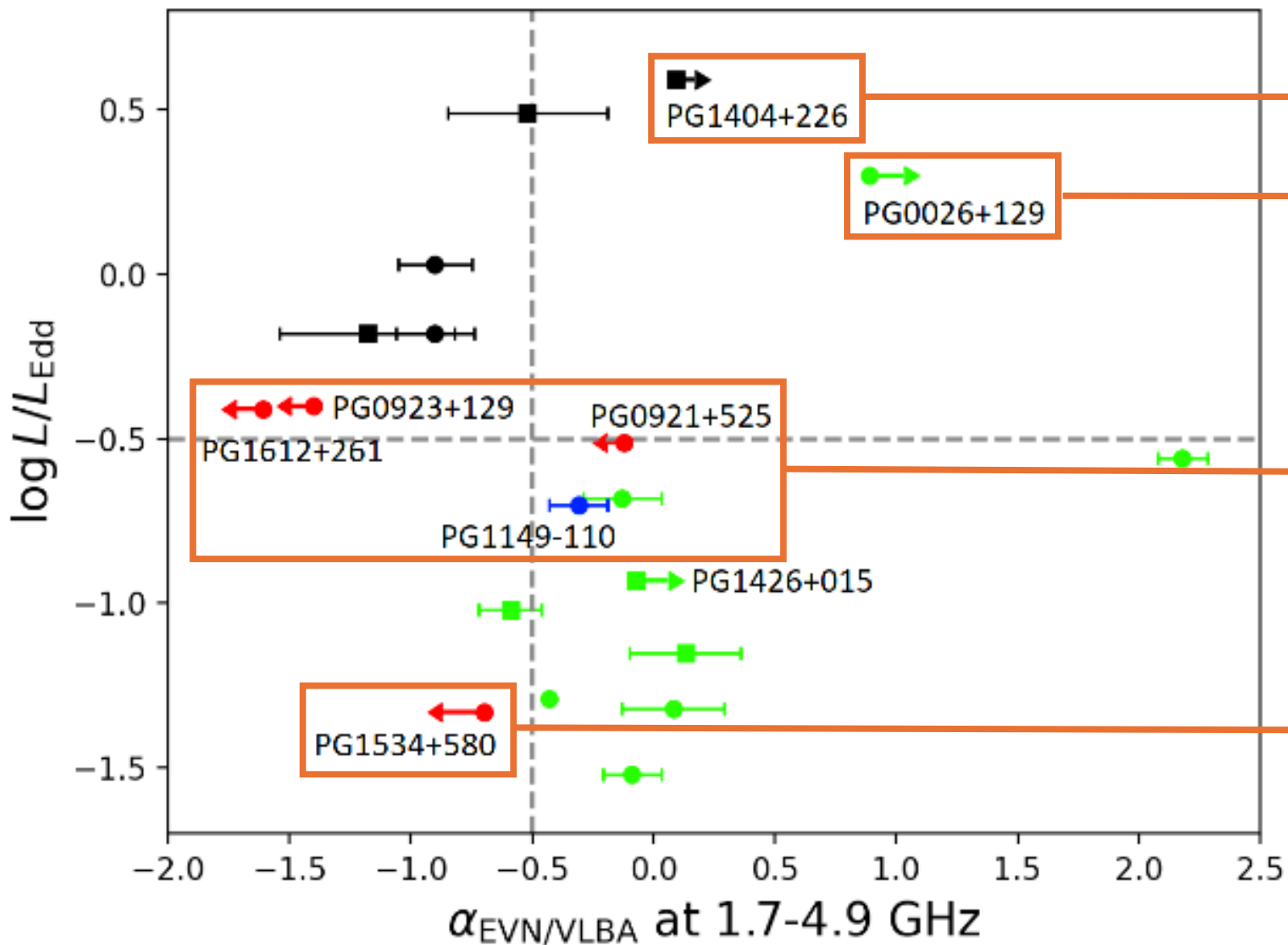
Radio+BLR winds

(Chen et al. 2024)



No wind

Effects on the wind indicators



Free-free absorption?

An overestimated L/L_{Edd} ?

A mild wind?

A low-power jet?

(Chen et al. 2024)

Summary

- All the five objects with both radio and BLR winds are found at high Eddington ratios ($L/L_{\text{Edd}} \geq 0.66$).
- Eight of the nine objects with neither radio nor BLR winds reside at low Eddington ratios ($L/L_{\text{Edd}} \leq 0.28$).

Conclusion: The radio and BLR winds in RQ AGN are likely related to a radiation pressure driven wind.